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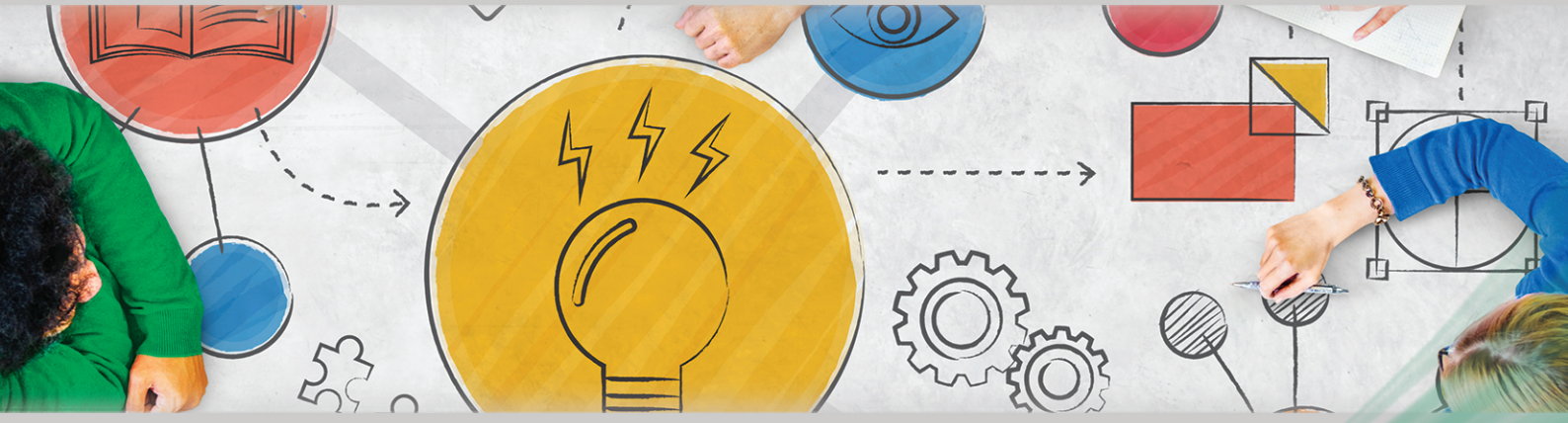

Edited by Mafalda Carmo

Advances in Education and Educational Trends

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Advances in Education and Educational Trends Series

Edited by: Mafalda Carmo

Edited by:

Mafalda Carmo,
World Institute for Advanced Research and Science, WIARS
Portugal

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FOREWORD

inScience Press is delighted to publish this book entitled *Education Applications & Developments IX* as part of the Advances in Education and Educational Trends books series. These series comprise the work of authors and editors to address global research in the Education area.

In this ninth volume, a dedicated set of authors explore the Education field, contributing to the frontlines of knowledge. Success depends on the participation of those who wish to find creative solutions and believe their potential to change the world, altogether to increase public engagement and cooperation from communities. Part of our mission is to serve society with these initiatives and promote knowledge, therefore it requires the reinforcement of research efforts, education and science and cooperation between the most diverse studies and backgrounds.

The contents of this 9th edition bring us to the most broadening issues in contemporary research on Education. This book explores four major areas within the broad spectrum of Education, corresponding to four sections: "Teachers and Students", "Projects and Trends", "Teachers and Learning", and "Organizational Issues". Each section comprises chapters that have emerged from extended and peer reviewed selected papers, originally published last year in the proceedings of the International Conference on Education and New Developments (END 2023) conference series (http://end-educationconference.org/). This meeting occurs annually always with successful outcomes. Original papers have been selected and the authors were invited to extend and to submit them to a new evaluation's process. Afterwards the authors of the accepted chapters were requested to make the necessary corrections and improve the final submitted chapters. This process has resulted in the final publication of 36 high quality chapters organized into 4 sections. The following sections and chapters' abstracts provide some information on this book's contents.

Section 1, entitled "Teachers and Students", provides studies within educational programs and pedagogy for both teachers and students.

Chapter 1: *Educational strategies in sustainability economics - Empowering change through education*; by Maria Luísa Vasconcelos & Sandra Bernardo. This chapter looks at different ways to consolidate Sustainability Economics in the curricula of undergraduate and graduate economic-related education levels so as to enhance the knowledge and analytical skills they need to successfully address sustainability-related issues. Proposals are guided by four key principles – interdisciplinary perspectives, critical thinking, experiential learning, and collaboration with stakeholders –, and are aligned with the Dublin Descriptors'

guidelines. The suggested multi-faceted educational approaches include integrating specific sustainability contents into the curriculum, using problem-based learning approaches, providing experiential opportunities, and facilitating interdisciplinary collaboration and community engagement. Anticipated outcomes include a more comprehensive understanding of economic principles related to sustainability, increased awareness of economically sustainable practices, and improved proficiency in policy evaluation. The ultimate goal is to devise educational approaches in Sustainability Economics at the undergraduate and graduate levels capable of better empowering students to make informed decisions for a more sustainable future.

Chapter 2: *The contribution of morphological awareness to reading comprehension in Arabic*; by Bahaa' Makhoul & Vered Vaknin-Nusbaum. This study examined the contribution of morphological awareness (MA) to reading and reading comprehension in Arabic among 3rd and 4th graders. MA tests (inflections and derivations) and reading tests examining phonological decoding, orthographic recognition and reading comprehension, were administered to 50 students whose Arabic is their mother tongue. Furthermore, differences in reading achievements between students with low and high MA were examined. Findings indicate that both inflectional and derivational MA significantly explain reading comprehension. Furthermore, it was found that students with lower MA demonstrate inferiority in phonological decoding and reading comprehension compared to those with high MA. It can be inferred that Arabic readers use MA as a strategy that contributes to their ability to identify words and to comprehend a text as early as in the 3rd and 4th grades.

Chapter 3: *The digital age of assessments – National benchmark test reconfigured to online platform*; by Naziema Jappie & Ashley Van Niekerk. The sudden shift from contact to remote digital learning platforms and the facilitation of assessments via online platforms brought about unique challenges to the South African (SA) education landscape. The purpose of this technical research paper is to document the digitization project from the @NBT Online perspective and describe the @NBT Online system migration from a project and technical management perspective. Consultations were held with stakeholders to brainstorm possible solutions that would assist the Centre for Educational Assessments (CEA) in responding to the global pandemic which led to a partnership with Territorium Life (TL). TL had an online platform known as EdTest-AI, a software as a service (SaaS) solution, which combined proprietary software that uses various to deliver remote test proctoring, including verifying student identity and monitoring the room during an assessment. The first pilot @NBT Online was successfully administered on Saturday, 25 July 2020. The cost-effective and innovative SaaS approach implemented for this project is the first of its kind to be used in SA. Thus, this project is envisaged to support the departmental CEA plans in highlighting the needs that require innovation and the adoption of new and emerging technologies.

Chapter 4: *The art and science of assessment – Connecting classroom-based speaking assessments to teachers' practice*; by Rúben Constantino Correia. Speaking has been increasingly promoted in language syllabuses and curriculums, both in Portugal and internationally, as one of the major aims of foreign language teaching. Naturally, the importance of oral skills has led to increasing research in this area, with the focus largely on the need to measure ability and the best way to do it. Unsurprisingly, considerable attention has been drawn both to assessment and the context in which it operates. However, the unique features of speaking make it the most challenging skill to assess. Bearing this in mind, and my role as both researcher and teacher with a vested interest in speaking, I spent almost a full school year at a Portuguese public school cluster doing classroom observation in an attempt to chart: a) – typical classroom interactions between learners / teachers and learners / learners, and b) – the general nature of most speaking events taking place in the classroom, including that of assessment. Findings seem to evidence that Portuguese EFL teachers appear to be at odds with designing suitable assessment procedures for monitoring students' progress. There is a narrow view of assessment as synonymous with testing, and thus the grading function, which largely contributes to the dominance of summative assessment over formative assessment.

Chapter 5: *Computer gaming and academic learning – Targeting the role of esport in school*; by Björn Sjödén & Michael Trotter. The role of computer games in school is a controversial topic. An increasing number of upper secondary schools offer three-year programs with an "esport profile" within aesthetics and media. Marketing suggests that esport can attract students who are interested in playing computer games, but the scholastic value of esport remains to be clarified. Whereas "gamification" is an established term for transforming educational and other formal practices into game-like activities, little has been said about its counterpart "schoolification": how originally playful and informal practices are transformed to fit within school curricula and syllabi for achieving academic goals. We discuss the relevance of esport in secondary education, a working hypothesis is that the potential benefits of esport in academic learning is more about how students learn than what they learn. Specifically, we present and discuss and propose how self-regulated learning (SRL) as a framework can facilitate skills transfer from esport to academic learning. Using examples from multiplayer games, we elaborate on how co-regulation through social interaction can be used as a means for developing SRL. We conclude by suggesting how esport and educational researchers may use the SRL framework to address empirical questions about esport in relation to academic studies.

Chapter 6: *Assessing compliance with bloom's taxonomy: An examination of summative assessment papers for final year b-ed students*; by Mokete Letuka. Summative assessment papers must be compiled in accordance with Bloom's taxonomy of the cognitive domain. For final year student teachers, the recommendation is that eighty percent of the question paper must be pitched at

Bloom's taxonomy's upper cognitive levels and only twenty percent of the question paper must be pitched at Bloom's lower cognitive levels. This distribution is designed to assess higher order thinking and thus instill, promote, and reinforce independent and critical thinking, as well as problem-solving skills in final year students. To determine whether examiners comply with this recommendation, I analyzed ten question papers from the faculty of humanities through document analysis. The study found that some examiners pitch their question papers for final year student teachers entirely at Bloom's lower cognitive levels and only a few distribute the questions close to the required recommendations. Of concern was that some examiners inappropriately used action verbs belonging to Bloom's higher levels. It is recommended that examiners be re-trained in setting question papers in line with the revised Bloom's taxonomy protocol and the correct use of action verbs. It is recommended also, that main assessment papers must be quality-assured in terms of the levels of questioning before they are administered.

Chapter 7: *RTI tier 2 executive function program for 1st grade Brazilian schoolchildren*; by Graziele Kerges-Alcantara & Simone Aparecida Capellini. Objectives: To develop a second-tier Response to Intervention (RTI) program for the development of executive functions in first-year elementary schoolchildren and to analyze the clinical significance of the program via a pilot study. Method: This study was developed in two phases: elaboration and application of the RTI program for Brazilian schoolchildren; and a clinical significance analysis of the children's performance in pre- and post-test situations. The initial sample comprised 71 children (age from 6 years to 6 years and 11 months of both sexes) from two Brazilian public schools. These were submitted to a pre-assessment protocol. Risk for difficulty in executive function was presented by 18/37 of the participants that completed the pre-assessment protocol, and these were selected for the intervention program. Results: There was a reliable improvement in the components of executive function inhibition, working memory and alternation, for some children and in rhyme identification tasks, phoneme production, and phonological working memory, although the program does not focus on its development. Conclusion: The program we elaborated demonstrated applicability and can be used by educational speech therapists, school psychologists and educators as a scientific evidence-based intervention tool to support the development of executive functions in second-tier RTI programs.

Chapter 8: *The transition from concrete to formal thinking*; by Ghada Wattad & David Chen. In the current study we have investigated the development of logical and mathematical reasoning among a mature sample following Piaget's theory of cognitive development. The purpose of the current study is examining if continued biological development and/or continued accumulation of life experience, learning and education can develop thinking that contributes to the transition to the formal operational thinking stage. Research was designed to test whether knowledge content (domain) affects learning by studying cognitive distribution in three domains. The

study further explores the premise that schooling is the main factor that precipitates the transition to formal thinking. The research is based on two kinds of populations: The first consists of one thousand literate adults aged between 18 and 76 (M= 39). And the second of one hundred and three illiterate adults. The findings indicate that, there was not any continuation of the formal cognitive development during the entire adult life. Only about 25% of the population continues to the formal operational stage, and this is before the age of 20. learning was affected by domain specificity. In addition, about one-fifth of the illiterate population that never attended school do achieve formal thinking.

Chapter 9: *Educating third culture kids and cross culture kids: Students with hidden and apparent diversity*; by Patricia A. Stokke. This chapter discusses the impact of cross-cultural experiences on the education of a growing student population; those who live mobile lives. These students move across countries for their parents' careers or as immigrants or travel daily across cities or national borders to attend school. A transitory lifestyle means they must adapt to unfamiliar educational environments (Lijadi & van Schalkwyk, 2018), which may cause challenges in their sense of belonging and interruptions in academic progression. Consequently, educators have a responsibility to understand the complexity and interrelatedness of learning, education, and culture (Hofstede, 2001) and adapt accordingly to support student success. The challenges facing this student population, including the needs and strengths emerging from their unique cross-cultural and mobile experiences will also be discussed, as well as methods of adapting teaching schemas. Additionally, potential areas of research are recommended. Teaching and serving students of hidden and apparent diversity is based on research in the fields of CCKs and TCKs, global transitions, cultural competence, cross-cultural and international education.

Chapter 10: *Contemporary art methods in teaching visual arts*; by Marija Brajčić & Dubravka Kuščević. Recomposition and photomontage are an integral part of contemporary art and should be implemented in the contemporary teaching of visual arts. This paper aimed to determine whether using recomposition and photomontage in visual arts classes stimulates student creativity. The research was carried out from 2019 to 2022 among students at the Department of Teacher Education and the Department of Preschool Education at the Faculty of Humanities and Social Sciences in Split, who applied the methods of recomposition and photomontage in visual arts classes. The research was qualitative and quantitative, observation and descriptive methods were used, and a total of 133 students participated in the research. The resulting artworks were divided into groups according to the degree of creativity that the students expressed in the artworks. It was concluded that the works created with the use of recomposition and photomontage stimulated creativity among students. A significantly greater degree of freedom was observed in combining, using imagination and creating new ideas.

Chapter 11: *Mentors' competence development to support novice teachers: Cross analyzing two mentoring context*; by Julie Courcy, Nathalie Gagnon, & Andréanne Gagné. Mentorship is known to be one of the most utilized and effective ways to support new teachers. Many researchers have focused on how the mentees are supported and how an experienced mentor can make a difference in their induction process. Knowing the benefits of this affiliation, one of the main keys for a successful mentorship program is the mentor's ability to respond to the mentee's needs. Based on Le Boterf's competent action model this chapter exposes the commonalities between two different studies, both focusing on the development of the mentors' competent action: S1 was conducted in the province of Ontario, with mentor supporting novice teachers in their induction process and S2 was conducted in the province of Quebec with 11 participants, acting as associate teachers (ATs) with interns, in Vocational Training Centres. The cross-analysis shows that both mentors and ATs have similar needs regarding their competency development. The results shed light on the various factors conducive to the development of competency as seen through the lens of Le Boterf's concept of competent action: how to act, desire to act and ability to act. Finally, three keys are recommended to better support the mentors competent action development.

Chapter 12: *Emergent literacy stimulation in initial years of literacy*; by Caroline Fernandes Brasil, Luana Baron Scollo, & Simone Aparecida Capellini. This study focus on verify the educational efficacy of a stimulation program with emergent literacy practices with students in the initial literacy series. Materials and Methods: The study included 20 students from the 1st and 2nd year of Elementary School I of a municipal public school, of both sexes. The students were divided into two groups, with group I (GI) consisting of 10 students, aged 6 years to 6 years and 11 months, five 1st year students and five 2nd year students undergoing the training program. stimulation and group II (GII) consisting of 10 students, aged between 6 years and 6 years and 11 months, five 1st year students and five 2nd year students not subject to the stimulation program. The results revealed that GI students had better performance in skills considered predictive of reading development, such as copying shapes, dictating pictures, segmenting syllables, dictating words, repeating words, alliteration, rhyming, repeating numbers in reverse order and naming digits in order fast and automatic, while GII students also performed better in copying shapes, dictating figures and segmenting syllables.

Section 2, entitled "Projects and Trends", presents chapters concerning, as the title indicates, education viewed as the center for innovation, technology and projects, concerning new learning and teaching models.

Chapter 13: *Abelian groups and what student teachers should learn for teaching algebra*; by Natalia Karlsson & Wiggo Kilborn. The purpose of this didactic project is to analyze a current research question, namely how student teachers' knowledge

of Abelian groups contributes to their understanding of an essential aspect of teaching algebraic concepts by extending numbers and arithmetic operations. The theoretical approaches employed are Subject Matter Knowledge, and the choice of algebraic content with focus on students' learning of algebra. Discussions about the Subject Matter Knowledge model related to teacher students' learning of algebra in the context of knowledge for teaching are crucial domains for the outcome of this chapter and the research questions. In this chapter a central content is a conceptualization of Common Content Knowledge (CCK) related to the algebraic content of the Abelian groups, and its conceptual transformation into Specialized Content Knowledge (SCK) for teaching of algebra. Conceptual findings illustrate theoretically the conceptual transformation as interplay between CCK and SCK within the SMK model. This study can contribute with new knowledge about professionally specific mathematic knowledge for teaching algebra. The outcome of this theoretical research work is a follow-up of an earlier research project, namely Mathematics in teacher education: Student teachers' knowledge of and perceptions of mathematics.

Chapter 14: *What are the models of courses in academic teaching in Slovakia? - Document analysis and the survey of lecturers' opinions*; by Tímea Šeben Zaťková. The aim of the study is to identify, describe and compare models of courses in academic teaching (AT) conducted at Slovak universities and to describe how the pedagogical content knowledge (PCK) of university lecturers is acquired at particular higher education institutions (HEI). There are also briefly described the organisational aspects of pedagogical education of university lecturers in Slovakia, which is mainly conducted as part of their further education. The document analysis was employed to identify existing models of courses in AT in Slovakia. The text of the study also illustrates the experience with the implementation of courses in AT at Slovak universities and summarises results from a questionnaire survey on the importance of the pedagogical preparation and educational needs of the course participants - university lecturers. A variety of good practices, surveys and opinions of participants and graduates from various models of education are good sources of inspiration for higher education quality improvement. The study also intends to emphasise the requirement that teachers´ work at any level of education (even in higher education) cannot be the result of high erudition in the scientific field and only intuition-based knowledge of education and its principles.

Chapter 15: *Student teachers behaving badly: Teachers' perceptions of student teachers' misbehaviour during teaching practice*; by Jaysveree M. Louw. Teaching Practice (TP) is a crucial component in initial teacher training programmes. All B. Ed and PGCE (Post Graduate Certificate in Education) students at South African universities must undertake TP and behave professionally and ethically during their TP period. However, universities often receive negative feedback from the teaching community about the behaviour of some students. This negative feedback was one of the motivating factors that prompted this study. The second

motivation was the findings of the portfolio content that student teachers have to submit after TP. Some students' actions were dishonest, for example, they forged mentor teachers' signatures. The purpose of this study was to obtain teachers' perceptions of how pre-service teachers conduct themselves during TP. Interviews were conducted with thirty participants to collect data. The findings revealed that even though many students are generally well-behaved and ethical, some of them are entitled, unprofessional and disrespectful. From these findings one can conclude that some student teachers behave in an undesirable fashion which can negatively impact their future placements at schools. One of the recommendations is for student teachers to be adequately prepared by teacher education programmes to meet the professional requirements of teaching in the real school and classroom environment.

Chapter 16: *Online quizzes for content consolidation in higher education: A comparative study in tourism degrees*; by Sónia Pais, Laura Chagas, & Ana Pires. New strategies regarding student-centered approaches have emerged in higher education contexts, to promote student motivation and engagement towards the learning process. Online quiz platforms such as Kahoot! seem to contribute to the consolidation of learning, particularly through content review. Our research is based on data from a quantitative survey conducted among students from a Portuguese higher education institution offering undergraduate degrees in the area of Tourism, specifically within the subjects of English and Statistical Analysis. Following a consistent application of Kahoot! quizzes in class for reviewing purposes, the survey was implemented to allow for an examination of how the students perceived the usage of this game-based learning tool. Results show that most students are very receptive to this tool and highly recommend it, as it promotes motivation. Students also consider the use of Kahoot! in classes to make learning more challenging and dynamic, while positively contributing to content consolidation. To better understand students' responses to the platform, in this study we aim at analyzing the results according to area of study and investigating different correlations between variables. However, the results obtained evidence that further studies are needed to confirm the effect on the use of Kahoot! in student performance.

Chapter 17: *Positive digital learning: Challenges and path forward for educators*; by Dimitra Pappa, Jan Pawlowski, Kati Clements, & Sofoklis Sotiriou. Digital technologies are rapidly changing teaching and learning in the 21st century as both teaching methods and priorities are evolving. Likewise, the skills required of 21st century educators are constantly evolving, and while it is widely recognised that digital literacy is critical, there is no general consensus on what it means for an educator to be digitally literate and what competencies should be included in literacy frameworks for educators. The debate over teachers' digital competencies continues as the rapid pace of technological change makes it difficult to keep up with the latest trends. At the same time, other critical dimensions emerge that also need to be taken into account. In the present research, we examine the impact of two significant challenges that have emerged in recent years on educators' competencies:

Emergency Remote Education (ERE) and generative artificial intelligence (generative AI). We examine their practical implications and the resulting emotional challenges of using digital technologies in education. We critically discuss existing competency frameworks that outline the knowledge, skills and attitudes that educators should possess to effectively support student learning and development. Based on the lessons learned, we discuss future directions for their improvement, namely the integration of digital skills with emotional e-competencies, towards the development of a holistic framework for positive digital learning.

Chapter 18: *Innovating teacher education through rural educational contexts: New possibilities in teaching and learning*; by J. Spencer Clark, Eileen M. Wertzberger, & Nooshin Darvishinia. In the United States (US), rural schools are often unable to provide the same academic opportunities as suburban and urban schools. Rural student populations are becoming increasingly diverse and require rural schools to provide new services to their community. This chapter examines how we have collaborated with rural schools to address their need for resources, teachers, and support. We use ecological agency to frame the ways contextual affordances and challenges of rural schools provide distinct opportunities for teacher education programs to innovate teaching and learning. Many factors that have prevented sustained and authentic engagement with rural schools have been minimized in recent years through technology and increased broadband connectivity. Technology offers a range of opportunities for teacher education programs to engage more authentically with rural schools and provide sustained support through telepresence-based field and student teaching experiences, distance and online-based supervision, and shared virtual and online pedagogies of the rural. To make these innovations more sustainable, the use of technology in rural schools will need to be evolved and supported in new manners to have an impact on the agency of rural teachers. In this way, rural can be a lens for technological innovation in teacher education and rural schools.

Chapter 19: *Analysing the extent to which student teachers implement their lesson design during teaching practice*; by Mokete Letuka & Paseka Patric Mollo. Lesson designing focuses on the structure of a series of lessons. It incorporates the planning, organization, and sequencing of lessons to achieve learning outcomes. Student teachers are capacitated to master the skills of lesson planning so they can plan their teaching on a lesson plan template. However, what they do in the classroom is not a reflection of the lesson design itself. As a result, the researchers sought to investigate the reasons for this lack of synergy between the lesson design and the actual lesson presentations. This qualitative research was conducted through document analysis and semi-structured interviews. A sample of 20 B.Ed. degree student teachers who are in their third year of study were randomly and conveniently selected. The findings revealed that most student teachers do not have high regard for lesson designing. The assessment rubric used to evaluate student teachers' teaching competence does not outline aspects of the lesson design. Moreover, student teachers are unsure of how to implement some of the aspects of the lesson plan

template. The study highlighted the need to put more emphasis on the importance of lesson designing. It was further recommended that lesson designing should allow for pedagogic flexibility.

Chapter 20: *Utilising social network analysis skills to meet pediatric palliative care needs in South Africa*; by Rika Swanzen. Integrating Pediatric Palliative Care (PPC) within the curriculum of the social services qualifications is part of new and niche development in education. To meet the needs of terminally ill children requires the best practices from the inter-disciplinary teams involved. The social service professions have a strong history in impacting communities to meet the needs of vulnerable populations. A tried and tested framework on environmental networking, that may be at risk of only being seen as part of earlier innovation, provides a practice model for meeting the partnership goal of sustainable development. Considering the risk to terminally ill children when sufficient partnerships are not in place, as required by the seventeenth sustainable development goal, a case is made for a deeper understanding of the service context and the strengthening of support structures through social network analysis and environmental modification.

Chapter 21: *The information designer role on health education: Participatory methodologies to citizen empowerment*; by Mónica Santos & Suzana Dias. The authors, Design research experts, explore Design Thinking's holistic methodology in this article. This burgeoning concept is gaining recognition and application in various contexts. Their aim is to emphasize the importance of collaboration and interdisciplinary work, fostering interactions among individuals from diverse domains and merging specialized and practical knowledge. This approach cultivates a participatory culture and stimulates innovative solutions. In this article, the authors present a segment of research conducted by (Santos, 2020), focusing on health education message co-creation and Information Design's role in healthcare, enabling population autonomy. After an extensive literature review involving health, Information Design, and Design Thinking experts, the study examined the clinical analysis report model used by the Portuguese National Health Service. Through co-design involving designers, users, and healthcare professionals, the study developed a prototype for a new clinical analysis report, which is showcased as a successful example in this paper. In conclusion, there's an urgent need to reassess longstanding power dynamics in decision-making centers. The authors stress that citizens/users shouldn't be relegated to passive content recipients based on assumptions but should be integral to the co-creation process, right from the beginning. With this paper, the authors aim to empower all individuals as direct agents of social innovation in their daily lives.

Chapter 22: *What difference does a social practice approach to adult literacies education make to adult learners' quality of life in western Rwanda?*; by Peter Mtika, Pamela Abbott, Wenceslas Nzabalirwa, & Ismael K Byaruhanga. Provision of quality adult education has the potential to make a difference in the lives of adult learners especially those from poor and marginalised backgrounds. In this chapter,

we report on the effect of implementing a social practice approach to adult literacies education in rural communities in three districts in Western Rwanda. Following the implementation of a social practice approach to adult literacies education, we interviewed a sample of 32 participants, two or three years after they completed adult classes, to understand what impact the classes may have had on improving their lives and wider capabilities. The findings indicate that a social practice approach to adult literacies education impacted participants in connection with health, hygiene and sanitation, nutrition, improved marital relationships, better support for children's education, and greater community involvement. Adult learners developed greater understanding and practical grasp of life skills, social competence, positive self-image, and personal and family wellbeing while developing their literacies. They retained and used the knowledge and skills to improve their lives, that of their immediate households and the wider community. Implications of the findings are discussed.

Chapter 23: *Analysing information and communication technology (ICT) skills of Setswana student teachers at a university of technology in South Africa*; by Bridget Kesaobaka Mangwegape & Paseka Patric Mollo. The use of ICT has become an indispensable component of education in modern times. Recently, most teachers, including indigenous language teachers, have been involved in integrating technology into their classroom practices. But there is a lack of research on integrating ICT by Setswana student teachers at higher education institutions. This study aims to investigate the competency levels of Setswana student teachers in using ICT in their classrooms. A total of 20 student teachers were purposively selected to participate in this study. Data was collected using classroom observations and interviews. The SAMR model was used as a data analysis tool to determine the extent to which Setswana student teachers can integrate ICT in their classrooms. The results of this study indicate that the student teachers' competence to use ICT was still at a lower level. They predominantly only have basic computer literacy skills, such as word processors, PowerPoint, and other digital resources. The study revealed that the student teachers' ICT integration levels were still at the substitution and augmentation levels.

Chapter 24: *The 'third space', where everyday and formal writing practices meet*; by Paolo Sorzio & Caterina Bembich. In this chapter, the development of literacy competence is intended as a process of progressive connection of the everyday writing repertoires with the more formal writing genre characteristic of schooling, through students' participation in innovative activities in the "third space" (Gutiérrez, 1993; 2008; Gutiérrez, Rhymes, & Larson, 1995). Moving from Jack Goody's conceptualization of writing as a "technology of intellect" (Goody, 1987; Olson, 1996), it is considered that young people work out highly contextualized writing repertoires in their everyday life to achieve specific goals in practice. These repertoires may differ from the literacy competencies required in school and this divergence may produce in students from non-mainstream backgrounds an experience of "cultural discontinuity" (Mehan, 1998) that, in turn, may be an element

of school failure. To mediate the development of appropriate literacy repertoires in multicultural schools, it is required the construction of a “third space”, in which the existing everyday writing repertoires may be transformed to achieve expressive and argumentative goals in social communication. The empirical basis for the analysis derives from a school ethnography, conducted in a secondary school serving a student population of recent immigration in Italy in a working-class town in Northern East Italy.

Section 3, entitled “Teaching and Learning”, offers research about foundations in the education process itself, in various contexts, both for tutors and students.

Chapter 25: *Integrating science in religious education using an argument-based inquiry approach in Kampala Ismaili secondary classroom*; by Bilquis Hamid. Current secular and Religious Educational (RE) systems in Uganda are registering improvement, but not fast enough to meet the needs of its students. Most secular and religious classrooms still follow a teacher-centred approach where students depend on their teachers' instructions to perform any task and rarely think critically beyond the curriculum. Extensive research indicates that students' critical thinking skills improve when science teachers use an Argument-Based Inquiry (ABI) approach. Relatively, less research is done in RE using science subject knowledge to prove religious claims through argumentation. Thus, this small-scale study aimed to enhance critical thinking in students by integrating science into religious education through discourses using the ABI approach. Data collection methods included students' written and verbal responses to religious claims and reflections from students and teachers. Data collected from sixteen sessions were analysed using codification. The findings suggest that the ABI approach facilitated critical thinking, extended discussions, and improved justification of scientific claims beyond the RE curriculum. This small study can inform global RE teaching practices to develop critical thinking skills in students using argumentation. Affirming that argumentation is at the heart of classroom practice, this paper concludes that teachers need to develop their argumentation skills through ongoing professional development.

Chapter 26: *Conceptual transition in students’ learning from arithmetic to an algebraic context: A conceptual way from rational numbers to rational equations*; by Natalia Karlsson & Wiggo Kilborn. Our current research addresses students’ arithmetic and algebraic knowledge, focusing on conceptual connections, and relationships between two aspects of knowledge. The contents in question are rational numbers and rational equations in grades 7, 8 and 9. The study contains three tests given to 400 students in grades 7-9. The tools for analysis comprised an algebraic concept of rational numbers, the theory of generalizing arithmetic into algebra, and theoretical approach about the relationship between arithmetic and algebra in a conceptual context. Current research shows that students’ knowledge of algebra and arithmetic has a limited conceptual connection and a weak relationship with each other. Their knowledge of arithmetic operations and solving rational

equations used to be solely procedural and relied on formulas learnt in a procedural – and often mixed – manner. This caused conceptual consequences for students' knowledge of rational numbers and their essential properties, as well as shortcomings in students' ability to operate with rational numbers. This study highlights that conceptual transitions from rational numbers to rational equations play a crucial role in students' learning, focusing on the conceptualization of arithmetic concepts and their ability to operate in an algebraic context.

Chapter 27: *Immersive virtual reality and artificial intelligence to prepare students for clinical examinations: Definitions and application*; by Brendan Concannon & Shaniff Esmail. This chapter explores the potential of virtual reality (VR) and artificial intelligence (AI) to reduce test anxiety in health science students. The chapter provides basic definitions of VR, AI, GPT and campus anxiety. The chapter describes an investigation which used a generative pre-trained transformer (GPT) to generate responses from virtual patients in a virtual clinic, allowing students to familiarize themselves with the clinical setting. The immersive VR simulation allowed students to practice for their clinical practical exams with history-taking and cognitive assessment modules. Results show that students exposed to VR had significantly lower anxiety scores compared to those who did not use it. Interviews and focus groups revealed themes related to student background, exam feedback, fear of the unknown, self-consciousness, and the exam environment. The study highlights the potential of AI-enhanced VR as an effective tool in increasing student familiarity with clinical exam environments and reducing test anxiety.

Chapter 28: *The MelArete project to foster children's ethical development: From theory to practice*; by Luigina Mortari & Federica Valbusa. The chapter presents the MelArete project, which includes the following components: (a) a theory of ethical education, conceived as education to care and virtues; (b) an educational programme aimed at encouraging primary school children to reflect on ethical concepts and experiences; and (c) a qualitative research to rigorously evaluate the effectiveness of the designed educational activities in fostering the development of children's ethical thinking. In particular, the chapter outlines the theory of ethical education in which the educational programme is grounded, also by comparing it with the main traditions in this field. Then, it presents in detail the educational activities designed for primary school and, in the conclusion, discusses them with reference to research findings.

Chapter 29: *Oral reading fluency measures for educational monitoring*; by Maíra Anelli Martins, Noemi Del Bianco, Ilària D'Angelo, Catia Giaconi, & Simone Aparecida Capellini. This study assessed oral reading fluency development in students from the 2nd to the 5th grade of Elementary School I over a school year. The research involved 400 students, aged 7 to 10 years, from a municipal public school in São Paulo. The Performance Assessment in Reading Fluency was employed, and students were evaluated in March, July, and November using three texts of similar complexity. The analysis considered the number of words

read correctly and incorrectly per minute, with statistical analysis conducted using SPSS 22.0. The results revealed significant improvements in reading fluency over time. The Wilcoxon Signed Rank Test indicated a statistically significant difference between the third and first assessment moments, with increased words read correctly and decreased errors. The Mann-Whitney Test further supported these findings, indicating that the first assessment had fewer words read correctly per minute compared to the second and third assessments, along with fewer misspelt words. In conclusion, this study provides a simple, reliable, and valid method for monitoring and tracking the progressive development of oral reading fluency in students from the 2nd to the 5th grade of Elementary School I.

Chapter 30: *Auditory and language processing disorder: A case study*; by Fabio Corsi & Ivan Traina. This chapter describes a psychoeducational intervention for supporting language learning. It concerns a child that lost about 80% of hearing functioning at 11 months age, caused by an occlusive otitis. Despite successful surgery, the child didn't learn to talk. Chapter objective consists of presenting the psychoeducational intervention adopted. This was based on inclusive practices aimed to develop language skills and carried out by an interdisciplinary team in collaboration with primary school teachers. The methodology used for describing the intervention consisted of a naturalistic observation that allowed collecting information on changes as result of the intervention. This permitted the analysis of the insights generated through practical experiences, and to find evidence in research on language learning. Also, the results emerged through the observation of this intervention provided useful elements for encouraging the exploration of intervention's potentiality and inspire future trajectories of research.

Chapter 31: *Eco-political rule awareness in childhood*; by Gudrun Marci-Boehncke, Matthias O. Rath, & Madeleine Rusch. Do preschool and primary school children already have a "political consciousness"? Furthermore, how is this expressed? A focused study examines ecological awareness in the context of the interdisciplinary research project "PoJoMeC", funded by the Federal Agency for Civic Education in Germany. The theoretical basis of the research presented here is Bronfenbrenner's (1979) ecological model of human development. However, we understand this development as shaped by a process of medial orientation (cf. Johnson, & Puplampu, 2008). Our study concretizes the question of political consciousness to the socioecological rule awareness of nine students from upper primary school classes (grade 4). Methodologically, we focus on the children's explicit knowledge, subjective theories, media sources of information, and their concepts of rule-guided action.

Section 4, entitled "Organizational Issues", gives a glance on tools for implementing organizational learning and change in the education context.

Chapter 32: *Bullying as driver of low mathematics and science achievement in South African schools in a challenged context*; by Marien Alet Graham. All children deserve safe, decent schooling; but school bullying dominates South African news. We used Bronfenbrenner's ecological theory to examine bullying and Grade 9 math and science achievement in public schools without tuition. We used a quantitative positivist approach using TIMSS 2019 data to develop multi-level models, each with 20 predictors and maths and science achievement as the outcomes. Unsurprisingly, learners who were refused to talk to, had their family insulted, forced to do things they didn't want to do, shared nasty or hurtful messages or embarrassing photos about them online and were physically hurt, performed significantly worse. Principals' views on learner intimidation and verbal abuse were significant predictors. Surprisingly, learners who reported being stolen from significantly outperformed those who reported being stolen from less or not at all. This seems counterintuitive, but we offer some explanations. In the maths model only, learners who had mean things said about their physical appearance outperformed those who had this happen less often, and in the science model only, learners who had lies spread about them significantly outperformed those who did not (again, we provide suggestions for these counterintuitive results). Recommendations are provided for future research.

Chapter 33: *The effect of entrepreneurial leadership on teacher job satisfaction: The mediating effect of professional development, teacher-student relations and teamwork*; by Devorah Eden & Ido Liberman. Privatization and decentralization policies in Israel's educational system have spawned entrepreneurial leadership among school principals. We define entrepreneurial leadership as the combination of principals' proactiveness (seeking opportunities for innovations), and school innovativeness (actual innovations). Principals as entrepreneurs must ensure that teachers overcome their resistance to the frequent changes and willingly participate in their implementation. We suggest that this depends on their job satisfaction. The literature indicates that job satisfaction is related to teachers' professional development, good teacher-student interaction, and teamwork. Data were collected from 410 Israeli teachers who completed a questionnaire evaluating their principal and his/her effect on them. We hypothesize that (a) proactiveness and innovativeness will have a positive effect on teachers' job satisfaction; (b) the relationship will be mediated by teachers' professional development, teacher-student relations, and teamwork. The results partially supported our mediation model. We concluded that teachers follow their principal willingly and actively when provided with opportunities for growth and satisfaction.

Chapter 34: *Transformation in school leadership: Voices of female leaders*; by Samantha Kriger & Sinobia Kenny. Due to an apartheid regime, South Africa was demarcated according to race classifications of 'white', 'coloured', Indian and 'black'. Race classifications determined where one lived, went to school, and the possibilities to pursue higher education. For women of color in South Africa interested in a post-schooling education, the state availed bursaries to pursue teaching (and nursing) to control and limit their careers. The backdrop to separate and segregated living and learning for each racially classified group was to socialise amongst themselves, school themselves and obtain careers deemed sufficiently fit by an apartheid government. The transition from apartheid to a more inclusive and less segregated society has been slow and particularly evident in school leadership. This chapter reports on an empirical case study of the first seven 'coloured' women principals who assumed leadership positions in historically 'white' led schools. The study locates itself in the broader Cape Town area of South Africa two decades into the country's democracy. It has a qualitative research design and uses a case study method for data collection. Following ethics approval, semi-structured interviews served as data collection instruments. Data were analysed thematically, and the findings provided insights into leadership in historically 'white' schools in post-apartheid South Africa.

Chapter 35: *Using the results of problem-solving simulations to improve group learning*; by Alexander Pojarliev. The paper discusses the application of simulations for group problem solving. The aim is to explore trends in group performance, which can enable analysis and discussion of decision-making processes during training sessions. The results of 115 groups with a total number of participants of about 510 people were obtained from 5 different simulations. The average individual and group results, the gain/loss from the group discussion and the resulting synergy were calculated as efficiency measures. The results of the groups in the sample were compared with those of known published abroad studies and the means and standard deviations were calculated to serve as reference values for Bulgarian groups. Expectations of similarity in the performance trends of individuals and groups are confirmed. The hypotheses regarding the increase in the quality of group decisions compared to the averaged individual results (in 83% of cases) and the relatively limited achievement of synergy (only in 30% of cases) are confirmed. Differences are also established between groups based on belonging to a private or state organization and open groups or members of a team/organization. The observations create a basis for in-depth discussions during the training sessions on how the quality of group learning can be improved.

Chapter 36: *Learning about heritage and identity through engraving and printing - Artistic mediation workshops for students in Tomé, Chile*; by Jessica Castillo-Inostroza. This work shares an innovative project, carried out with students from early childhood to secondary education in the commune of Tomé, Chile. It is an artistic mediation project materialised in an exhibition as a pedagogical

proposal. It seeks to highlight the value of the territory through the observation of works of art in order to approach the creation of images that show the local identity. The plastic language mainly used are simple techniques linked to engraving and printing as the main strategy of knowledge. Through the Artistic Teaching Methodologies, creative exercises were proposed based on the work of 6 local artists with the aim of understanding what was observed in the works of art, relating to it from personal experience and, finally, creating something from it. In this way, art is taught through art. The dynamics and visual results of the students' work were analysed through Arts Based Methodologies, using visual tools.

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Mafalda Carmo
World Institute for Advanced Research and Science (WIARS)
Portugal

CONTRIBUTORS

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Section 1
Teachers and Students

Chapter #1

EDUCATIONAL STRATEGIES IN SUSTAINABILITY ECONOMICS
Empowering change through education

Maria Luísa Vasconcelos & Sandra Bernardo
Faculdade de Ciências Humanas e Sociais, Universidade Fernando Pessoa, CEPESE, Portugal

ABSTRACT
This chapter looks at different ways to consolidate Sustainability Economics in the curricula of undergraduate and graduate economic-related education levels so as to enhance the knowledge and analytical skills they need to successfully address sustainability-related issues. Proposals are guided by four key principles – interdisciplinary perspectives, critical thinking, experiential learning, and collaboration with stakeholders –, and are aligned with the Dublin Descriptors' guidelines. The suggested multi-faceted educational approaches include integrating specific sustainability contents into the curriculum, using problem-based learning approaches, providing experiential opportunities, and facilitating interdisciplinary collaboration and community engagement. Anticipated outcomes include a more comprehensive understanding of economic principles related to sustainability, increased awareness of economically sustainable practices, and improved proficiency in policy evaluation. The ultimate goal is to devise educational approaches in Sustainability Economics at the undergraduate and graduate levels capable of better empowering students to make informed decisions for a more sustainable future.

Keywords: sustainability economics, education for sustainability; academic curriculum.

1. INTRODUCTION

Climate change, resource depletion, animal extinction, and other adverse effects are depicted in the *Anthropocene* (UNDP, 2020) as a result of some modern societies' production and consumption practices. The current critical situation is a reminder of the need to reassess our practices. However, a one-sided perspective on the problem is insufficient. A comprehensive approach is necessary to change the Anthropocene trajectory (Baumann, 2021). Indeed, in a context of *(poly)crisis* (Morin, 2011; Tooze, 2022), mankind faces a moment of truth, which can be one of confrontation with the end or of opportunity for change. Humanity does have the option to make different choices.

In this scenario, Education, and Education for Sustainability in particular, are essential for empowering people to become responsible, active global citizens who can contribute to a more sustainable world (Ohlmeier, 2015; Schroer, Lowman, & Just, 2015). Although Science Education is well suited to impart the vital knowledge, skills, and values essential for making informed decisions towards achieving a sustainable future for our planet (Taylor, Taylor, & Chow, 2013), educating for sustainability carries great importance across various learning domains of the social sciences (Gadotti, 2010). The study of Economics is particularly important for understanding the dimensions of sustainable behavior, evaluating the effects of environmental conservation policies, and managing the challenges of creating a sustainable global economy within a capitalist framework (Bartelmus, 2010; Wijethilake & Upadhaya, 2020).

This chapter looks at ways to consolidate Sustainability Economics into undergraduate and graduate curricula related to economics. The aim is to cultivate a more thorough awareness of sustainable economic practices and suggest educational approaches that may empower future citizens with the knowledge for consistent Sustainability Economics decision-making, thus setting the course for a more sustainable future.

2. PERSPECTIVES AND DEBATES IN SUSTAINABILITY ECONOMICS

In the face of growing global environmental tribulations, Sustainability Economics has taken center stage, engaging economists who seek to untangle the complex interactions between human activities and the environment. Several authors offer diverse perspectives on Sustainability Economics, addressing its usability, characteristics, and scope, calling for an integrated approach that considers ecological, social, and economic dimensions to effectively address contemporary sustainability challenges.

O'Hara (1995, p. 111) critiques the multiple, narrow, and often conflicting definitions of sustainable economic development within economic theory and argues that "to reframe the relationship between production and sustainability as compatible rather than adversarial requires a broadening of theory, inquiry, and methodology." For this conceptual expansion, he proposes three essential principles: emphasizing concreteness rather than abstraction, connectedness rather than isolation, and diversity rather than homogeneity. Complementarily, Seghezzo (2009) challenges the traditional understanding of sustainability and proposes a conceptual framework with five dimensions: "place" (which encompasses three spatial dimensions), "persons" (the human dimension), and "permanence" (the temporal dimension), thus offering a more comprehensive view of sustainability and development.

Söderbaum (2022, p. 2) focuses on the ecological dimension and proposes Sustainability Economics (read as 'Ecological Economics') as an alternative or complement to neoclassical economics, thus moving from the theoretical limits of efficient allocation of scarce resources to “multidimensional management of resources in democratic societies where the expected interests of future generations are taken seriously.” Ayres (2008) contends that Sustainability Economics should integrate resource and environmental economics, addressing economic growth while mitigating pollution and fossil fuel consumption and considering challenges like climate change and energy supply. He sees Sustainability Economics as a multidimensional field that goes beyond the traditional confines of Environmental Economics, and emphasizes a comprehensive approach that systematically incorporates ecological, social, and economic considerations under the Sustainability Economics framework, providing a normatively rooted vision for managing the intricate relationships between humans and nature.

Baumgärtner and Quaas (2010) also present Sustainability Economics as an evolving concept that systematically integrates ecological, environmental, and resource economic considerations. They focus on the relationship between humans and nature, acknowledging an inherently uncertain future and taking a long-term perspective with a normative foundation rooted in the principles of justice among present and future generations and a commitment to economic efficiency in the allocation of natural resources. Bartelmus (2010) also presents Sustainability Economics as the merging of economic efficiency and justice. Accordingly, he argues for a quantifiable sustainability concept through environmentally modified national accounts, emphasizing sustainable economic performance and growth.

Quental, Lourenço and da Silva (2011) identify four key sustainability principles, incorporating insights from Ecological Economics, sustainability transition, and sustainability science: biophysical limits that constrain the economy, a focus on societal welfare and development, the existence of minimum irreducible needs, and system complexity. Mensah (2019) is more concerned with inter- and intragenerational equity anchored on three interconnected pillars: environment, economy, and society. He stresses the importance of considering interconnections, synergies, and compromises among these elements and calls for substantial actions from key players (such as the United Nations, governments, the private sector, and civil society organizations) to promote sustainable resource management at multiple levels in terms of policies, education, and regulations on social, economic, and environmental resource management. These actions are deemed crucial to fostering widespread awareness and compliance with the principles of sustainable development.

These diverse perspectives reveal only a few of the ongoing debates within Sustainability Economics, addressing the balance between economic efficiency, justice, and environmental considerations. Indeed, for years, many influential scholars have enriched the discourse on Sustainability Economics from varying perspectives. Hardin (1968) discussed resource management and sustainability. Schumacher (1973) advocated for human-scale, decentralized technologies and sustainable development. Georgescu-Roegen (1986) strongly influenced ecological economics. Ostrom (1990) provided valuable insights into the sustainable management of natural resources, focusing on common-pool resources and institutional analysis. Daly (1996) extensively discussed ecological economics and the complexities of sustainable development. Costanza et al. (1997) focused on ecological economics, valuing ecosystem services, and promoting sustainability. Schor (1999) explored the relationship between work, consumption, and sustainability and related it to economic systems and environmental sustainability. Sen (1999) left an indelible mark on discussions surrounding sustainable development, with an emphasis on social justice. And Jackson (2009) discussed the intricate relationship between economic growth and sustainability.

Other noteworthy contributions to the practical application of economic principles to address sustainability challenges include the seminal contributions of Ostrom (1990; 2009) in sustainable resource management, Nordhaus's (1994; 2019) investigations into the costs and benefits of climate policies, and Romer's (1990) research on innovation and technological progress fostering sustainable economic development. These recognized works, acknowledged by laureates, exemplify the effectiveness of applying economic principles to address sustainability concerns.

Collectively, all the above contributions significantly added to the theoretical foundations of Sustainability Economics. However, despite sharing elements such as integrating ecological, social, and economic considerations and emphasizing long-term perspectives, Sustainability Economics exhibits discrepancies in the importance given to justice, efficiency, conceptual framework dimensions, and the role of economic growth. These differences, however, contribute to the dynamic, multifaceted nature and comprehensiveness of Sustainability Economics.

For the purpose of this chapter, we choose to follow the direction provided by Baumgärtner and Quaas (2010) and again by Drupp, Baumgärtner, Meyer, Quaas, and von Wehrde (2020) after a systematic examination of the development and state of Sustainability Economics between 1987 and 2013, and adopt a four-dimensional characterization: (i) a subject matter focus on the human-nature relationship; (ii) orientation to the long-term and uncertain future; (iii) a normative orientation of sustainability; and (iv) a genuinely economic efficiency concern. Accordingly, Sustainability Economics is to be understood as

a multidimensional and interdisciplinary field with a genuinely economic focus that encompasses the relationship between humans and nature, adopts a long-term perspective, and prioritizes economic efficiency while establishing a normative foundation for sustainability challenges.

3. CRITICAL ROLE OF SUSTAINABILITY ECONOMICS EDUCATION

The pressing global challenges facing humanity over the last several decades have highlighted the intricate interplay between environmental degradation, social inequality, and economic instability. These challenges highlight the need for comprehensive, interdisciplinary approaches that transcend traditional disciplinary boundaries and ultimately tackle issues pertaining to human rights (Vasconcelos &Vasconcelos, 2022).

As previously discussed, Sustainability Economics goes beyond environmental considerations and adopts an interdisciplinary long-term approach that prioritizes social equity and environmental responsibility over short-term economic gains, attempting to provide transformative solutions to global problems beyond the environmental sphere. While Environmental Education raises awareness and instills a sense of responsibility for environmental issues, it cannot replace education in Sustainability Economics, which provides a more comprehensive framework.

Achieving sustainability requires a fundamental cultural shift that can only be brought about through the education of sustainability-responsible citizens. In this context, education for Sustainability Economics plays a central role by empowering students with an interdisciplinary knowledge base. This knowledge enables students to grasp fundamental concepts such as Ecological Economics, social justice, common-pool resources, ecosystem services, and decentralized technologies, providing them with the competencies necessary to effectively address the complexities of sustainability challenges and actively contribute to a sustainable future. Thus, the interdisciplinary nature of Sustainability Economics aligns with the transformative vision of education for sustainability.

Educational initiatives related to Sustainability Economics foster critical thinking skills essential for analyzing and evaluating the impacts of economic decisions on environmental and societal domains. This capacity is crucial for guiding individuals towards informed decision-making aligned with sustainable practices. Simultaneously, the development of problem-solving skills in Sustainability Economics encourages creative thinking, facilitating the generation of innovative solutions to real-world challenges and favoring sustainable practices across diverse sectors of the economy. Additionally, ethical considerations in economic decision-making, emphasized in education, encourage individuals to reflect on the social and environmental impacts of economic activities, fostering values such as equity, social justice, and responsibility towards future generations. Furthermore, education actively promotes community engagement and participation, empowering individuals to contribute to local initiatives, advocate for sustainable practices, and collaborate with others to address sustainability concerns.

Ultimately, education for Sustainability Economics has to be able to exert a disruptive-transformative influence (Gadotti, 2010) by heightening awareness of the sustainability-related implications of individual decisions and deepening the comprehension of how personal choices can either support or hinder long-term sustainability, social equity, and environmental well-being. This ‘transition from transmissive education to transformative education' was pointed out as a necessity and "includes elements of insight, reflection, learning in the outdoors, and learning through sustainability themes, implementing ESD [Education for Sustainable Development] in schools through a series of regional hubs with

clusters of schools in partnerships with existing tertiary institutions, government and nongovernment organizations" (4th International Environmental Education Conference, held from November 24–28, 2007 at the Center Environmental Education cit. in Gadotti, 2010, p. 206).

Given the objective of not only imparting knowledge but also fostering a sense of responsibility and awareness regarding sustainable economic issues and their interconnectedness with broader social, economic, and environmental systems, it is necessary to revise curricula to prioritize the promotion of sustainability awareness across various educational levels. This can be achieved through the implementation of diverse approaches such as interdisciplinary curriculum integration, experiential learning, technological integration, and community engagement. The following sections 4. and 5. seek to present educational approaches in order to accomplish this objective.

4. METHOD

This study adopts a qualitative method (Creswell, 2017), drawing on scholarly research and theoretical knowledge to suggest educational approaches for Sustainability Economics education.

The selection of approaches was grounded in four key premises. Firstly, Sustainability Economics adopts an interdisciplinary perspective, recognizing the need for knowledge from other disciplines in order to effectively address the intricate global issues of today. This interdisciplinary approach incorporates economic concepts with perspectives from Environmental Science, Sociology, Ethics, and several other fields, offering students a comprehensive understanding of sustainability. Secondly, critical thinking is deemed a fundamental characteristic of sustainability education. It enables students to effectively analyze the complex and multidimensional character of issues associated with sustainability and empowers them with the capacity to consider the trade-offs that come with decision-making and to develop innovative, systemic solutions. Thirdly, experiential learning is considered a crucial educational methodology within sustainability education. Engaging in activities like field excursions, internships, and community participation provides students with the opportunity to apply theoretical knowledge in practical, real-world contexts and gain a more profound and intricate comprehension of sustainability concerns and the many complexities associated with them. Fourthly, collaboration with stakeholders is considered another fundamental component of sustainability education. By fostering collaboration with communities, companies, non-governmental organizations, and government entities, educational institutions may provide a range of viewpoints, real-world experiences, a collective sense of accountability, and chances for students to actively contribute to positive transformations towards a more sustainable future. Therefore, educational institutions should prioritize fostering collaboration and engagement with relevant stakeholders, enriching the educational process, and offering practical insights into the application of sustainable practices in real-world scenarios. Based on these premises, proposals were devised to pursue a transformative role for Sustainability Economics education, drawing from over thirty years of academic and pedagogical experience in the fields of economics, macroeconomics, and development. The proposals align with the Dublin Descriptors' guidelines (Report for the Joint Quality Initiative Informal Group [RJQIG], 2004), which serve as a fundamental framework for delineating learning objectives, outcomes, and competencies across various educational levels. Additionally, consideration was given to the development of students' cognitive, practical, communicative, and problem-solving competencies at each educational level. Efforts were also directed towards assessing the degree of autonomy, the level of task complexity, and the desired learning outcomes for different stages of learning, ensuring an overall alignment of pedagogical approaches with the needs of the students involved.

Since these are general proposals, each should be adapted to the unique context and needs of the educational institution and students involved in each specific case.

5. PROPOSALS AND EDUCATIONAL APPROACHES

Tables 1 and 2 summarize proposals for incorporating Sustainability Economics into academic curricula through the implementation of interdisciplinary curriculum integration, experiential learning, community engagement, and the integration of sustainability principles across diverse educational levels and disciplines.

Table 1 presents an overview of educational curricula and strategies aimed at enhancing Sustainability Economics education among undergraduate economics students. Table 2 focuses on helping graduate economic-related students comprehend the intricate linkages between socioeconomic factors and sustainability while acknowledging potential challenges and limitations in the field of Sustainability Economics. The proposals in both tables benefit significantly from a review of relevant literature, which helps identify approaches, challenges, and opportunities.

Table 1.
Promoting Sustainability Awareness among Undergraduate Economics Students.

Main Objectives:	**1.** Understanding sustainable economic concepts and practices; **2.** Promoting transformative thinking and action to foster change.
Educational Strategies (ES)	**Related Actions (RA)**
Curriculum - Learning Topics (Cassar, 2022; Eizaguirre, García-Feijoo, & Laka, 2019; Lengyel et al., 2019; Novo-Corti, Badea, Tirca, & Aceleanu, 2018) **ES1. Sustainability Economics contents** • *Sustainable development*; • *Environmental economics*: resource depletion and circular economy models; negative externalities and renewable energy sources; • *Consumer and business practices*: ecosystem services; corporate social responsibility; sustainable supply chains; consumption patterns. **Educational approaches** **ES2.** Problem-based learning approaches (Natkin, 2016); **ES3.** Experiential learning opportunities: Field trips, Applied projects (Lozano, Merrill, Sammalisto, Ceulemans, & Lozano, 2017); **ES4.** Inquiry- and Active-based learning approaches (Govender & Pillay, 2022; Sierra & Suárez-Collado, 2021).	**RA1.** Invite sustainability experts and practitioners to deliver **guest lectures** and provide real-world insights and problem-solving approaches (e.g., Robina-Ramírez & Luna, 2020). **RA2.** Conduct interactive **workshops, seminars, and small-group roundtable discussions** where experts facilitate discussions, group activities, and problem-solving exercises (e.g., Leal, Azeiteiro, & Aleixo, 2024; Mititelu, Fiorani, & Litardi, 2017). **RA3.** Host **panel discussions** with experts from different sectors and disciplines to provide diverse perspectives on sustainability issues (e.g., Aronczyk et al., 2022). Students can engage with panelists through Q&A sessions. **RA4.** Arrange **informal networking events** where students can meet and interact with sustainability experts informally, fostering meaningful connections and discussions (e.g., Henry, 2018). **RA5.** Arrange **visits** to organizations, research centers, or projects (e.g., Samuel, Thomas, McGouran, & White, 2022). **RA6.** Establish **mentorship programs** that pair students with sustainability professionals, providing students with one-on-one opportunities to learn from experienced practitioners and personalized learning experiences (e.g., Birdman, Barth, & Lang, 2022). **RA7.** Integrate sustainability concepts into **capstone courses,** encouraging or requiring students to apply their knowledge to real-world problems or situations

	(e.g., Palacin-Silva, Seffah, & Porras, 2018; Thomas, 2018). **RA8.** Encourage students to **identify sustainability challenges** within their communities or on-campus and design and implement projects to address them, fostering a sense of ownership and responsibility. **RA9.** Assign **homework** that requires students to investigate real-world sustainability challenges and propose evidence-based solutions, enhancing their understanding of complex sustainability issues. **RA10.** Organize **challenges** where students work in teams to develop sustainable solutions, encouraging creativity and teamwork (e.g., Govender & Pillay, 2022; Sierra & Suárez-Collado, 2021).
Expected Results	**Challenges**
1. Increased awareness and understanding of sustainability issues. **[ES1; RA1-4]** **2.** Enhanced critical thinking and problem-solving skills. **[ES2&4; RA1-10]** **3.** Real-world exposure to sustainable practices. **[ES2-4; RA5-6]** **4.** Improved analytical and research skills. **[ES2-4; RA7]** **5.** Increased sense of ownership and responsibility. **[ES3; RA8-10]**	**1.** Engaging students in practical sustainability implementation (Pearson, Honeywood, & O'Toole, 2005; Rampasso et al., 2019) **2.** Addressing students perceptions of economic growth vs. environmental protection (Müller, 2018). **3.** Facing little support for transformative learning for sustainable development in most higher education quality assurance frameworks (Janssens, Kuppens, Mulà, Staniskiene, & Zimmermann, 2022).

Table 2.
Promoting Sustainability Awareness among Graduate Economics Students.

Main Objective	**1.** Deepen the understanding of the complex interactions between socioeconomic factors, climate change, environmental policies, and renewable energy adoption to inform sustainable and equitable decision-making in the field of economics.
Educational Strategies (ES)	**Related Actions (RA)**
Curriculum - Learning Topics (Cassar, 2022; Eizaguirre et al., 2019; Lengyel et al., 2019; Novo-Corti et al., 2018) **ES1. Sustainability Economics theory** • Growth and sustainable development • Economics, biodiversity loss, and ecosystem degradation • Externalities of economic policies on the environment • Economic effects of moving to a circular economy model • Land-use and natural resource management • Economic impact of renewable energy adoption • Green technologies and sustainable growth • Sustainable transportation and urban mobility solutions • Sustainable tourism practices on local economies • Sustainable consumption patterns • Sustainable business practices • Economic models related to climate change	**RA1.** Host climate change-related **conferences**, **seminars**, and **workshops** on policy analysis and renewable energy policy and economics (e.g., Leal et al., 2024; Mititelu et al., 2017). **RA2.** Collaborate with **environmental organizations** and **energy companies** for real-world data collection and analysis (e.g., Barnes & Phillips, 2000; Susilo, 2022). **RA3.** Partner with **Non-Governmental Organizations** (NGO) and Community-based Organizations (CBO) to conduct environmental research, focusing on the relationship between inequality and sustainability (e.g., Kenney, Dukes, Lips, & Hellmann, 2016; Susilo, 2022).

ES2. (Offering) interdisciplinary courses on sustainability • Sustainable Development • Sustainable Cities • Environmental Sustainability • Climate Change Policy and Governance • Sustainable Business Practices • Sustainable Energy Solutions Sustainable Tourism and Ecotourism • Sustainable Agriculture and Food Systems • Biodiversity Conservation and Ecosystem Services • Circular Economy and Waste Management • Consumerism • Environmental Ethics **Educational approaches** **ES3. Emphasizing data-driven approaches to understand and address sustainability challenges** (Peças et al., 2023) • Analyzing data on the impact of capitalist production and consumption on sustainable development (Bătuşaru & Rădoiu, 2022); • Focusing on data analysis and evidence-based approaches to inform decision-making and policy development in the context of sustainability (Brown, Schildkamp, & Hubers, 2017; Lozano et al., 2017); • Conducting simulation exercises to assess policy effectiveness (Hallinger, Wang, Chatpinyakoop, Nguyen, & Nguyen, 2020; Yeung, So, Cheng, Cheung, & Chow, 2017);	**RA4.** Engage in **community outreach programs** to promote environmental awareness and sustainability (e.g., Lozano et al., 2017). **RA5.** Promote **networking initiatives** in sustainability-oriented higher education to enhance students' involvement in policy debates and professional development, helping them build a strong foundation in Sustainability Economics (Dlouhá, Henderson, Kapitulčinová, & Mader, 2018). **RA6.** Encourage students to collaborate with experts on **research projects**, giving them firsthand experience working with professionals and gaining insights from their expertise (Leal et al., 2024). **RA7.** Foster interdisciplinary collaboration through **multidisciplinary team projects** to address sustainability challenges, encouraging diverse perspectives and holistic problem-solving (Meyer, Mader, Zimmermann, & Çabiri, 2017; Sundermann & Fischer, 2019). **RA8.** Offer **study abroad programs** focused on sustainability to provide a global perspective on sustainability challenges and solutions.
Expected Results	**Challenges**
1. Comprehension of Sustainability Economics and renewable energy economics, including the economic impacts of climate change **[ES1-2; RA8]** **2.** Expertise in formulating and assessing economic policies for equitable development and environmental conservation **[ES3; RA1-7]**. 3. Enhanced skills in policy analysis and evaluation with a focus on sustainability and climate change mitigation **[ES3; RA1-7]**.	**1.** Addressing data limitations and integrating complex climate models into economic analysis (Bretschger, 2014). **2.** Addressing students' perceptions of economic goals vs. long-term sustainability objectives (Müller, 2018; Sternäng & Lundholm, 2012). **3.** Fostering interdisciplinary cooperation in sustainability research and staying updated on rapidly evolving renewable energy technologies (Sharma, Steward, Ong & Miguez, 2017). **4.** Overcoming policy resistance to the implementation of sustainable practices (Duarte et al., 2023; Farinha, Caeiro & Azeiteiro, 2020).

6. DISCUSSION

Tables 1 and 2 present an overview of educational approaches aimed at integrating Sustainability Economics into both undergraduate and graduate levels.

Table 1 addresses educational approaches to promote sustainability awareness in undergraduate Economics students, with the main objective of enabling them to understand and critically examine sustainable economic problems and comprehend the significance of sustainability in practical contexts so as to foster change. To begin with, it is recommended to incorporate mandatory Sustainability Economics subjects into the curriculum focused on sustainable development, Environmental Economics, and consumer and business practices (ES1). The pedagogical emphasis on introductory concepts that are the basis for theories in Sustainability Economics motivates the selection of these major topics. At this level, students are introduced to fundamental problems and economic-related principles and theories – e.g., resource depletion and circular economy models, negative externalities and renewable energy sources, corporate social responsibility, and sustainable supply chains –serving as a preparatory basis for more advanced studies and instilling a sense of global citizenship. Note that in this regard, Gomes, Jorge, and Eugénio (2021) found that there is already some concern about addressing sustainable development in Business Sciences in Portugal, as it is covered in Accounting and Taxation, as well as Management and Business Administration degrees and courses. However, their analysis reveals that only 95 degrees (48.5%) integrate related content into their curricula, with a mere 79 mandatory curricular units devoted to these subjects.

The integration of problem-based learning, experiential opportunities, and inquiry- and active-based learning approaches at the undergraduate level in Sustainability Economics education (ES2-ES4) is in line with the literature and attempts to bridge theory with real-world scenarios. These pedagogical approaches contribute to the development of practical skills, such as critical thinking and problem-solving, and actively engage students in the learning process, fostering a transformative mindset.

The related actions outlined (RA), including inviting specialists in sustainability for guest lectures and panel discussions, and organizing interactive workshops, facilitate direct engagement with professionals, fostering the exchange of information. Similarly, roundtable discussions and networking events aid students in engaging with diverse perspectives, contributing to a comprehensive understanding of sustainability issues. Anticipated outcomes include heightened awareness, improved critical thinking, and a deeper sense of ownership through community-based projects, as students are expected to experience increased awareness and understanding of sustainability issues. Additionally, engagement in problem-based learning approaches is anticipated to enhance critical thinking and problem-solving skills, providing students with real-world exposure to sustainable practices, broadening their perspective on sustainability challenges and enhancing their skills to propose evidence-based solutions.

However, it is crucial to acknowledge two significant challenges, namely, engaging undergraduate students in practical sustainability initiatives and their role in achieving a balance between economic growth and environmental protection. The challenge of engaging undergraduates is not a reflection of their lack of interest but rather lies in providing students with tangible experiences that align with their theoretical understanding Simultaneously, the persistent challenge of balancing economic growth with environmental protection demands continuous academic attention. According to Sternäng & Lundholm (2012) students focus exclusively on economic growth and social welfare and seem to believe that environmental problems are inevitable, and that there is no dilemma between economic development and

environmental protection. Such wrong perception needs to be countered. Initiating discussions at the undergraduate level is deemed fundamental to cultivate a mindset that recognizes the intricate relationship between economic growth and environmental sustainability, strengthening a knowledge-based sense of responsibility and awareness from this level of education.

The educational approaches outlined in Table 2 aim to empower graduate economics students with advanced knowledge and skills essential for making informed decisions in areas related to Sustainability Economics. The proposals are comprehensive, covering academic study of the intricate connections between the economy and sustainability, interdisciplinary courses on sustainability, and a focus on data-driven approaches to tackle sustainability challenges

A diverse array of subjects is recommended (ES1), encompassing the adoption of renewable energy sources, the economic implications of biodiversity loss, the transition to a circular economy, and sustainable land-use practices. These topics were selected based on their contemporary relevance and global impact. They address urgent challenges, reflect the interconnectedness of economic activities with environmental and social dimensions, align with emerging trends, and hold strategic policy relevance. The adoption of renewable energy sources aligns with the need to transition towards environmentally friendly energy systems, addressing both economic and environmental concerns. Economic implications of biodiversity loss relate to a strategic need for conservation policies. The transition to a circular economy is crucial for resource efficiency and waste reduction, directly impacting economic sustainability. And finally, sustainable land-use practices are crucial for balancing economic development with environmental preservation. As Gadotti (2010, p.207) pointed out, "at the university level, besides diffusing environmental information, we need to produce new knowledge and to conduct research that aims at looking for a new development paradigm." Together, these subjects are expected to form a comprehensive and forward-looking graduate curriculum in Sustainability Economics, today. Nonetheless, while recognizing their importance, the dynamic nature of Sustainability Economics demands ongoing consideration of emerging issues and global needs to keep graduate programs at the forefront of sustainability discourse.

The comprehensive approach to sustainability education is also demonstrated by the inclusion of related interdisciplinary courses (ES2) and data-driven methodologies (ES3). Related actions (RA) include hosting climate change events to foster critical analysis, collaborating on real-world data to merge theory with application, partnering with Non-Governmental Organizations and Community-Based Organizations to link environmental issues with societal impact, networking, and multidisciplinary activities. These actions aim to bridge academic knowledge with practical relevance, emphasizing the commitment to practical fieldwork and research and the importance of connecting academia with community needs.

Major challenges include addressing data limitations and integrating complex climate models into economic analysis, demanding meticulous consideration to ensure the reliability of outcomes. Another significant hurdle is addressing students' perceptions of economic short-term goals vis-à-vis long-term sustainability, which explains the difficulty of aligning economic priorities with environmental sustainability. Moreover, fostering interdisciplinary cooperation in sustainability research is challenging, particularly given the rapid evolution of renewable energy technologies. Despite these challenges, the proposed broad and interdisciplinary approach is expected to equip graduate students in Economics (and other related courses) with the knowledge and effective communication and collaboration competencies to address critical sustainability issues.

Note that the objectives of multidisciplinary education approaches to Sustainability Economics can significantly benefit from the use of data-driven methodologies and information technology, including digital technologies, internet platforms, and data analytics. This is particularly true when attempting to expedite simulations and enable access to settings in different parts of the world, as well as data that would otherwise be unattainable. Equally relevant are soft skills, such as critical thinking, communication competencies, and problem-solving capabilities, since they enhance students' capacity to think ethically about economic choices and understand their consequences for society and the environment. This comprehensive educational approach, blending technological advancements with essential soft skills, promotes a well-rounded preparation of graduate economics students, equipping them to address the challenges of sustainability issues in the contemporary world.

7. CONCLUSION

This chapter looked at different ways to consolidate Sustainability Economics in the curricula of undergraduate and graduate economic-related education levels so as to enhance the knowledge and analytical skills they need to successfully address the urgent challenges posed by sustainability-related issues. The suggested educational approaches included integrating specific sustainability contents into the curriculum, using problem-based learning approaches, providing experiential opportunities, and facilitating active engagement with experts from different fields. The aim of these approaches was to promote an educational environment that encourages the formation of knowledgeable students who are capable of actively promoting sustainability.

When devising the educational proposals, it was considered their expected effectiveness and long-lasting influence within the realm of Sustainability Economics and sustainability as a whole. This was especially true when considering the complex relationship between economic growth and environmental preservation, as well as the inherent difficulties associated with implementing sustainability practices. Accordingly, the multifaceted proposals aimed to help prepare students with the knowledge and skills deemed essential for an informed balancing of immediate economic priorities with long-term environmental sustainability goals, despite the inherent challenges associated with such endeavors.

At the undergraduate level, a comprehensive and interactive approach to sustainability education was proposed, focusing on foundational concepts, practical skill development, and engagement with real-world scenarios. Two significant challenges were identified - engaging undergraduate students in practical sustainability initiatives and defining their role in achieving a balance between economic growth and environmental protection. In spite of these challenges, the importance of early discussions on the complex relationship between economic growth and environmental sustainability was acknowledged, as was the need to provide undergraduate students with tangible experiences aligned with their theoretical understanding.

At the graduate level, the goal was to equip students with advanced knowledge and skills in economic sustainability. The curriculum aimed to incorporate diverse topics such as renewable energy, biodiversity loss, the circular economy, and sustainable land-use practices, emphasizing the interconnectedness of economic activities with environmental and social dimensions. Despite acknowledged challenges, educational proposals involved enhancing interdisciplinary approaches, adopting data-driven methodologies, and engaging students in practical actions. The proposals acknowledged the dynamic nature of Sustainability Economics, emphasizing ongoing consideration of emerging issues to ensure relevance in the ever-evolving field.

Finally, the text emphasized the importance of integrating technology and data analytics into modern Sustainability Economics education, particularly highlighting their potential in processing and analyzing large datasets. Simultaneously, emphasis was placed on soft skills such as critical thinking, efficient communication, and proficient problem-solving, which empower students to critically analyze the implications of their economic decisions and the far-reaching consequences of their choices on society and the environment. Given these considerations, the effort to consolidate Sustainability Economics into academic curricula appears to be a relevant educational endeavor with the potential to influence how individuals make economic decisions in the future, thereby promoting a sustainable and equitable society.

8. FUTURE RESEARCH DIRECTIONS

Future research relevant to this study could consider relating these educational proposals to the United Nations' Sustainable Development Goals. Another research direction could examine how to develop dynamic, employability-focused, and practical Sustainability Economics curricula that stay in line with changing student requirements, the needs of the labor market, and sustainability concerns.

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AUTHORS' INFORMATION

Full name: Maria Luísa Silva de Vasconcelos
Institutional affiliation: Universidade Fernando Pessoa
Institutional address: Praça 9 de Abril, 349; 4249-004 Porto; Portugal
Biographical sketch: Maria Luísa Vasconcelos holds a degree in Economics from the University of Porto, an MLitt in Strategic Studies from the University of Aberdeen, Scotland, and a PhD in Arts - Politics and International Relations from the same institution. She has been an educator since 1994 and currently holds the position of Associate Professor at the Faculty of Humanities and Social Sciences at Universidade Fernando Pessoa. She is a researcher at the Centre for Population, Economy, and Society Studies, where she conducts research in the field of sustainability economics.

Full name: Sandra Maria Carvalho Vicente do Bernardo
Institutional affiliation: Universidade Fernando Pessoa
Institutional address: Praça 9 de Abril, 349; 4249-004 Porto; Portugal
Biographical sketch: Sandra Bernardo completed her MSc. in Services Engineering and Management at the Faculty of Engineering in Porto and her MSc. and Doctor degree in Economics from the Nova School of Economics in Lisbon, Portugal. She has been committed to education since 1996 and is now an Assistant Professor at the Faculty of Humanities and Social Sciences at Universidade Fernando Pessoa. She conducts research at the Centre for Population, Economy, and Society Studies.

Chapter #2

THE CONTRIBUTION OF MORPHOLOGICAL AWARENESS TO READING COMPREHENSION IN ARABIC

Bahaa' Makhoul[1] & Vered Vaknin-Nusbaum[2]
[1]Department of Education, Oranim Academic College, Israel
[2]Education Department and Literacy Education Center, Western Galilee Academic College, Israel; The Center for the Study of Society, University of Haifa, Israel

ABSTRACT
This study examined the contribution of morphological awareness (MA) to reading and reading comprehension in Arabic among 3rd and 4th graders. MA tests (inflections and derivations) and reading tests examining phonological decoding, orthographic recognition and reading comprehension, were administered to 50 students whose Arabic is their mother tongue. Furthermore, differences in reading achievements between students with low and high MA were examined. Findings indicate that both inflectional and derivational MA significantly explain reading comprehension. Furthermore, it was found that students with lower MA demonstrate inferiority in phonological decoding and reading comprehension compared to those with high MA. It can be inferred that Arabic readers use MA as a strategy that contributes to their ability to identify words and to comprehend a text as early as in the 3rd and 4th grades.

Keywords: morphological awareness, reading comprehension, Arabic, elementary school students.

1. INTRODUCTION

Morphological awareness (MA) is the understanding of a word's structure and the ability to consciously manipulate that structure to express different meanings (Carlisle, 1995). Individuals with developed MA are aware of simple and complex words and can decompose complex words into sub-linguistic elements (morphemes) to obtain their meaning (Carlisle, 1995; Boudelaa, 2014). They are also sensitive to the way sub-lexical meaning units (such as roots and affixes) join one another to create new words (Taft, 2003; Taft & Ardasinski, 2006).

The ability to compose and decompose new complex forms appears as early as kindergarten and first grade, but it continues to develop throughout the school years (Carlisle, 1995; 2010). The ability to use this information consciously to analyze the morphemic structure of written words appears in the first years of elementary school (Carlisle, 2003). Children use their MA in reading after their reading accuracy and fluency are well developed (Ehri, 2005; Wolf, 2008) and their attention resources can be shifted from grapheme to phoneme decoding to the word's structure to gain meaning (Chall, 1983; Stanovich, 2000; Saiegh-Haddad & Geva, 2008). In Arabic, MA and reading are strongly related to each other due the language's complex morphology and high density (Abu-Rabia & Awwad, 2004; Saiegh-Haddad & Geva, 2008). Nevertheless, most of the studies on the contribution of MA to reading in elementary school were conducted in English, a language with a relatively simple morphology. Because languages differ in morphological structure and in the way they are represented in the orthography, the contribution of MA to reading can shift according to

the distinctive characteristics of each language (Share, 2008; Verhoeven & Perfetti, 2011). The current study seeks to explore the contribution of inflectional and derivational MA to word recognition and reading comprehension among Arabic speaking elementary school students.

2. BACKGROUND

2.1. MA and Reading: A Cross-Language Perspective

MA have a unique contribution to reading (Kirby & Bowers, 2017, 2018; Tibi & Kirby, 2019). It is linked to better accuracy and fluency (Carlisle, 1995) and to reading comprehension in primary grades (Carlisle, 2003; 2007; Kuo & Anderson, 2006; Rispens, McBride-Chang & Reitsma, 2007). Deacon and Kirby (2004) found that the quality of performance in inflectional MA tasks in second grade contributed to word recognition in third to fifth grades and to reading comprehension in fourth and fifth grades, beyond the contribution of verbal and non-verbal abilities and prior reading knowledge. Similar results were found regarding the contribution of MA (inflections and derivations) to reading comprehension among fourth to ninth graders, when the vocabulary was controlled (Nagy, Berninger, & Abbot, 2006).

A study examining developmental aspects of phonological, orthographic and morphological awareness in elementary school indicated that MA has a significant contribution to the development of reading. The most accelerated development of inflectional MA was identified in the first three years of elementary school, while complex MA, such as derivational awareness, continued to develop in higher grades. The development of awareness to a more complex morphological level is crucial for successful reading of rare, new and complex words. These types of words tend to appear more frequently in fourth grade texts and onward (Berninger, Abbott, Nagy, & Carlisle, 2010).

2.2. MA and Reading among Struggling Readers

Struggling readers with low MA are less sensitive to morphological units and struggle with identifying and manipulating morphemes that can assist them in constructing and understanding new words (Carlisle, 2003; 2010; Fowler & Liberman, 1995), specifically concerning complex forms such as derivations (Tong, Deacon, Kirby, & Parrila, 2011). Difficulties in an efficient morphological analysis of complex words may increase difficulties in reading comprehension (Tong et al., 2011).

Traficante and colleagues (2011) investigated the effects of the word's frequency and length on reading complex words among skilled and dyslexic readers in elementary school. They found that dyslexic readers read pseudowords composed of a root and a derivative affix faster and more accurately than words with simple morphological structure. They seemed to benefit from the transparent morphological structure of words regardless of their frequency. The researchers claimed that familiarity with morphological units is essential to develop fluency in reading, especially among children with reading difficulties.

Results of intervention studies support a causal link between MA and reading skills and indicate that an intervention which includes learning and practice of morphemes, such as composing and decomposing of inflections and derivations or recognition of prefixes and affixes in familiar and unfamiliar words, significantly improves reading achievement in students who struggle with reading. After participating in a morphological enrichment program, third to sixth grade students improved their word reading and spelling achievement (Katz & Carlisle, 2009; Kirk & Gillon, 2009), and fourth graders improved their reading

comprehension (Carlisle, 2007). Similar findings were reported in intervention studies conducted among seven- and eight-year-olds (Nunes, Bryant, & Olsson, 2003).

Overall, the literature shows that with improvement in reading, the use of morphological strategies for word recognition and reading comprehension increases. Considering its importance to reading, there is a need to examine the contribution of inflectional and derivational awareness to reading in languages with complex morphology such as Arabic.

2.3. MA in Arabic

Arabic is characterized by a complex morphological structure and high morphological density. It belongs to the category of languages which often use bound morphemes and attach several morphemes in one word by a linear or non-linear construction. *Linear construction,* which normally characterizes nouns or adjectives, is created when inflectional morphemes are joined to an existing word, such as in plural inflections. *Non-linear construction* is normally characterized by verbs or nouns and created by intertwining the root morpheme with the structure morpheme. The phonological pattern determines the structure of the verb, therefore, different verb patterns with the same root bear a different meaning.

The stability of the root as a permanent sequence of letters, despite the phonological changes that involve its integration in the word pattern, strengthens the reader's perception of an independent morpheme that can produce a general meaning, while a specific meaning can only be achieved after the integration of the root in the pattern (Mahfoudhi, Elbeheri, Al-Rashidi & Everatt, 2010). The morphological complexity of Arabic requires the recognition of various morphemes such as suffixes, roots and patterns (Abu-Rabia, 2007; Mahfoudhi et al., 2010). The knowledge of these representations is a part of the quality of the lexical representation (Perfetti, 2007) of Arabic speakers, who use it to process spoken and written words, both consciously and subconsciously. Therefore, in Arabic, MA serves as an anchor for the reader in the process of word recognition and reading comprehension (Abu-Rabia, 2007; Abu-Rabia, Share & Mansour, 2003; Saiegh-Haddad, 2018).

The morphemic units in Arabic are given prominent expression in the Arabic writing system, especially since it does not represent the vowels inside the word, so that the consonant fluency of the root morpheme is preserved in most cases, turning the morpheme into a prominent and stable verbal unit for readers (Taha, 2013; Vaknin-Nusbaum & Saiegh-Haddad, 2020).

Tibi and Kirby (2019) found that in Arabic speaking third graders, MA was the biggest predictor compared to the other underlying mechanisms of reading (vocabulary, phonological awareness, rapid automatized naming, and orthographic processing). Abu-Rabia (2007) found that MA predicted reading accuracy, word recognition and reading comprehension in both typical and dyslexic children and adolescents. Findings indicated that recognition and production of words based on the root is a crucial factor in determining the reading level of all examined ages.

2.4. The Current Study

Multiple studies examined the contribution of MA to word recognition and/or reading comprehension; however, only a few separated between inflectional and derivational awareness and their unique contributions to word recognition and reading comprehension (e.g., Tibi & Kirby, 2019). Additionally, research conducted in Arabic is relatively sparse (Mahfoudhi et al., 2010).

Since alphabetic orthographies vary in the ways they represent the morpho-phonemic structure of the spoken language and in the level of their morphological transparency, the contribution of MA to reading may differ between languages based on their morphological density and complexity (Verhoeven & Perfetti, 2011). The unique structure of morphology in Arabic and students' awareness of this structure may affect the reading process both in elementary school students and in adult readers (Abu-Rabia et al., 2003; Abu-Rabia, 2007; Abu-Rabia & Taha, 2004, 2006; Schiff & Saiegh-Haddad, 2018).

Arabic is characterized by diglossia –two varieties of the language, one for speech and the other for writing, which is expressed in language structure, phonological, morphological and syntactic characteristics (Saiegh-Haddad, 2005; Khamis-Dakwar & Froud, 2007; Saiegh-Haddad & Henkin-Roitfarb, 2014), as well as lexical and morpho-lexical aspects (Tibi & Kirby, 2019). Readers may lean on MA in reading to overcome the linguistic gap between the languages (Vaknin-Nusbaum & Saiegh-Haddad, 2020).

This study examined the contribution of inflectional and derivational awareness to word recognition and reading comprehension among Arabic native speakers in third and fourth grades. We also investigated the differences in reading achievement between students with low and high MA. The following questions were examined:

1) Do inflectional and derivational morphology correlate with word recognition and reading comprehension in Arabic among third and fourth graders?
2) Are there differences in reading between students with low MA and students with high MA?

Hypotheses were as follows:

1) Based on previous studies conducted on young readers in Arabic (Vaknin-Nusbaum & Saiegh-Haddad, 2020), both awareness to inflections and derivations would contribute to word reading and reading comprehension in Arabic.
2) Students with low MA would exhibit inferiority in their word reading and in reading comprehension achievement compared to students with high MA.

3. METHOD

3.1. Participants

Participants were 50 students from an elementary school in Northern Israel whose mother tongue is Arabic: 27 third graders and 23 fourth graders. The sample included 29 males (58.0%) and 21 females (42.0%), 15 males and 12 females in the third grade and 14 males and 9 females in the fourth grade. The gender differences according to grades were not significant ($\chi^2(1) = 0.14$, $p = .704$). These grades were chosen since readers in the third and fourth grades have already acquired the basic skills of reading and thus direct much of their attention to reading comprehension.

3.2. Tools

3.2.1. Word Recognition and Reading Comprehension Tests

Sub-tasks of the Arabic version of the Elul assessment battery (Shatil, Nevo, & Breznitz, 2007) were used to test phonological decoding and reading comprehension. The Arabic Elul battery was developmentally designed, with age-appropriate versions from first to ninth grade, to identify low-achieving readers. It was validated on a large random sample of children and includes national norms. For the phonological decoding test, Elul was developed and validated on 596 Arabic-speaking second graders and for the comprehension test on 553 students. All tests were presented in the fully vowelized Arabic orthography and were timed according to battery instructions.

3.2.2. Orthographic Word Recognition Test

The test contained fifteen questions. Each question contained three words from which the student was requested to select the one with the correct orthographic representation. The time allocated to this test was 10 minutes.

3.2.3. Phonological Decoding Test

This test presented fifteen sentences with one missing word in each sentence. The student was required to select the missing word out of two options: both words had an identical sequence of letters but with different vowels below or above the letters. The punctuated words appeared in parentheses at the end of the sentence. The words included commonly occurring speech segments, such as nouns, verbs, and adjectives. The test was limited to 13 minutes. The score in the orthographic recognition and phonological decoding was defined as percentages out of a total of 100.

3.2.4. Reading Comprehension Test

This test examined the child's reading comprehension ability using two narrative texts. Each text was followed by multiple choice questions. The first text contained 84 words followed by six questions with three distractors for each item. The second text contained 94 words followed by ten questions with three distractors for each item. The time allocated for each text was 13 minutes. Reading tests were identical for both the third and fourth grades. Comprehension scores were the percentage of correct answers. The correlation between the reading comprehension tests was found to be positive, high and significant in both the third grade ($r = .55$; $p=.007$) and fourth grade ($r = .55$; $p=.009$); therefore, a general score was given according to the achievement level in each age group.

3.2.5. Morphological Awareness Test

Morphological awareness (MA) was examined using a test which was developed based on a previous test conducted with Hebrew readers (Vaknin-Nusbaum, Sarid, & Shimron, 2016; Vaknin-Nusbaum, 2018). The Arabic version of the inflectional and derivational sections of the test was used in research carried out by Vaknin-Nusbaum and Saiegh-Haddad (2020). The items were all based on common and familiar standard Arabic words which appear frequently in children's textbooks. Students were presented with the instructions before completing sample test items and then were asked to complete the task. The test had no time limit. Because morphological forms differ in complexity, separate scores were calculated for each MA task. Both grade levels received the same tests.

*Inflections***.** This part included 18 items, half for plural and half for possessive. *Plural inflections* included four regular nouns and five non-concatenated plurals (also called broken plural). *Possessive inflections* included nine possessive pronouns (e.g., mine, theirs). In both sections, distractors were wrongly inflected words created by attaching an incorrect suffix. In the plural formation section, students were presented with a singular target noun followed by the correct plural and a distractor and were asked to choose the correct one. In the possessives section, students were presented with a singular target noun and a possessive pronoun. Next to the noun and the possessive pronoun appeared three complex possessive. Students were asked to choose the correct possessive form. The morphological awareness score was the percent of correct answers out of the total number of items in each subtest. Cronbach's α was 0.93.

Derivations. The test included 12 items, half of which were root extraction tasks requiring participants to find the common root of the presented words. The rest of the items included derivations by analogy tasks, all involving deverbal nouns. Students were presented with a pair of words that included the default third person singular perfective form and its transformation to deverbal noun using the correct derivational nominal pattern. Then they were presented with another new perfective verb form and were asked by analogy to identify the right deverbal form out of three given options (note that in Arabic this transformation is a derivation). To identify the correct derivation, the child had to analyze the morphological root-and-pattern structure of the example pair, locate and extract the root from within the new word, and weave it into the derivational pattern introduced in the example. Distractors included words with the same root as the root source but with different nominal patterns. The score was the percent of correct answers out of the total number of items. Cronbach's α for this task was 0.86.

Construct formation. This section of the test included six items. Students were asked to choose the correct construct formation out of two given options. The score was a percentage score of accuracy. The morphological test was presented to all readers with diacritics. Reliability was α = 0.64.

The MA test sequences can be assembled according to morphology type: linear morphology (plural inflections and possessive), non-linear (determining roots and derive a word by analogy) and construct formation. The correlation between the plural inflections and the possessive was not significant (r = .16, p=.260), as was the correlation between root extraction and analogy derivations (r = .08, p=.567). Therefore, the scores in the five test sequences were separated.

3.3. Procedure

Tests were administered to the whole group in the classroom by two research assistants. The reading tests were administered according to the 'ELUL kit' in the following order: word perception (orthographic, phonological) and reading comprehension. The MA test was administered last. At the beginning of each test the research assistants read the instructions together with the students and solved examples. Tests were administered in the second trimester of the school year.

4. RESULTS

Table 1 shows means and standard deviation for the study variables according to age group. Significant age differences were found for orthographic word recognition, with achievements of fourth graders higher than those of third graders. No age differences were found in reading comprehension and MA, except for derivational awareness, where achievements of fourth graders were better than those of third graders.

Table 1.
Means, standard deviations and differences in the study variables according to age group (N = 50).

Variable	Sample M (SD)	Third grade M (SD)	Fourth grade M (SD)	t(48)
Reading comprehension	63.87 (20.32)	64.12 (21.69)	63.57 (19.05)	-0.10
Orthographic word recognition	66.67 (21.72)	55.80 (19.84)	79.42 (16.44)	4.53***
Phonological decoding	82.53 (22.49)	75.56 (24.60)	90.72 (16.79)	2.50*
MA				
Plural inflections	90.89 (9.96)	88.48 (11.32)	93.72 (7.36)	1.90
Possessive inflections	94.22 (13.51)	91.77 (15.89)	97.10 (9.60)	1.40
Root extraction	85.20 (25.49)	83.70 (24.83)	86.96 (26.70)	0.45
Analogy derivations	65.50 (33.46)	49.07 (32.88)	84.78 (22.28)	4.41***
Construct formation	96.00 (12.12)	96.30 (11.15)	95.65 (13.43)	-0.19

*p<.05, **p<.01, ***p<.001

Table 2 shows correlations between the study variables. Positive significant correlations were found between word recognition and reading comprehension. Achievements in the test's morphological parts were not linked to one another, except for plural inflections with the root extraction. Positive correlations were found between the scores in the morphological variables (possessive inflections, root recognition and analogy derivations). They were not significant for construct formation.

Table 2.
Correlations between the study variables (N = 50).

	WR	PD	Plural	Posse-ssive	RE	AD	Construct Formation
Reading comprehension	.37**	.56***	.20	.38**	.34*	.23	.05
Word recognition (WR)		.61***	.36*	.28*	.33*	.38**	.19
Phonological decoding (PD)			.27	.42**	.34*	.33*	-.09

	WR	PD	Plural	Posse-ssive	RE	AD	Construct Formation
Plural inflections				.16	.37**	.21	-.05
Possessive inflections					.25	.20	-.14
Root extraction (RE)						.08	-.04
Analogy derivations (AD)							.03

*p<.05, **p<.01, ***p<.001

4.1. The Contribution of MA to Reading

The first hypothesis assumed a positive correlation between MA and word recognition and reading comprehension in both grade levels. Three multiple regressions, where the dependent variables were reading comprehension, orthographic recognition and phonological decoding, were conducted (Table 3). In the first stage, the age group was entered, and in the second stage, the MA measures were entered.

Table 3.
Multiple regressions of word perception and reading comprehension on the age group and MA (N = 50).

	Reading comprehension			Orthographic recognition			Phonological decoding		
	B	SE	β	B	SE	β	B	SE	β
Step1									
Age group	1.98	5.86	.05	23.29	5.32	.54***	13.03	5.71	.32*
Adj.R^2		.001			.27***			.08*	
Step2									
Age group	-7.88	5.93	-.20	17.94	5.85	.41**	6.88	6.20	.17
Plural	0.14	0.28	.07	0.26	0.27	.12	0.12	0.29	.06
Possessive	0.48	0.19	.33*	0.18	0.19	.11	0.45	0.20	.29*
Root	0.22	0.11	.28*	0.25	0.11	.27*	0.24	0.11	.29*
Derivations	0.19	0.09	.31*	0.05	0.09	.08	0.07	0.09	.10
construct formation	0.20	0.20	.12	0.39	0.20	.22	-0.04	0.21	-.02
Adj.ΔR^2		.27**			.13*			.17*	
Model		Adj.R^2 = .27, F(6, 43) = 3.90, p = .004			Adj.R^2 = .40, F(6, 43) = 6.43, p < .001			Adj.R^2 = .25, F(6, 43) = 3.72, p = .005	

*p<.05, **p<.01, ***p<.001

All regression models were found to be distinctive. 27% of the variance in reading comprehension, 40% of the variance in orthographic recognition and 25% of the variance in word phonological decoding were explained by age group and MA. Possessive inflection, root extraction and analogy derivations were found to significantly predict reading comprehension. Age group and root extraction significantly predicted the score in the orthographic word recognition, indicating that for fourth graders, the higher the score in root extraction, the better the orthographic word recognition. Furthermore, possessive inflections and root extraction significantly predicted phonological decoding, indicating that as possessive inflection and root extraction enhance, the phonological decoding improves.

4.2. Reading Achievements of Readers with High and Low MA

A K-Means Cluster Analysis was conducted to classify the students by high and low MA. Students were divided into low MA (n = 21) and high MA (n = 20). Table 4 shows group differences in the five morphological tests, corroborating group classifications. Groups significantly differed on plural, possessive, root extraction and analogy derivations, but not in construct formation.

Table 4.
Means, standard deviations and t test values for the morphological test sequences by group (N=50).

Variable	Low MA M (SD)	High MA M (SD)	Variance T(48)
Plural	84.66 (10.82)	95.40 (6.31)	4.08***
Possessive	87.83 (18.56)	98.85 (4.55)	2.66*
Root extraction	72.38 (33.75)	94.48 (10.55)	2.90**
Analogy derivations	36.90 (23.21)	86.21 (22.74)	7.50***
Construct formation	97.14 (9.56)	95.17 (13.79)	0.56

***p*<.05, ***p*<.01, ****p*<.001**

In the third grade 59.3% of the students ($n = 16$) have low MA and 40.7% ($n = 11$) have high MA. In the fourth grade 21.7% ($n = 5$) have low MA, and 78.3% ($n = 18$) have high MA ($p = .007$, $\chi^2(1) = 7.18$). Differences in reading achievements between the groups were examined by using a MACNOVA analysis according to the MA classification group, with age group as a covariate variable (Table 5).

Table 5.
Means, standard deviations and F values for the perception of the word and reading comprehension, according to MA classification (N = 50).

Variable	Low MA *M* (*SD*)	High MA *M* (*SD*)	Variance *F*(1, 47) (η^2)
Reading comprehension	55.32 (20.38)	70.05 (18.20)	8.76** (.157)
Orthographic recognition	56.83 (21.97)	73.79 (18.85)	2.75 (.055)
Phonological decoding	70.16 (28.25)	91.49 (10.82)	8.72** (.156)

*p<.05, **p<.01

Results were significant (p = .019 ,η^2 = .196). Reading comprehension and word phonological decoding of students with high MA were better than those with lower MA. No significant differences were found for orthographic recognition.

5. DISCUSSION

The current study examined the contribution of MA to reading (orthographic recognition and phonological decoding) and reading comprehension among third and fourth graders while also examining whether this contribution changes by MA levels. Findings indicate that possessive inflections, root extraction and analogy derivations significantly predict reading comprehension. Root extraction also significantly predict orthographic recognition among fourth graders. MA also helped in phonological decoding, suggesting that the use of a morphological unit also stimulates phonological knowledge (Abu-Rabia, 2007; Taha, 2013).

Findings are in line with previous studies conducted in other languages (Carlisle, 2003; Carlisle & Fleming, 2003; Gonter-Gaustad & Kelly, 2004; Kirk & Gillon, 2009; Kuo & Anderson, 2006; Rispens et al., 2007) and in Arabic (Abu-Rabia, 2007; Vaknin-Nusbaum & Saiegh-Haddad, 2020), indicating that MA has an important role in reading. The current study elaborates that MA contributes to reading in Arabic at different levels: orthographic recognition, word decoding and reading comprehension. It can be assumed that the morphological complexity of Arabic and its shallow representation in print encourage the reader to lean on morphemes while reading (Abu-Rabia et al., 2003; Abu-Rabia & Taha, 2004, 2006; Saiegh-Haddad & Taha, 2017; Saiegh-Haddad, 2018; Vaknin-Nusbaum & Saiegh-Haddad, 2020). By decomposing words into their morphemes, the reader can retrieve a word's meaning. This strategy can also be effective along the process of decoding unfamiliar words which are composed of familiar morphemes. Because the root provides the core meaning of the word, a process of morphological decomposition can encourage access to orthographic, phonological and semantic knowledge that provides the meaning of the word

(Abu-Rabia, 2007; Taha, 2013). As a result, the process of reading words is facilitated (Carlisle, 2003; 2010; Carlisle & Fleming, 2003; Carlisle & Stone, 2005; Gonter-Gaustad & Kelly, 2004; Kuo & Anderson, 2006; Nagy et al, 2006; Ravid & Malenky, 2001).

Another explanation for the contribution of MA to reading is that morphemes are more consistent and easier to remember than orthographic units (Carlisle, 2003; Tong et al., 2011). The current study indicated that 40% of the variance in orthographic recognition and 25% of the variance in phonological decoding are explained by MA and age group. Awareness of possessive inflections as well as awareness of the root morpheme and analogy derivations were found to have a significant positive correlation with word recognition. MA contributed to reading comprehension, explaining 27% of the variance in reading comprehension. Possessive inflections, root extraction and analogy derivations significantly predicted reading comprehension. Although most previous studies did not examine different types of MA, current findings are in line with findings obtained in European languages (Carlisle, 2000; Deacon & Kirby, 2004; Kieffer & Lesaux, 2008; Gilbert, Goodwin, Compton, & Kearns, 2014) and in Arabic (Abu-Rabia et al., 2003; Abu-Rabia, 2002, 2007; Mahfoudhi et al., 2010). It appears that students use their MA to better comprehend the text they read. The fact that different types of MA predicted success in reading comprehension may indicate that reading comprehension is a complex task that requires diversified reading of morphologically complex words. This is especially relevant due to the tendency of Arabic to be morphologically dense and unite several grammatical and syntactic morphemes into a single word. It seems that for the purpose of reading comprehension, third and fourth grade readers employ different and varied types of MA.

With the improvement in reading fluency, readers' attention resources are shifted to words' morphological structures, and they use morphology to retrieve their meanings (Bar-on & Ravid, 2011; Gonter-Gaustad & Kelly, 2004). When the phonological decoding becomes automatic, readers can divert their reading resources to the morphemic structure of the written word and thus develop their MA further. While in other languages the contribution of complex MA to reading comprehension is mostly evident in the higher elementary school grades and middle school (Verhoeven & Perfetti, 2011), in Arabic, its contribution is evident earlier (Vaknin-Nusbaum & Saiegh-Haddad, 2020).

5.1. Low MA and Reading Difficulties

The current study examined differences in reading skills between students with low and high MA. The main difference was observed in derivations, which is considered more complex than inflections. In derivations, in addition to identifying morphemes, the reader must manipulate and build a new form, while extracting the root and placing it into a different phonological pattern. Inflections, on the other hand, are formed by a simpler linear formation.

Students with low MA demonstrated weaker abilities in phonological decoding and reading comprehension than readers with high MA. These findings support the hypothesis that MA in Arabic is a key factor in reading in elementary school students (Abu-Rabia et al., 2003; Abu-Rabia & Taha, 2004, 2006). Thus, MA can also be used as a differentiating factor between typical and struggling readers. These findings are in line with findings from other languages showing a correlation between poor reading achievement and difficulties in identifying morphemes and manipulating them (Fowler & Liberman, 1995; Kirk & Gillon, 2009; Tong et al., 2011).

It seems that students with high morphological ability are more skilled at identifying morphemes in morphologically complex words. These morphemes also encourage the phonological and semantic knowledge of the word, leading to the production of the meaning of words in the text, and ultimately to understanding. When the morphemes contained in the word are more familiar and frequently used, the written words are identified more quickly (Carlisle, 2000; Fowler & Liberman, 1995; Taha, 2013).

6. CONCLUSION

Findings of the current study support the hypothesis that third and fourth grade Arabic readers lean on morphological strategy when reading and likely develop awareness of the morphemic structure of the written word, parallel to the development of reading and improvement in fluency. In this study, the derivational awareness score doubled between the third and fourth grade. This sensitivity is made possible because as the grapheme-phonemic decoding is automated, attentive resources can be assigned to identifying meaningful morphemes (Bar-on & Ravid, 2011). The experience in identifying and dismantling complex words into morphological units that compose them helps in decoding and learning new and complex words, and ultimately contributes to the quantity and quality of the lexical representation of written words (Verhoeven & Perffeti, 2011) and to improvement in reading fluency (Mahfoudhi et al., 2010).

The contribution of MA to reading can be affected by the language's morphological complexity (Abu-Rabia et al., 2003; Abu-Rabia, 2007; Abu-Rabia & Taha, 2004, 2006) and the characteristics of the writing system (Verhoeven & Perfetti, 2011). Third and fourth grade Arabic speakers read non-voweled orthography; therefore, it is possible that they require MA to compensate for the missing phonological representation in print. Another possibility is that the transparency of morphemes in the Arabic writing system encourages the reader to use MA in reading (Vaknin-Nusbaum & Saiegh-Haddad, 2020). Finally, the fact that Arabic morphology is considered complex and that children are exposed to it at an early age can also strengthen the awareness of morphemes and their use in the reading process as early as in elementary school. Future studies might examine developmental aspects of the contribution of MA to inflections, derivations and reading comprehension in Arabic in higher grades of elementary school, as well as the effectivity of intervention programs aimed to improve reading by developing MA and its various aspects.

Some limitations to this research should be noted. First, to better understand the unique contribution of each morphological aspect of reading, a larger group of participants is needed. Second, verbal variables such as vocabulary should be taken into consideration since there is a link between MA and vocabulary knowledge.

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AUTHORS' INFORMATION

Full name: Bahaa' Makhoul
Institutional affiliation: Oranim Academic College of Education
Institutional address: Oranim College of Education, Tivon 3600600, Israel
Biographical sketch: Dr. Baha Makhoul is a senior lecturer and researcher at Oranim Academic College, and senior researcher in Edmond J. Safra Brain Research Centre for the Study of Learning Disabilities at Haifa University. Until 2020 She served as a senior academic consultant at the NCJW (Research Institute for Innovation in Education). Since 2007, she is the head for the Arabic language section at the Centre for Educational technology (CET). Recently, she became an affiliated Faculty Member of the Media Education Lab at the Harrington School of Communication and Media, University of Rhode Island. Dr. Makhoul is currently cooperating with both national and international leading researchers in the field of literacy, Digital Media Literacy and education.

Full name: Vered Vaknin-Nusbaum
Institutional affiliation: Western Galilee Academic College; University of Haifa.
Institutional address: Western Galilee Academic College, Akko 2412101, Israel; Abba Houshi Bvd 199, Haifa 3498838, Israel.
Biographical sketch: Prof. Vaknin-Nusbaum is an associate professor in the Department of Education, Western Galilee College, and a research associate at the University of Haifa. She is the head of the Education Department and the head of the Literacy Center for Education. She teaches undergraduate and graduate students in topics related to reading, reading acquisition, and learning disabilities. Over two decades, she systematically studied the processing of written language and the way specific characteristics of the Hebrew orthography and morphology modify the reading process. In the past 6 years, she collaborated with international researchers to investigate the communicative strategies of effective elementary teachers. This research was accepted as a WERA International Research Network. Her areas of interest are reading acquisition; reading comprehension; literacy and emergent literacy; poor readers; morphological awareness; attitudes towards language; and communicative strategies in class.

Chapter #3

THE DIGITAL AGE OF ASSESSMENTS – NATIONAL BENCHMARK TEST RECONFIGURED TO ONLINE PLATFORM

Naziema Jappie & Ashley Van Niekerk
University of Cape Town, South Africa

ABSTRACT
The sudden shift from contact to remote digital learning platforms and the facilitation of assessments via online platforms brought about unique challenges to the South African (SA) education landscape. The purpose of this technical research paper is to document the digitization project from the @NBT Online perspective and describe the @NBT Online system migration from a project and technical management perspective. Consultations were held with stakeholders to brainstorm possible solutions that would assist the Centre for Educational Assessments (CEA) in responding to the global pandemic which led to a partnership with Territorium Life (TL). TL had an online platform known as EdTest-AI, a software as a service (SaaS) solution, which combined proprietary software that uses various to deliver remote test proctoring, including verifying student identity and monitoring the room during an assessment. The first pilot @NBT Online was successfully administered on Saturday, 25 July 2020. The cost-effective and innovative SaaS approach implemented for this project is the first of its kind to be used in SA. Thus, this project is envisaged to support the departmental CEA plans in highlighting the needs that require innovation and the adoption of new and emerging technologies.

Keywords: digital platform, technical report, emerging technologies, technical management.

1. INTRODUCTION

The NBT was commissioned by the Higher Education of SA to assess the extent to which incoming students might be said to be ready to cope with the conventional demands of academic study (Cliff, 2014). Prince (2016) agrees and adds that the NBTs are based on academically researched test specifications which use modern test theories to evaluate scores of students and prospective students in the three domains of Academic Literacy (AL); Quantitative Literacy (QL) and Mathematics (MAT) in the language of instruction, namely English and Afrikaans. Frith and Prince (2018) state that the NBTs are administered in PnP format so as not to exclude any writers from participating and have testing venues in all nine SA provinces. The SA Government's Risk-Adjusted Strategy does not permit NBT testing at its national venues. Communiques from the Department of Basic Education indicate a phased reopening of schools from 1st June 2020. COVID-19 guidelines suggest that access to schools will initially be tightly controlled with no visitors or external personnel permitted. This has obvious implications for access to NBT venues at both schools and universities. Moving this high-stakes assessment online, meant that certain considerations had to be made to retain the credibility and security of the NBT tests, without compromising the validity and reliability of the scores. Digitizing the paper-based assessment(s) and adapting them for online delivery in the NBTs' context, meant that this implementation required an innovative, flexible, and robust solution to complement the

paper-based implementation. Consultations were held with stakeholders to brainstorm possible solutions that would assist CEA in responding to the global pandemic which led to a partnership with TL. TL had an online platform known as EdTest-AI. It combined proprietary software that uses Microsoft Azure Cognitive Services, Azure App Service, and Azure Database (DB) for MySQL to deliver remote test proctoring, including verifying student identity and monitoring the room during an assessment (Microsoft Inc, 2023). With a global customer base, TL had developed a product that already had existing rules and business processes that were easily implemented, demystifying several concerns raised by CEA leading to the partnering with this strategic technology partner that specializes in secure, proctored online assessments. This cloud-based digital assessment solution has a collection of features that were developed to service international institutions. These features and/or services are not restricted to, but comprise of, artificial intelligence (AI), video and audio proctoring of writers, live chat support services, and multiple authentication layers to mention a few. However, the digitization of the NBT had a significant impact on the business workflow of the Research, Data Management, and Logistics team within CEA. In response to these challenges, CEA had to fast-track its plans for a secure, proctored online assessments with the pilot commencing on 25th July 2020. This project was initiated on 1 June 2020 and completed on 12th July 2020, and would be the first of its kind with an assessment of this nature which uses technology-enhanced items (TEIs). Leonard (2020) explains that "TEIs are computer-delivered assessment items that involve higher-order thinking skills and leverage specialized interactions for capturing test-taker response data" (p. 01). An online survey was also conducted following the initial pilot of the NBT assessment, to gauge writer understanding as well as to adapt the platform to improve writer engagement and experience. While the writing experience is important to CEA, the team also needed to develop new terms and conditions regarding the new solution while remaining compliant with both Protection of Personal Information Act (POPIA) and general data protection regulations (GDPR). The digitization of this high-stakes assessment allows CEA the opportunity to offer the product via a hybrid model. This will ensure that writers will be able to participate in the assessment either digitally or via PnP which will allow for better uptake of the service(s) offered.

1.1. Project Schedule

The project manager of @NBT Online was the CEA Director and the project lead was the DSM. The DSM was responsible for translating all CEA requirements to ensure a smooth transition. CEA created the first online assessment for EdTest-AI SaaS solution within 33 working days. The first official pilot of this high-stakes assessment was pioneered on the 25th of July 2020. This was a full team effort of the CEA staff.

2. ADVANTAGES AND DISADVANTAGES OF SAAS

2.1. Advantages

To most developers, SaaS is the sacred treasure of a recurrent revenue model which provides quicker deployment time than traditional on-premises software solutions. In keeping with other cloud service industries, TL's EdTest-AI, SaaS offers small business units like CEA an opportunity to interrupt existing markets while taking advantage of their fair SaaS pricing model. Benefits of a SaaS Solution Adjusted from IBM CLOUD TEAM, 2020 are listed below:

Reduced waiting time – software as service (SaaS) differs from the traditional model because the software is already installed and configured. You can simply provision the server in cloud and in an hour the application is ready for use.

Lower costs – since SaaS resides in a shared or multi-tenant environment, where hardware and software licenses costs are low, including maintenance costs, there is a reduction in cost.

Scalability and integration – due to SaaS residing in Cloud it is scalable and is not like traditional models in which a new server is required.

New releases and upgrades – the provider upgrades the solutions and it becomes available to the user. Costs associated with upgrades are also much lower. Additionally, there is the flexibility to be able to scale SaaS use up and down depending on specific needs.

Easy to use and perform proof-of-concept – SaaS are easy to use because they come with baked-in best practices and samples. Users can do proof-of-concept and test the software functionality or new releases in advance.

2.2. Disadvantages

The advantage to using TL SaaS is also its number one challenge – demanding an internet connection. If writers have a solid, dependable connection, then it is beneficial. Understandably, if writers do not have a reliable bandwidth connection, it is a disadvantage. However, with the progressively wide availability of high-speed broadband and networks, not unlike 5G, this is becoming less of a concern. However, there are a few other situations to consider before CEA agrees to go with the TLs SaaS solution. These concerns are listed below:

Loss of control - TL administers everything, making CEA dependent upon their particular skills. The geographical location of the TL office in Mexico added to the availability of the team.

Limited customisation - TL's EdTest-AI SaaS application offers little in the way of customization and clients are offered a standardised template and/or duplication of an already existing environment.

Slower speed - TL's EdTest-AI SaaS solution can have more latency than client/server apps. With TL offices being located outside of SA this was a problem. However, this was mitigated by publishing the solution on Microsoft Azures server centres based in SA.

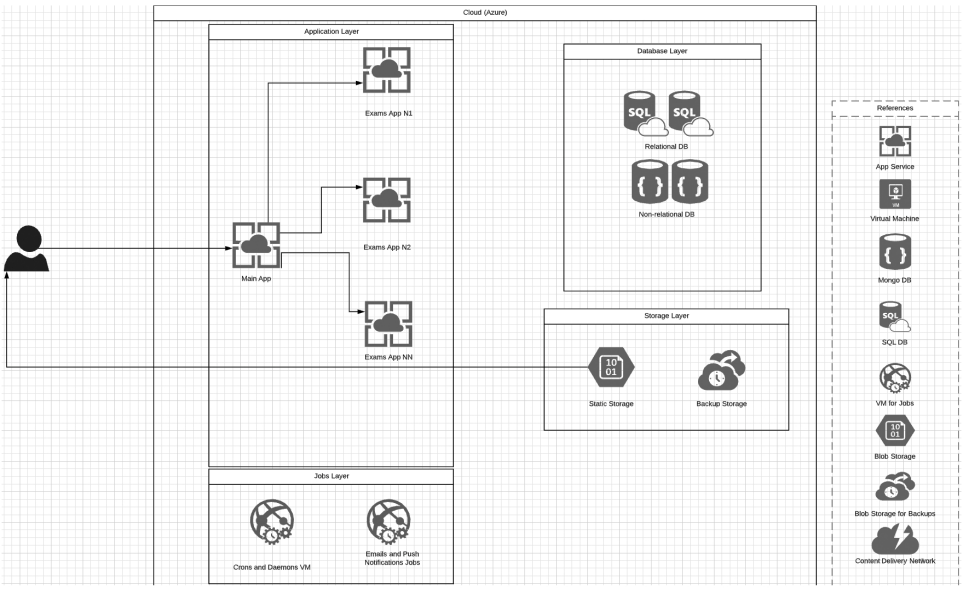
Security risks - while the EdTest-AI SaaS provider secures the application itself, rigorous measures should be taken especially with NBT writer data (CompTIA, 2021).

For CEA the benefits outweighed the challenges and therefore proceeded to move forward with the digitisation of the NBT using the EdTest-AI platform**.**

3. CEA EdTest-AI PLATFORM

On 1 June 2020, this phase started, taking a total of three days, and was concluded on 3 June 2020. TL during this time started the process of creating the development environment and setting up the platform. Figure 1 looks at the deployment of the SaaS solution and as displayed, the solution is hosted on the cloud (cloud computing). A breakdown of the services and layers is provided below:

Figure 1.
High level Deployment Diagram.



1. The application layer consists of the following application services, Main application, Exams App NN, Exam App N1, and Exam App N2. The EdTest AI SaaS rests here and data is transferred and managed at client level, with the writer modifying data before sending it to lower levels for storage.

2. The DB layer has a non-relational DB and a relational DB. The non-relational DB utilised is a MongoDB (MDB). Taylor (2021) describes MDB as being a document-oriented NoSQL DB used for high volume data storage. Instead of using rows and tables as in the traditional relational DBs, MDB makes use of documents and collections. Documents consist of key-value pairs which are the basic unit of data in MDB.

3. The jobs layer consists of crons and daemons, virtual machines, email, and pushes notification jobs. The EdTest AI platform has many cron jobs in place which enable search engine indexing, generation of anomaly notice, data clean-up, and more.

4. The storage layer uses azure blob storage which is Microsoft's object storage solution for the cloud. This product is designed to render drawings or documents directly to a web browser, write to log files, store files for distributed access, stream audio and video content, store data for backup, and restore disaster recovery, as well as data archiving (https://learn.microsoft.com/en-us/azure/storage/blobs/storage-blobs-introduction).

In the following section, we review the technical requirements of supported devices and controls implemented to facilitate an error free experience for writers.

4. MINIMUM TECHNICAL REQUIREMENTS

CEAs EdTest-AI platform delivers remote proctoring and monitors the writer's workspace during an assessment. The platform therefore requires access to either an integrated camera or peripheral camera. The same applies for device microphones. Table 1 lists the minimum technical requirements along with the recommendations of most used devices.

Table 1.
Pre-test preparation checklist.

Minimum device requirements to write the NBT test online				
	Desktop/Tower	**Notebook/Laptop**	**iMac/Macbook**	**Apple iPad**
Operating System	Windows 10; 8; and 7	Windows 10; 8; and 7	Mac Operating System 10.15 – 10.12; Mac OSX 10.11 and OSX 10.10	iPad iOS 11.0 and more recent are supported
Microphone	Microphone/Headset with mouthpiece (inserted to aux point or sound input)	Microphone/Headset with mouthpiece (inserted to aux point or sound input)	Microphone/Headset with mouthpiece (inserted to aux point or sound input)	Microphone/Headset with mouthpiece (inserted to aux point or sound input)
Webcam/Camera	Minimum of 480p, however, 720p is recommended	Minimum of 480p, however, 720p is recommended	Minimum of 480p, however, 720p is recommended	Minimum of 480p, however, 720p is recommended
Memory (RAM)/Permanent Hardrive Space	Minimum memory (RAM) required is 75 MB	Minimum memory (RAM) required is 75 MB	Minimum memory/hard drive space is 120 MB	N/A
Bandwidth/Internet line speed	512 kpbs (recommended 1 MB)	512 kpbs (recommended 1 MB)	512 kpbs (recommended 1 MB)	512 kpbs (recommended 1 MB)

It should be noted that the platform doesn't support the use of android-based devices such as Google Chromebooks. However, this may be adapted to include such devices should a demand arise. To ensure writers are prepared, CEA has developed a pre-test preparation checklist which assists writers in setting up their workspace and configuring their device to allow for a seamless test experience. Figure 2 provides a copy of the checklist made available to writers within the online platform.

Figure 2.
Pre-test preparation checklist.

Am I ready to write the NBTs online?

Pre-test preparation checklist

Welcome to the NBT test session! While you wait for the session to start, please complete the "Biographical information" survey that is available on the platform now and make sure you complete all the steps on this checklist.

SETTING UP YOUR WORKSPACE	
☐	Make sure that the lighting in the room is good enough for you to be able to see your screen properly during the test.
☐	Make sure that the lighting in the room is good enough for the camera to recognise your face throughout the test.
☐	Keep some scrap paper and a pencil/pen in case you need to write something down or do a calculation.
☐	Make sure there are no books, notebooks, calculators, mobile devices, or other prohibited items on your desk or near you during the test.
☐	Use the restroom before the test starts. You are allowed to leave your desk for 5 minutes should you need to use the restroom during the test but remember: Just like in a normal test, your timer will continue even when you are not at your desk.
SETTING UP YOUR COMPUTER	
☐	Make sure that your computer is plugged in and that the outlets and plugs are within your reach.
☐	Check that your internet connection is stable and make sure that you will not need to charge the device you are connecting with or purchase additional data during the test.
☐	Did your device's web camera work during the simulation? If you are not sure or are using a different device, follow the instructions that are available on the online support chat.
☐	Check your computer's power settings and make sure that it will not switch off during your test. Check the instructions that are available on the online support chat.

REMEMBER! You are writing under exam conditions and no-one else should be in the room with you or should disturb you while you are completing the test(s). You are not allowed to use your phone, a calculator, or any reference materials or notebooks. You must be always visible and if the camera cannot see you, you need to fix that before continuing the test. The online support chat is available should you need assistance. Good luck with the test(s) today.

– The NBT Team

5. PLATFORM SECURITY

Coombe, Lester, and Moore (2020) state that, when introducing a digitised assessment will eliminate various risks traditionally associated with the paper-based approach, however, new risks are associated to the digital platform, for which equally or even more dynamic security protocols would be required (p. 13). Coombe et al. (2020) specifically suggest that misuse brings about unfairness, necessitating new structures being established in the management of the digitised platform to replicate the rigorous security processes that exist in the administration of the paper-based assessment. Sango, Prince, Steyn, & Mudavanhu (2022) agree and add that, test protection and reliability create a crucial part of the design scope for the @NBT assessment and the management processes, regardless of its modality (p. 216).

5.1. Information Security

CEAs test platform uses Azure Cognitive Service "Computer Vision" and natural language processing (NLP) to extract and make sense of text from an image. This is done using optical character recognition (OCR) which allows CEA to extract printed or handwritten text from images, such a green barcoded SA identity documents (ID), smart card ID, and passports to mention a few. Data curated by the platform is encrypted, validated through data sanity checks, authenticated, and stored for review. These security protocols are described below:

1. *Encryption of data*: Data is encrypted using transport layer security (TLS) v 2.0 while in transfer. Sensible data is stored and encrypted using a two-way algorithm such as Personal Data, Questions and Answers, and scoring. Passwords are stored and encrypted using a one-way algorithm.
2. *Data sanity*: Any input (text, files, media, etc) is filtered before being transferred and saved. Text is validated to prevent Injections such as OS, NoSQL, SQL and lightweight directory access protocol (LDAP). Text is validated to prevent cross-site scripting (XSS). Files are scanned to detect malware.
3. *Authentication and authorization*: Multiple implementations are considered within TL: Multi Factor authentication, Captcha v3, Weak password checks, Token based cross-site request forgery (CSRF), authorization for application program interface (API) calls, secure cookies, and session management.
4. *Data repository:* All files are stored and encrypted using an advanced encryption standard (AES)-256 algorithm.

5.2. Writer Verification

All writers are required to register and book a test session on the official NBT website (https://nbt.uct.ac.za) where writers are issued with a unique NBT reference number post registration. A list of these variables and attributes are available in Table 2. This data is then transferred to the online platform via a secure file transfer protocol (SFTP) site.

Table 2.
Registered writer data.

	Variable	Description
1	**NBT Reference no.**	A unique ID that is automatically generated by the official NBT website and will remain with a writer indefinitely
2	**Writer Surname**	This is the writers last name
3	**Writer First Name**	This is the writers first name
4	**Initials**	This refers to the writers initial
5	**South African ID**	This refers to the writers 13-digit South African issued identity (ID) document
6	**Foreign ID / Passport no.**	This refers to writers Foreign ID and/Passport should they not be a SA citizen
7	**Date of birth**	This refers to the writer's date of birth
8	**Gender**	This refers to the sex disclosed on the official identify document
9	**Classification**	This refers to the writer's ethnicity
10	**AQL & Math**	indicates which test(s) the writer has registered for
11	**Language**	The language of choice the test will be presented in
12	**Venue**	Refers to the venue where the writer will be taking the test
13	**Date of test**	This refers to the official date of the test.
14	**Mobile**	Refers to the writer's mobile contact number
15	**Home**	Refers to the writer's home contact number
16	**E-mail**	Refers to the writer's email where all communication will be sent.

5.3. Lockdown Browser

The CEA EdTest-AI solution integrates the respondus lockdown browser which is currently regarded as the "gold standard" for securing online assessments by higher educational institutions. With that having been said the platform implicitly inherits the protocols listed in Table 3.

Table 3.
Features of Lockdown Browser.

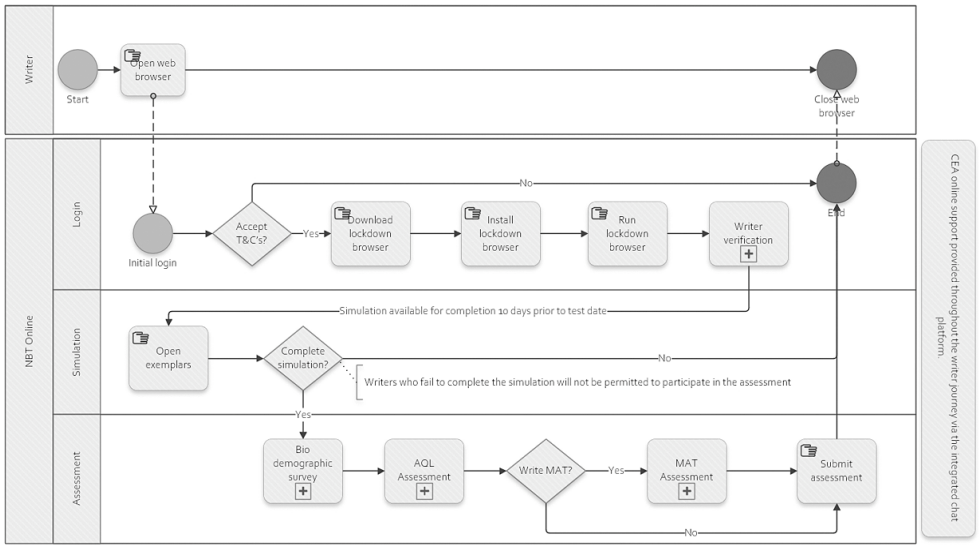
	CETAP EdTest.AI (@NBT Online)
1	Assessments are displayed full-screen and cannot be minimized
2	Browser menu and toolbar options are removed, except for Back, Forward, Refresh and Stop
3	Prevents access to other applications including messaging, screen-sharing, virtual machines, and remote desktops
4	Printing and screen capture functions are disabled
5	Copying and pasting anything to or from an assessment is prevented
6	Right-click menu options, function keys, keyboard shortcuts and task switching are disabled
7	An assessment cannot be exited until the student submits it for grading
8	Assessments that are set up for use with LockDown Browser cannot be accessed with other browsers

All writers who intend on participating in the NBT Online sessions will be required to download the application to continue. The writer's journey is explained in the next section.

6. WRITER JOURNEY

TL has adapted the EdTest-AI platform for many international higher education institutions (HEI). This allowed the CEA team to select a standardised web interface which has previously been tested, adapted, and implemented for existing HEI's. This is better understood through the writer's journey displayed in the business process mapping notation diagram displayed in figure 3.

Figure 3.
BPMN of writer journey.

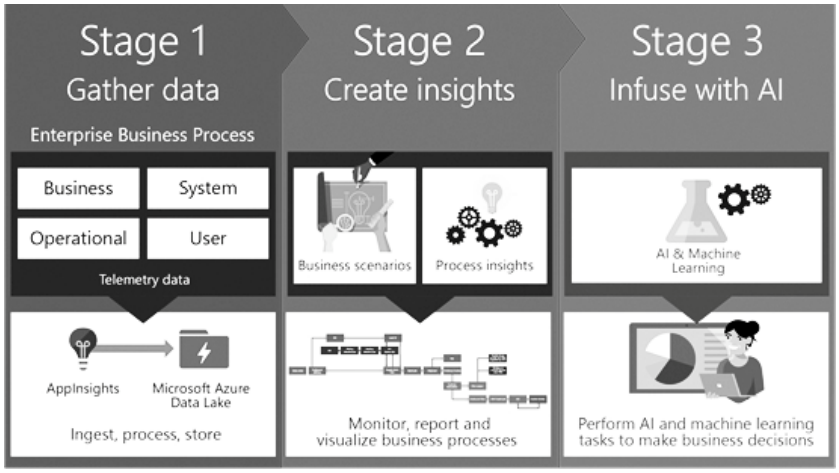


The writer's journey is initiated by accessing the online platform via web browser. As displayed above, writers are provided with online support through means of an integrated chat facility. The chat facility also assists the CEA online support identify exactly where in the process the writer is in real-time. This has afforded the CEA the opportunity to create saved responses to frequently asked questions. The solution also records and archives all chat history for future analysis. A detailed guide has been developed to assist writers in navigating the solution. During the writer's journey there is a lot of data being collated and this data is processed through data mining which will be discussed in the next section.

7. DATA MINING

CEA's SaaS solution incorporates data mining by using data analytics tools from the Microsoft Azure Services as displayed in figure 4. Microsoft application insights facilitates the capturing of CEA business process data and transforming it into a digital footprint which is stored in Microsoft Azure Data Lake nodes. This enabled the team to use data mining techniques to synthesize the data curated by the solution and gain insights, analysis, and/or real-time process monitoring on performance. This was only possible utilising Microsoft Cognitive Services, Azure Bot Service, and the Microsoft Azure Machine Learning Studio.

Figure 4.
Data mining to accelerate digital transformation (Microsoft Inc, 2019).



Data quality/sanity is crucial to any industry as the results are only as good as the data received. The quality of data was examined upfront to ensure the curation of accurate results through the data mining process. This allowed CEA the opportunity to establish several practices—including the creation of policies to enable appropriate logs, regular data checks, and ensuring that data sources were connected appropriately—to allow for relational data flow across the entire dataset. However, CEA found several places in our processes where we had whitespace in the form of no data or not enough data being recorded by the system. For example, if we didn't receive any information from a when video streaming had started and when it ended, that was considered whitespace in the continuum of our data stream. After identifying whitespace in our processes, CEA

suggested fixes for the issue wherever possible. TL had hard-coded business rules commonly applied by international HEI's. However, many of these rules were not applicable to CEA and the team embarked on creating and using dynamic rulesets that account for what's happening within CEA to continuously adjust these metrics within the processes. With the collation of all this information it is important that the data is backed up in real-time to avoid any data loss. In the coming section we elaborate on the backup and disaster recovery process for the solution.

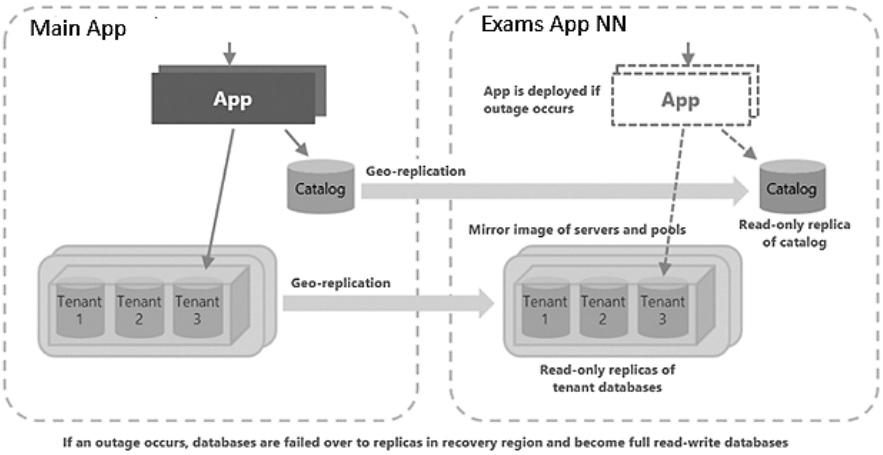
8. BACKUPS

Due to the TL cloud-based SaaS solution, CEA no longer controls the hosting, backup, and recovery of the solution. The Disaster Recovery Journal (2021) adds that while SaaS providers assume the responsibilities, organisations, and departments, such as CEA, would be responsible for retaining the protection and recovery of the data stored in the cloud. The solution dashboard is one method used to download the data from the cloud platform and import the data to CEA DB servers following every online session. However, the disaster recovery (DR) plan displayed in figure 1 is elaborated on below.

8.1. Disaster Recover

With reference to figure 1 there exists a Main App as well as 3 additional environments which are Exams App NN, Exams App N1, and Exams App N2. These Exams Apps are all recovery environments which allows for the failover of the application and DB from the primary hosting region to the secondary recovery environment. Figure 5 provides a visual of how this process would occur.

Figure 5.
Disaster Recover image adapted from Microsoft Inc (2022).



Azure DB for MySQL facilitates the maintenance, backup, and replication of the solution components and all associated data. This allows the writers to have an uninterrupted experience should the solution ever experience downtime. The change between the main application to any of the recovery environments is seamless and writers are none the wiser to the real-time switch. Table 4 provides details on how MS Azure service/platform achieves this.

Table 4.
Disaster recovery for a multi-tenant SaaS application adapted from Microsoft Inc (2022).

Disaster recovery for a multi-tenant SaaS application		
1	Azure Resource Manager templates	Reserves all needed capacity as quickly as possible. These templates are used to provision a mirror image of the production server(s) and elastic pools in the recovery region.
2	Geo-replication	Is used to create asynchronously replicated read-only secondaries for all databases. During an outage, you fail over to the replicas in the recovery region. After the outage is resolved, you fail back to the databases in the original region with no data loss
3	Asynchronous	All failover operations are sent in tenant-priority order, to minimize failover time for large numbers of databases.
4	Shard management recovery features	Is used to change database entries in the catalog during recovery and repatriation. These features allow the app to connect to tenant databases regardless of location without reconfiguring the app.
5	SQL server DNS aliases	Enable seamless provisioning of new tenants regardless of which region the app is operating in. domain name server (DNS) aliases are also used to allow the catalog sync process to connect to the active catalog regardless of its location.

Sync database and elastic pool configuration info into the tenant catalogue. Set up a recovery environment in an alternate region, comprising application, servers, and pools. Use geo-replication to replicate the catalogue and tenant databases to the recovery region. Fail over the application and catalogue and tenant databases to the recovery region. Later, fail over the application, catalogue, and tenant databases back to the original region after the outage is resolved. Update the catalogue as each tenant database is failed over to track the primary location of each tenant's database. Ensure the application and primary tenant database are always collocated in the same Azure region to reduce latency. In the coming section we discuss the solution and view the previous state of the CEA assessment offering and its improvements.

9. HIGH-LEVEL VIEW OF THE SOLUTION

This section describes the previous state of the assessment as well as the improved state after introducing the SaaS solution.

1. NBT assessments are only offered via PnP with proctoring conducted by CEA staff on-site (test venue).
    a. Introduced the NBT assessment digitally with integrated AI proctoring and ML.
2. Access to test venues and gatherings were prohibited during lock-down levels 5 – 3.
    a. Introduced a digital product that allows writers to participate in the NBTs online and remotely.
    b. Introduced innovative technology (AI proctoring; etc.) to assist with test monitoring.
    c. Introduced online chat support service to writers during both the simulation and live test sessions.
3. Validating writers and ensuring test security and storage of test material in test venues.
    a. Introduced digital check-in and multifactor authentication of writers.

   b. Introduced digital test content that can be edited/authored via the platform interface delivering changes in real-time.
   c. Introduced lock-down browser to ensure no other application and/or services are running in the background ensuring the test cannot be exited until complete.
4. Invigilators assigned through use of 1:50 ratio where 1 refers to the invigilator and 50 to the number of writers.
   a. Introduced AI proctoring which implements a ratio of 1:500.
   b. Real-time alerts/notifications inform writers of any test contraventions.
   c. Video and audio data is available to consult either in real-time and/or post-test session.

The above are only a few of the notable improvements since the adoption of this solution. In the coming section we will discuss some of the lessons learnt during this journey.

10. LESSONS LEARNT

The following is a list of lessons realized during this project that can be used to inform impending digitization endeavours:

1. Authorize and detail all concessions to the specifications.
2. Organize routine consultations with the project team to confirm that the project is accomplished within the timeframe and that all constituents are cognizant of their various roles and responsibilities.
3. The geographical location of the service provider had a huge impact on the time these meetings were scheduled as there is a nine-hour time difference (SA was ahead).
4. Follow up on project deliverables.
   a. Training of the AI service took time to refine as it had to learn to exclude items that have been classed as anomalies.
5. Frequent reporting to patrons and the CEA management team.
6. Oversee projects within budget.
   a. Inform stakeholders and management timeously where budgets have been surpassed.
7. Ensure the delivery of products in a timeous manner.
   a. The SaaS solution is published on Microsoft data centers located in Cape Town.
8. Ensure that human resources are available when required.
   a. Upskilling of staff.
   b. Repurpose staff.
   c. Adapt staff job descriptions.

The above are just a few of the lessons learnt during this project. In the coming section we will discuss some of the recommendations.

11. RECOMMENDATIONS

The SaaS solution provides scoring and marking facilities that may need to be reviewed to allow for faster scoring of writer tests. Following the feedback received from writers, CEA will require additional staff to assist with responding to writer queries and

possibly shorten the period in receiving a response. Additional collaboration may be required to assist in providing writers with alternative verification processes. The TL SaaS solution also has the facility to randomize items/questions. For the CEA team to take advantage of this facility research leads will need to digitize more test items. Additional reports may also need to be developed to assist the CEA team with post-session mitigation when reviewing the anomaly reports. It was also clear from the pilot that writers having the test section/session invalidated would impact writer score sets. This will need to be discussed with stakeholders and require adapting existing MOUs.

12. CONCLUSION

The onset of the global pandemic forced many industries to embrace the digital age. This created an opportunity for CEA to take a high-stakes assessment digitally. The platform is the first of its kind in SA that incorporates a fully functional AI-Proctoring that incorporates ML. This was made possible using Microsoft's Azure Cognitive Services. Which ensures the platform is utilising the latest technologies which has afforded CEA to remain relevant and in the forefront of the assessment arena. This has allowed CEA an opportunity to offer additional support in real-time to all writers via its integrated chat functionality.

The online platform has provided new insights into existing data which has implicitly expanded the list of services and products CEA has available. Furthermore, the new hybrid model has given writers a chance to choose the test delivery that best suits their needs. Some of these new products have been used to identify a writer's readiness for higher education and assist HEIs with the opportunity to get to know the ability of an incoming cohort. In addition, these products have also offered HEIs to identify at-risk student(s) and guide them to resources readily available. The most popular new diagnostic product has assisted HEI faculties the chance to better understand courses inhibiting graduation and to mitigate them.

Additional research identifying the differences between the traditional pencil and paper assessment revealing the difference, if any, in writer performance. CEA may offer look to offering the AI-Proctored online assessment as a service to its stakeholder in the future to determine the need for such a product.

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AUTHORS' INFORMATION

Full name: Naziema Begum Jappie, PhD
Institutional affiliation: University of Cape Town (UCT)
Institutional address: Rondebosch, Cape Town, South Africa
Short biographical sketch: Dr Naziema Jappie holds a PhD; Masters and Honours in Social Science and Bachelor of Social Science; Higher Diploma in Education; Certificate in Executive & Management Coaching. She has worked as a schoolteacher; a National Education Officer for the Clothing & Textile Workers Union; a lecturer at the ML Sultan Technikon, Durban and the Institute of Women's Study Lahore (IWSL), Pakistan. She served as Dean of Students at the Durban University of Technology and the University of the Witwatersrand between 1995 and 2011. Her research interests include educational policy, leadership, management, and governance with a focus on social justice. She has received many awards during her career including a Fellowship at the University of Iowa, USA and an Emerging Scholar Award from the Common Ground Research Network at Queen's University in Belfast, Northern Ireland and has a visiting scholarship at Rutgers University, USA.

Full name: Ashley Van Niekerk
Institutional affiliation: University of Cape Town
Institutional address: Rondebosch, Cape Town, South Africa
Short biographical sketch: Mr Ashley Niekerk holds a postgraduate qualification in Management Information Systems (MIS) and worked at the University of Cape Town. He has been working in the capacity of Data Systems Manager at the Centre for Educational Assessments, previously he occupied the position of Clinical Data Manager, at the University of Stellenbosch (US) at the Desmond Tutu TB and HIV centre. He has also contributed to the national Climate Change white paper during his 6-years at National Department of Environmental Affairs as Assistant Director, Data Management. During this time, he contributed to the curation of large volumes of data collected by devices (Data Buoys, Wind sensory devices, etc) and the transmission of this data securely to servers where the data went through vigorous data sanity checks before being imported and mined to generate data visualisation aids to assist senior managers in making informed decisions.

Chapter #4

THE ART AND SCIENCE OF ASSESSMENT – CONNECTING CLASSROOM-BASED SPEAKING ASSESSMENTS TO TEACHERS' PRACTICE

Rúben Constantino Correia
CETAPS NOVA FCSH – Centre for English, Translation and Anglo-Portuguese Studies, Portugal

ABSTRACT
Speaking has been increasingly promoted in language syllabuses and curriculums, both in Portugal and internationally, as one of the major aims of foreign language teaching. Naturally, the importance of oral skills has led to increasing research in this area, with the focus largely on the need to measure ability and the best way to do it. Unsurprisingly, considerable attention has been drawn both to assessment and the context in which it operates. However, the unique features of speaking make it the most challenging skill to assess. Bearing this in mind, and my role as both researcher and teacher with a vested interest in speaking, I spent almost a full school year at a Portuguese public school cluster doing classroom observation in an attempt to chart: a) – typical classroom interactions between learners / teachers and learners / learners, and b) – the general nature of most speaking events taking place in the classroom, including that of assessment. Findings seem to evidence that Portuguese EFL teachers appear to be at odds with designing suitable assessment procedures for monitoring students' progress. There is a narrow view of assessment as synonymous with testing, and thus the grading function, which largely contributes to the dominance of summative assessment over formative assessment.

Keywords: English as a foreign language, speaking, assessment, learning, learning-oriented assessment.

1. INTRODUCTION

Learning a foreign language, as a rule, is seen by experts (anthropologists, sociologists and professors/teachers) as a major asset for global understanding and the mobility of people. English is found at the top of the pyramid as the number one language to achieve these goals. Nowadays being able to express oneself proficiently and intelligibly in English is decisive for learner-users who want to thrive both academically and professionally.

The search for more effective ways of teaching English as a Foreign Language (EFL) gave rise to different teaching methods/approaches on both sides of the Atlantic over the past century. From those, the Communicative Language Teaching (CLT) approach emerged as the one adopted by most practitioners, marking "a major paradigm shift within language teaching in the twentieth century, one whose ramifications continue to be felt today" (Rodgers & Richards, 2001, p. 151). CLT argues for genuine communicative exchanges through activities designed to develop the students' ability to use language appropriately and meaningfully. Along with the rise of CLT, the importance of oral skills in language syllabuses and curriculums grew and led to increasing research in this area, with the focus largely on the need to measure ability and the best way to do it. Considerable attention has, then, been drawn both to assessment and the context in which it operates. In view of these premises, this study sought to explore the knock-on effect of Portuguese EFL teachers' practices on classroom-based speaking assessments, which translated into one central research question:

→ Are speaking assessment tasks aligned with the ongoing classroom activities used by the teachers?

The primary goal of classroom-based speaking assessments is to support learners' language learning trajectories. Assessment results must be used to inform instruction, identify areas for improvement, and foster a positive and supportive language learning environment. This is all the more important in EFL contexts like the Portuguese where the learners attending lower-secondary education (5^{th} – 9^{th} grade) should be given ample opportunities to progress through five years of language instruction.

2. BACKGROUND

2.1. Problem Statement

Speaking has unique traits that make it the most distinctive and probably the most difficult skill to assess in classroom-based contexts. Unlike writing, speaking is done spontaneously, greatly restricting the possibility to plan one's discourse before processing and producing it. Thus, the teacher has to judge, in real-time, production and/or interaction related to several aspects of what is being said (range, pronunciation, accuracy, fluency, interaction, coherence). Furthermore, in Portugal the assessment of speaking proficiency seems to face a major challenge – the apparent reluctance of Portuguese state schoolteachers to address it. Most students studying English at the lower levels (5^{th} up to 9^{th} graders) are overloaded with grammar instruction and exercises, usually done via course-books, quizzes or worksheets. Clearly, the emphasis given to linguistic competence outweighs that given to linguistic performance, which in turn hinders the students' speaking proficiency and the assessment process itself.

Right from day one, Portuguese learner-users are faced with the strict grip of this type of assessment, that of diagnostic assessment, which is a common practice usually done via testing related to their past learning. Theoretically, it aims to ascertain the learner's strengths and weaknesses, although it is the latter that is acted upon by teachers. All their efforts seem to be directed at what the students cannot do. This type of assessment neither does what it is meant to do – identify strengths and weaknesses – nor is it designed as a diagnostic tool. Firstly, it hardly ever covers all the major skills, as speaking is usually omitted and secondly, it resembles an achievement test instead of a diagnostic one. As a result, students are not assessed to check what they can or cannot yet do, but instead are assessed on their understanding of language features from previous years with little or no valid feedback available for students or teachers. The effectiveness of diagnostic assessment is undermined and does not contribute as it should to successful learning. Pertaining to the scope of this study, Kazemi and Tavassoli (2020), who investigated the impact of diagnostic assessment on the speaking skills of EFL learners, found that the group of participants who received diagnostic feedback based on their initial assessment showed significant improvement of their speaking proficiency when compared to that of their control group counterparts. Even though the study was conducted with adult learners, it strengthens support for the positive impact of diagnostic assessment on learners' (speaking) achievement. It may even resonate deeper with the cohort addressed here. Identifying strengths and weaknesses is, as Nikolov and Timpe-Laughlin (2021) point out, "particularly important for YLs, as they need substantial encouragement in the form of frequent, immediate, and motivating feedback on where they are in their learning journey so that their vulnerable motivation can be maintained […]" (p. 24).

The root of the problem may lie in the confused nature of diagnostic testing in past and recent literature. Very often diagnostic and placement tests are taken as interchangeable terms serving the same purposes, when in fact they are not. Brown implies they can be indistinguishable, and a placement test can serve the same aim as a diagnostic test (2004, pp. 46, 47). As mentioned above, the latter is supposed to identify strong points and weaknesses, whereas the former is meant to help teachers place their students in a certain proficiency level appropriate to their abilities. Alderson (2007) notes how neglected diagnostic testing is in language testing research: "[…] there is virtually no description, much less discussion, of what the underlying constructs might be that should be operationalized in valid diagnostic tests" (p. 28). In addition to being limited, the information about diagnostic assessment is also rather unclear, leading to multiple interpretations and misconceptions. In the light of such a lack of rationale, Blood (2011) suggests that "in the broadest sense, then, diagnostic second language (L2) assessment refers to any L2 assessment practice, whether in the form of a formal written test or informal teacher questioning, that yields diagnostic feedback" (p. 57). As it happens, one avenue for future research on assessment is that of diagnostic assessment. Several key aspects such as the functions and constructs that should underlie it remain obscure. If we believe that prior knowledge shapes new learning, we need to redefine our conceptualisation of diagnostic assessment.

Adding to this predicament, summative assessment has become the most dominant type of assessment. Ideally, formative assessment would pick up where diagnostic assessment finishes, through a range of tasks designed to provide further learning opportunities, learners' strong points would be reinforced, and their weaknesses would be improved. Nonetheless, this is not exactly what happens because of the importance given to summative assessment. Teachers tend to undertake assessments which are a replica of Low Stakes testing. Besides, in a similar fashion to diagnostic assessments, summative assessments in Portuguese EFL classrooms usually omit speaking. In fairly analogous EFL contexts (Greece and Cyprus) to the Portuguese, Tsagari (2016) found the same pattern. Assessment was predominantly made of vocabulary and grammar, followed by writing. Listening and speaking were hardly assessed if at all. In Cyprus, speaking was completely absent. Assessment is, then, carried out not to support learning, but by grading tests that normally do not provide useful information feedback. There is "a widespread public expectation of assessment, and while it could be argued that this is insufficiently future-oriented, it would be difficult to mount a case which involved shifting existing well-established perceptions of this purpose" (Boud & Falchikov, 2006, p. 401). The perception of assessment as marking/grading runs deep amongst students as well, whose focus is driven by the desire for higher grades rather than learning. Thus, students' efforts are not volitional, but motivated by the demands of assessment. Input is simply memorized and not transformed into real operational knowledge, prior knowledge is not related to new knowledge, and concepts are simply applied mechanically without reflection. In Portugal, like in many other EFL contexts, summative assessment practices have prompted the devaluation of actual learning. Although we need summative assessment to make decisions, learners' results should contribute to forthcoming learning.

2.2. Speaking's Inherent Character

Speaking is a fundamental aspect of human communication and plays a crucial role in how we interact with others and express our thoughts, ideas, and emotions, and make connections with the world around us. It is a dynamic process that involves both speakers and listeners. However, speaking has not always figured centrally in the field of applied linguistics. Even when it became particularly implicated in language teaching methodology,

speaking was inaccurately seen as similar to writing. Thus, the overall nature of speaking was disregarded in favour of the long writing tradition of teaching and learning a foreign/second language.

Researchers have fairly recently started to dedicate similar attention to spoken language as they did to written language, only to realise that they differ significantly from each other. Unlike writing, where a shared spatio-temporal ground is by definition non-existent, speaking is done in real-time, narrowing greatly the possibility to plan, edit or revise one's discourse before processing and producing it. In addition, the speaker must master and mobilize an array of linguistic knowledge – vocabulary, sound system (segmental features), suprasegmental aspects like stress, intonation and rhythm and language functions – alongside the kinesics usually related to spoken language, to avoid extensive hesitation or communicational breakdowns. Unsurprisingly, speaking seems to be more challenging than writing, or reading for that matter.

Speaking is broadly characterised by the use of incomplete sentences (known as ellipsis) to avoid unnecessary effort, connected or not with conjunctions, what Luoma (2004, p. 12) conceives of as idea units, short turns between interlocutors together with simple interrogative structures, manipulation of strategies to gain time to speak, such as fillers and hesitation markers, repetitions and rephrasings (to correct, alter or improve what has been said by the speaker who is taking the floor or by previous speakers), fixed conventional phrases and use of informal speech (simpler syntax to make improvisation easier) due to its spontaneity and purposes. These devices are employed to both facilitate speaking and compensate for difficulties that (may) arise. Indeed, disfluencies and consequent repairs are quite natural in spoken language. Spoken language is commonly less lexically dense and fragmented, resulting in a high frequency of pro-forms, incomplete clauses, and a low frequency of information-carrying words. The fact that speaking is traditionally an interactional activity contrasts with the detached stance of most writing. While the writer embarks on a solo endeavour, and his/her audience is not present and often is not known, the speaker is directly involved with his/her listener(s), the subject matter, and the context. This involvement is marked by the use of first-person pronouns, vocative forms, and attention signalling. Table 1 (based on Biber, Conrad, & Leech, 2002) identifies and summarises a variety of social and situational features of speaking. The set of features presented are intrinsic to the time-bound nature of speaking's processing conditions. The shape and nature of speaking is intimately connected to its socio-psychological processes, which clearly impact on language use and are responsible for most of the differences between spoken and written language.

Table 1.
Circumstances and Features of Spoken Language.

Social and Situational Traits	Association with Conversational Traits
Typically occurs in a shared context	• High frequency of (personal) pronouns; • Low frequency of nouns; • Use of substitute pro-forms and ellipsis; • Reliance on deictic words; • Use of fragmentary components (frequently inserts).
Avoids elaboration and/or specification of meaning	• High frequency of verbs (especially primary and modal verbs); • Low frequency of elaborated noun phrases; • Use of complement clauses: that and wh-; • Reliance on function words; • Considerable usage of vague language (often hedges).
Is marked by interaction	• Abundance of negative utterances; • Large quantity of question-answer sequences. Responses are often elicited via question-tags; • Profusion of attention-signalling forms; • Common use of vocatives; • Frequent use of discourse markers.
Expresses stance	• Heavy reliance on endearments (e.g., dear), interjections (e.g., wow), exclamations (e.g., good for you!), evaluative predicative adjectives (e.g., nice) and stance adverbials (e.g., fortunately).
Takes place in real time	• Occurrence of disfluencies; • Use of reduced forms (e.g., "gonna"), contractions and elision processes; • Usage of a restricted and repetitive repertoire.
Employs vernacular phraseology	• Style is eminently colloquial; • Occurrence of regional dialect forms.

Considering the cohort to be studied (9th grade students), a final point to be made about the nature of speaking regards age. The language used by young speakers has some distinctive features, when compared to adult speakers, that need to be taken into account by their teachers. For instance, youngsters tend to be more informal than adults, which translates

into using less modality while producing the language. It is uncommon for adolescents to use could or might. They are much more likely to use their present corresponding forms can and may, especially can. Complex modalized sentences do not seem to fit this specific group of speakers. The point I am trying to make is the necessity to rethink if it is fair or even realistic to demand of our adolescent learners styles of speaking that do not conform to their age span and they do not use in their L1, nor that we will ever hear from the mouths of their NS counterparts.

2.3. Key concepts

Measuring and understanding student learning outcomes is a complex but crucial process that involves the assessment of learners' language proficiency, skills and knowledge. Gaining a solid knowledge of assessment has the potential to empower teachers to design and implement effective classroom-based assessments that accurately measure learners' language abilities, encourage language development and support meaningful learning outcomes. Unsurprisingly, assessment has become a popular buzz word but "sometimes misunderstood term in current educational practice" (Brown, 2004, p. 4) and for this reason a distinction between the terms assessment and testing must be made. While these terms are often used interchangeably, they represent distinct methodologies with different purposes and implications. "The debate may seem abstract and theoretical, but it is of considerable importance to classroom teachers of language because it impacts not only how learners are assessed, but how they are taught" (Hamp-Lyons, 2007, p. 488).

Testing is an administrative product-oriented procedure, usually imposed by the teacher, that occurs at specific moments with the purpose of measuring second/foreign language knowledge for scoring and grading. So, tests tend to create immense pressure on learners, leading to heightened stress and anxiety. The fear of failure and the potential consequences on their academic future can impede learners' cognitive functions, negatively impacting their spoken language performance. As advocated elsewhere (Correia, 2015), some speakers' frequent pauses and hesitations, resulting in reduced intelligibility, may positively correlate with speaking anxiety. The words of a Croatian 12-year-old learner cited in Mihaljević Djigunović (2019) tellingly illustrate such view: "Each time our teacher announces a test, I panic. While preparing for the test at home, I feel nervous all the time" (p. 25). Tests are often a norm-referenced instrument – scores are compared amongst students, used to determine individual ability, or demonstrate mastery of a given skill, and offer limited information to identify areas for improvement because they tend to be "one-off" events of speaking proficiency. Again, the issue of feedback must be highlighted. In a similar fashion to diagnostic assessment, little or no valid feedback for learners is obtained from these procedures. Teachers do not critically discuss and review these results with their learners and thus do not provide (non-threatening) information about what they are doing well and what needs to be tackled with more enthusiasm. There is little reflection on what is being tested and why is it being tested. Nikolov's (2017) research in Hungary goes further to show that many teachers failed to see the added value of timely feedback. Ultimately, when a teacher gives a test, s/he is obtaining a narrow sample of the test-taker's performance in a specific domain that does not account for the progress made (or not) based on that performance. For the less proficient learners we are simply telling them they lack ability without pointing to ways for improvement. Perhaps, I would argue, some EFL practitioners do not feel comfortable going beyond what they experienced as learners themselves and now perpetuate this as teachers, while others are simply caught in a predicament between what they believe is best and more helpful for their students (moving away from summative assessment done via testing) and the pressure to achieve the success percentages set by school

boards. Throughout literature we can find examples (Hamp-Lyons, Hood, & MacLennan, 2001; Davison, 2004; Bonner, Torres Rivera, & Chen, 2018) of this conflicting pattern between teachers' beliefs and system pressure.

On the other hand, assessment is an ongoing process-oriented approach that takes many different forms. One of these forms is tests. Thus, testing is a subset of assessment and should be seen as one of the many methods available for assessing students' verbal performance. Teachers may employ a diverse range of assessment methods and tools that align with specific learning objectives and students' unique needs, whilst enabling their differences. In view of the limited nature of tests, alternative assessment procedures such as self-assessment, peer-assessment, portfolios, performance assessment, observation, etc., have been advocated at different times by some experts like Shohamy (1997), Bachman (2002), Hamp-Lyons (2007) and Nikolov and Timpe-Laughlin (2021). I prefer to consider these methods, tests included, as simply assessment, preferably when used in an integrated fashion to help improve learners' speaking skills. Assessment is often a criterion-referenced measurement – students' performance being compared against a set of criteria, used in educational contexts to monitor students' strengths and weaknesses. It is operated in a systematic way for the purpose of helping teachers trace the students' individual learning trajectories throughout the school year. Assessments serve as tools to identify learning gaps and draw inferences that the teachers can rely on about the students' achievements, and to make the necessary adjustments in the teaching-learning environment, i.e., using assessment results to change practices and adapt teaching strategies which in turn assist learners to improve their speaking proficiency by meeting their individual learning needs. In a nutshell, "assessment is the systematic collection, review, and use of information […] undertaken for the purpose of improving student learning and development" (Banta & Palomba, 1999, p. 4), entailing careful planning, implementing and acting upon the results. Unlike testing, which focuses on grading and final outcomes, assessment emphasizes timely continuous feedback that helps learners recognize areas for improvement while the learning experience is still fresh in their minds. Involving students in the assessment process enhances their metacognitive awareness, promoting a deeper understanding of their strengths and weaknesses. Indeed, the iterative feedback loop between students and teachers allows for continuous progress and targeted support. Learners are more likely to demonstrate higher levels of motivation, engagement, and perseverance when they are actively engaged in the assessment process and can make sense of the information given and use it to enhance their spoken proficiency. Assessment goes beyond the question of how much the students have learned; instead, it asks how they learned and what can be done to improve their learning.

Recognizing the differences between assessing and testing is fundamental for teachers to make informed decisions regarding their learners. While both approaches play a role in identifying student learning, assessment's flexible, holistic, and learner-centred nature offers a more comprehensive view of learners' competences. Emphasising assessment whilst deemphasising testing practices can lead to a more comprehensive and meaningful understanding of the learners spoken language proficiency that empowers them and supports their long-term ability and communication success. However, turning this narrow view of assessment as synonymous with testing around seems as yet an optimistic but blurred vision.

2.4. Assessing with a Learning-Oriented Frame of Mind

From the beginning of the twenty-first century, a new framework has steadily gained ground in the field of educational assessment, the learning-oriented assessment approach. This innovative view of educational assessment pedagogy "holds that for all assessments, whether predominantly summative or formative in function, a key aim is for them to promote

productive student learning" (Carless, 2009, p. 80). Hence, whatever form the assessment takes it must be a means of supporting learning and, simultaneously, to acknowledge its centrality. Implementing a learning-oriented assessment approach to speaking "involves the collection and interpretation of evidence about performance so that judgments can be made about further language development" (Purpura, 2004, p. 236) to promote knowledge. Analysing Purpura's words carefully, we conclude that evidence is the core ingredient of learning-oriented assessments. After being collected from multiple sources, evidence helps teachers to monitor students' progress, shows students' acquisition (or otherwise) of what is being taught, and provides meaningful feedback for students and teachers.

Carless (2009) summarizes learning-oriented assessment in three simple principles. Bearing these principles in mind, teachers will be able to engage learners in productive assessment activities. "Principle 1: Assessment tasks should be designed to stimulate productive learning practices amongst students; Principle 2: Assessment should involve students actively in engaging with criteria, quality, their own and/or peers' performance [*sic*]; Principle 3: Feedback should be timely and forward-looking so as to support current and future student learning" (p. 83). To achieve these intended purposes, appropriate tasks should be designed, students have to be involved and feedback has to be significant. First, learning tasks should be conceptualized as assessment tasks and vice-versa, encompassing the anticipated learning goals by promoting interactional authenticity, a reflection of the real-world and collaborative work. Besides mirroring real-life language usage, authentic tasks expose learners to natural language patterns, expressions, and contexts. Engaging with authentic speaking tasks enables learners to navigate various communication situations they might encounter in the target language environment, thereby enhancing their spoken language proficiency. Second, students must be given the opportunity to understand the criteria and standards applied to their work, enabling them to accurately judge whether they meet these criteria and standards or not. "The conceptual rationale for peer assessment and peer feedback is that it enables students to take an active role in the management of their own learning" (Liu & Carless, 2006, p. 280). Indeed, a paradigm shift in focus must occur from merely testing learners' performance to actively involving them in the assessment process. Learners should be encouraged to reflect on their learning progress, set goals, and take ownership of their learning. Yet, traditional beliefs over EFL teaching and learning continue to go counter to these expectations. Another of Nikolov's (2017) findings shed light on the teachers' disagreement with the use of peer and self-assessment. Teachers mistrusted their learners' ability to do so as well as their honesty. Third, feedback must be timely, relevant, and able to be acted upon by the students, i.e., it functions as feedforward. If it does not help students close the gap between their expected learning outcomes and the present state, it does not really qualify as feedback. If we are to succeed as EFL teachers, we have to recognise that timely and constructive feedback is the heart of classroom-based assessment. This goes beyond the traditional feedback practices discussed above, it guides learners towards future improvements (feedforward). Feedback(forward) should be given at regular intervals during the learning process, enabling students to make real-time adjustments and enhance their understanding of the subject matter.

Learning-oriented approaches to speaking should not be concerned only with measuring ability, but also with the actual learning of pronunciation (segmental and suprasegmental aspects), vocabulary, language functions, register, turn-taking and breakdowns compensation. Thus, teachers must make sure that learning/assessment tasks represent spontaneous, real-life spoken interaction and target the speaking aspects the learner-users are supposed to use, i.e., how assessment relates to and can help promote speaking acquisition.

3. METHODOLOGY

The study followed a qualitative driven approach, drawing on two complementary sources of data – classroom observations and field notes. The rationale for conducting qualitative research in this study was threefold: first, due to the exploratory nature of the study; second, because it allowed a longitudinal detailed examination of the unit of analysis (regular weekly intervals were made over the course of a school year); and third, for its potential representativeness and contribution to understanding the connection between typical classroom interactions between learners / teachers and learners / learners and the general nature of most speaking assessment events occurring in the classroom.

3.1. Participants, Instruments and Procedure

The EFL teachers taking part in this study were recruited based on nonprobability convenience sampling from Portuguese state school contacts known to the researcher. Out of the available pool of 9th grade English teachers, four gave me their written informed consent to observe their lessons. All the teachers have English teaching experience, ranging from 14 to 22 years of teaching. They hold undergraduate teaching degrees in Languages (either English and Portuguese or English and German) from Portuguese state universities. As it happens, the limited number of teachers in the sample may well be considered one of the study's limitations. Although research results are never so context-dependent that they have no implications for other settings, nor are they so generalisable that may apply to every single setting, the results offered here are, then, suggestive only. Therefore, given the qualitative character of this study, another avenue for future research would be to delve into this topic with larger cohorts of teachers, either across the country or abroad, namely through large-scale questionnaires. It would yield a different source of information to be matched against classroom observations, thus providing more reliable information to answer the research question.

The source of data for this study were classroom observations. Altogether I observed 41 lessons. Apart from the odd exception (e.g., national holidays) observations were evenly distributed. My own degree of participation in the setting moved back and forth between complete observer and observer as participant, starting with the latter and then moving back as much as possible to the former. Students and teachers knew my identity and the teachers the purpose of my stay, but I did not interfere with the natural development of the lesson. To capture the phenomenon under study first-hand, I followed a combination of structured and unstructured classroom observation. The former hinged on an adapted version of the Communication Orientation of Language Teaching (COLT) (Spada & Fröhlich, 1995) observation scheme while the latter hinged on field notes. The combination of both served the purpose of on the one hand coding events as they occurred to have a clearer gist of the teachers' speaking practices over time and on the other hand to make detailed descriptions, which progressed into a running narrative, of important nuances about the nature of speaking assessment events as they unfolded.

The procedure was carefully negotiated because it involved a weekly presence in the classroom for almost a full school year. Complying with the teachers' instructions, I sat at the rear right-hand side of the classrooms to disturb as little as possible.

4. DATA RESULTS AND INTERPRETATION

Most of the lessons observed (92%) were teacher-led, either teacher to learner or teacher to class, which translated in a lion's share of learner's individual work performing the same activity. Only 7% of the lessons were fully learner-led, either learner to learner or learner to class. Yet, it must be stressed that in these occasions, learners were engaged in speaking assessment activities. All of them were asked to do the same activity, being organised once in groups and five times in pairs. Teacher-centred instruction clearly outweighs learner to learner interaction, either in pairs or groups. Indeed, this type of freer activity that allows language acquisition by experimentation was seldom encouraged thus restricting the learners' possible use of the language as well as opportunities to engage in sustained speech outside the strictures of the textbook. Learners rarely had the opportunity to explore the language collaboratively and engage in extensive speaking with their peers on meaningful topics. Such finding parallels that of Koizumi (2022) in Japan. Koizumi highlights the lack of formats for speaking assessment which prompt spoken interaction amongst learners and extemporaneous talk. However, one remark must be made. Some learners, either by anxiety or lack of proficiency, even if given the opportunity refuse to speak. As stated elsewhere (Correia, 2015), the fear of making mistakes in front of peers and being subjected to potential general mockery or laughter, plus the frustration caused by the inability to express oneself clearly in the same way as using one's mother tongue, hinders learners' willingness to communicate and participate in class activities.

As for language itself, a strong emphasis continues to be attributed to grammar. Three out of the four teachers observed spent entire lessons dwelling on grammar, either from the workbook, worksheets, quizzes or all of the above. This pattern is not new in many EFL contexts. For instance, Al Hosni (2014) found it too in Oman. The observation data from her study revealed a marked preference for grammar, whilst speaking was repeatedly not included. More recently (2021), although referring to tertiary education, so did Nguyen, Hung, Duong, & Le (2021), whose study of the Vietnamese EFL context showed an emphasis on linguistic form rather than on communication skills. The issue of grammar instruction raised in the problem statement section is confirmed here. The focus of many classes was on accuracy, grammar rules and the printed word, which translated in being heavily dependent on the textbook and its additional resources. Language functions were coded in all lessons, but their importance in accurately conveying and/or interpreting meaning was never discussed nor was there a connection between them and the co-construction of meaning in intercultural encounters, which would help to combat erroneous stereotypes and prejudiced views of the other. In addition, learners spent most of the time restricted to topics, again usually determined by the textbook, with a narrow range of reference that apply to the classroom domain and/or their first-hand experiences instead of being prompted more regularly to engage with topics that go beyond their immediate environment; and I would venture to say, far more appealing and in line with their interests. Similarly, Adem and Berkessa's (2022) observation of Ethiopian teachers' classroom practices shows that in 15 out of a possible 20 lessons, the nature of the speaking topics stemmed from the textbook. Perhaps, learners' willingness to initiate sustained discourse and interact in the TL would be boosted by taking advantage of their integrative oriented motivation. For now, form, particularly grammar, clearly outweighs meaning. Admittedly, the pervasive testing culture of Portuguese EFL classrooms is mirrored by this teaching behaviour.

Of special interest for the scope of the study was the category "student modality". As it happens, speaking is the least practiced skill, whereas writing tops the rank. Tellingly, not only is speaking the least coded skill in isolation but also the skill that systematically has

a subordinate role when in combination with the rest of the skills. The most popular combination rests with writing-reading, and usually the primary focus is on writing. Only once was speaking given the spotlight in instruction. The data shows that speaking practice lags far behind writing, but also reading and even listening practice. This state of affairs translates in an exceedingly small number of self-initiated turns by the learners and a sparing use of the TL. In line with the rationale offered for the original COLT, "it's important to note that self-allocations, such as calling out an answer, are not considered to be *Discourse initiations*" (Spada & Fröhlich, 1995, p. 87). Although learners are sensitive to turn-taking, they are either left in response mode for most of the time or simply use their first language, mostly for clarification requests. Observation in other settings (Al Hosni, 2014; Adem & Berkessa, 2022) juxtapose this excessive use of the mother tongue. Authentic interaction was scarce, occurring almost exclusively between the teachers and the native-speaker (NS) learners of each class. When they do use English, most learners moved back and forth between ultraminimal (one or to two words) and minimal (three or more words, long phrases and/or one or two main clauses) speech. Sometimes the difference in coding was truly small, minimal speech could easily become ultraminimal (e.g., "Ok teacher" vs. "I need help"). Many learners did not go beyond five word stretches of spoken language. Sustained speech (at least three main clauses) was coded in as little as 11 lessons, of which 5 matched up with speaking assessments whilst another 5 with NS learners. This may be the combined result of low proficiency, language-skill-specific anxiety (negative self-confidence and self-efficacy), and the teacher-centred nature of the class. As alluded to above, the use of non-threatening, freer activities could easily encourage learners to initiate discourse and use the TL more often and for longer stretches, thus positively impacting on both their overall spoken language proficiency and intelligibility. Furthermore, "[…] talk-based instructional practices provide for feedback, self, and peer assessment without the need for formal assessment products" (Shepard, Diaz-Bilello, Penuel, & Marion, 2020).

How exactly, then, do these typical daily lessons influence the general nature of most speaking assessment events taking place in the classroom. First and foremost, teachers seem to be letting themselves be negatively guided by the impact of washback and not by learning. Indeed, most activities carried out reflect summative assessment demands instead of catering to the learners' needs. This teaching-to-the-test effect leads to a narrow focus on test-related content, thus creating a gap between instruction and what should be the intended learning outcomes, i.e., speaking the language proficiently and intelligibly. Teachers tended to prioritize test-specific knowledge, sacrificing a broader and more comprehensive approach that would foster problem-solving abilities through spoken language germane to their lives in and outside the classroom. The disconnection of learning from real-world applications hinders the learners' ability to transfer knowledge and competences to authentic contexts. Meaningful speaking learning tasks were systematically overshadowed by decontextualised test-preparing tasks that hardly, if at all, contributed to the development of the learners' speaking skills and internalisation of new knowledge. Further evidence of the mismatch between traditional forms of assessment and learning, this time from the Czech Republic (Seden & Svaricek, 2018), substantiate the claim for a need to align learning outcomes, classroom activities, and assessments. Seden and Svaricek's results "indicated that the majority of the teachers used assessment for managing behaviour and for certification rather than to improve teaching and learning" (p. 119). Classroom-based testing tasks that concentrate on recalling isolated details or facts are ineffective and promptly forgotten by the learners. When the teachers' primary focus is on preparing for tests, often learners resort to rote memorisation and superficial learning strategies to simply reproduce information. In point of fact, the learners observed seemed to perceive their test-like speaking assessments

as a means to an end rather than a tool for deeper learning. Yet, it must be said that teachers should not carry all the blame. Even though the available legal framework (Ministry of Education and Science, 2016) for assessment in Portugal (an EFL specific framework does not exist) states that formative assessment should be privileged and thus connecting formative assessment to the eligible teaching approaches in (EFL) teaching; as a teacher myself, I am no stranger to the pressure of summative assessment. It results in pressure to achieve success percentages set by school boards, who in turn are under the veiled pressure of the Ministry of Education and national school rankings whose hierarchy is based on the gradings of national exams.

Unsurprisingly, teachers set up oral presentations, role-plays, and description tasks with a grading frame of mind instead of a formative one. Learners ended up restricted by the teacher, textbook or activity to produce pre-set language expected from them in near future test-like speaking assessments. In this manner, the relationship between task and assessment task is one and one alone, that of grading. As a result, learners paid attention solely to their grades, not taking agency over their present state of mastery of the language and showed even less interest in potential feedback sought to guide proficiency improvement. Tailoring speaking tasks to ensure that learners perform well on speaking assessments does not get us beyond surface-level learning whilst limiting the understanding of important speaking skills and intelligibility patterns. In formative contexts such as classrooms, "assessment will mainly go on in the classroom with more formal periodic assessments designed to blend into the learning continuum and recognize what the student has learned and what progress s/he has made" (Hamp-Lyons, 2007, p. 479). Adding to the challenge, many of the tasks conducted often took after the printed word. Learners thought and/or discussed amongst themselves, if it involved pairs, in Portuguese and wrote down their sentences/text in English. This uncharacteristic planning in advance for speaking was followed by plenty of memorisation and rehearsal. As could be expected, learners struggled with their speaking or even came to a halt when they forgot their lines and had to restart their script all over again. Such evidence correlates positively with Koizumi's (2022) findings in Japan where prepared and scripted talk for assessment was the rule. Although resorting to speaking, this behavioural pattern does not match the characteristics of spoken language but the printed word instead. In this vein, learners' speech sounds unnatural, bookish, and too formal.

5. IMPLICATIONS FOR PRACTICE

Out of the data results, the following question can naturally be raised – how are students supposed to provide extensive chunks of spoken language for assessment purposes, or otherwise, if oral practice is not part of normal lessons? The starting point must, then, revolve around effective oral practice as part of normal lessons and from there to a properly functioning assessment system (learning-oriented assessment), which in turn implies a constructive alignment of the curriculum and its intended learning outcomes (intended because we do not necessarily always get the outcomes that we have planned), teaching methods and assessment tasks (for a deeper understanding of this approach see Biggs & Tang, 2011). For present purposes, a constructive alignment in the context of speaking skills with an English as a Lingua Franca (ELF) frame of mind would make the connection between (intended) learning outcomes, teaching methods and assessment in the following manner. First, we want learners to be able to develop their ability to speak proficiently and pronounce the language intelligibly, from a NNS standpoint as future ELF users in situational speaking communities. It is important to share the (intended) learning outcomes with our learners to make them part of the process and thus enhance the learning outcome and for the sake of

transparency. Second, a move from audiolingualistic pedagogy (memorisation and scripted talk) to CLT principles (meaningful communicative tasks that foster intelligibility-like pronunciation) must occur. Classroom activities and procedures must be appropriate to achieving the desired learning outcomes (e.g. collaborative group work activities). Third, assessment is not used with a grading function only but primarily to monitor learners' progress and language acquisition, whilst providing timely feedback by judging the qualities of their performance against what was intended in the learning outcomes. Assessment tasks should match classroom activities and mirror the intended learning outcomes. Unlike many assessment events observed that are separate from classroom activities, there must be a logical thread and consistency to optimise the outcome otherwise we are tricking the learners. Biggs and Tang (2011) go further to assert that when assessment is aligned to what students should be learning, washback can even work positively:

> From the teacher's perspective, summative assessment is at the end of the teaching–learning sequence of events, but from the student's perspective the assessment is at the beginning. However, if the intended outcomes are embedded in the assessment, the teaching activities of the teacher and the learning activities of the student are both aligned towards achieving the same goal. In preparing for the assessments, students will be learning the intended outcomes (p. 198).

By explicitly aligning learning outcomes, classroom activities, and assessments, teachers will promote a supportive learning environment that deepens conceptual understanding and thus improved spoken language proficiency and intelligibility, whilst potentially minimising the negative effects of washback. The vital point when discussing (speaking) assessment is making sure it reflects instruction (frequent opportunities to engage extensively with the language), supports learning, and is meaningful for learners.

Perhaps, some input both for pre- and in-service teacher training which takes into consideration the rationale offered should be adopted for enhanced learner outcomes, both in Portugal and abroad, in view of the similarities between the evaluation procedures used in other countries for assessing speaking in EFL teaching. Despite the cultural differences between countries – Portugal, Czech Republic, Oman, Ethiopia, Japan – they do not seem to significantly impact EFL speaking assessment practices and outcomes. Indeed, teacher training has a role to play in filling the gap of formative speaking assessment. If, on the one hand, most, if not all, Portuguese universities offering teaching degrees for prospective teachers include plenty of curricular units related to assessment, this is not the case with continuous professional development (CPD) courses for in-service teachers. This is paramount if we think of the Portuguese teachers' profile. Novice teachers are few and far between in the classroom. School staff is made up of older teachers who did not have up-to-date assessment pre-service training. The teachers' profiles provided by the Portuguese Directorate-General for Statistics of Education and Science (2021) shows that more than half in-service teachers are over 50 years old. It is, then, the responsibility of local policy makers to act upon the gap identified here, by providing hands-on teacher training on classroom-based formative speaking assessment. In addition, thinking about the findings of this study, some refinement of the current guidelines offered by the Ministry of Education and Science for EFL teaching and learning (2018), encouraging speaking and pronunciation (focus on intelligibility) practice would be advisable. In a similar vein to policy makers, materials writers must also be held accountable for their potential role in a positive knock-on effect of Portuguese EFL teachers' practices on classroom-based speaking assessments. Drawing on the tendency of over-reliance on the textbook by the teachers observed, if it ever incorporates the development of oral proficiency and intelligibility as one of its main goals it may duly contribute to steadily closing the gap alluded to above.

Thinking of local policy makers, one interesting initiative, referred to by Koizumi (2022), that could eventually be mimicked by the Portuguese government, is being developed in Japan by the National Institute for Educational Policy Research (research institute integrated in the Japanese Ministry of Education, Culture, Sports, Science and Technology). Teachers are being provided with "with handbooks that include good assessment practice samples along with explanations; encouraging performance-based speaking; and conducting learning-oriented and criterion-referenced teacher, self-, and peer assessment" (Koizumi, 2022, p. 145). Yet another commendable and freely actionable initiative developed by teachers for teachers with the support of the Education and Training department of the Victoria State Government can be found at https://teal.global2.vic.edu.au/. The Tools to Enhance Assessment Literacy (TEAL) project is an online resource for teachers of primary and secondary level pupils who are learning English as an Additional Language (EAL) in Australia. This online open resource underscores the assessment for learning theoretical principles, providing an assessment tool bank, guiding principles and advice, and exemplars of assessment tasks with formative feedback, to name but a few. Although stemming from a rather distinct context, TEAL may prove useful to gather practical insight on how to implement classroom-based speaking assessments with a learning-oriented frame of mind.

Another possible way to tip the scales in favour of learning and thus of formative speaking assessment values would be process speaking. This suggestion is not entirely new, it draws from the widely recognized pedagogical method process writing. "Process writing refers to a set of beliefs and strategies that enable teachers to work with student writers while they are writing, rather than waiting until a piece of writing is finished and then marking or critiquing it" (Hamp-Lyons, 2007, p. 477). Process writing has been advocated for its pedagogical advantages over product writing (Onozawa, 2010; Rao & Durga, 2018), including its benefits for reduced anxiety (Bayat, 2014). Naturally different from writing, the underlying rationale for speaking is the same. Rather than simply focusing on grading learners' product, i.e., their speaking assessment performance, teachers would closely support learners' language learning trajectory, i.e., their process. Instead of putting the focus solely on the final spoken product, the process speaking approach would place equal emphasis on the various stages prior to the final assessment task, such as pre-speaking preparation (brainstorming ideas, organizing thoughts), practicing on a regular basis (collaboratively with their peers), receiving ongoing constructive feedback (ideally both from the teachers and peers, guiding learners towards improving their proficiency and intelligibility), and refining speaking performance based on the feedback received. In this fashion, learners are pivotal in the learning process, being encouraged to discuss topics relevant to their lives and interests and consequently more engaged, motivated, and confident to use the language in its spoken form. Throughout the process, alternative teaching methods that go beyond traditional approaches whilst taking advantage of technology can also be implemented, e.g. flipped classroom. Along these lines meaning is paramount, whilst form is deemphasised, grammar is a means not an end, the textbook plays a subsidiary role, being used only and if it contributes to genuine learning, the link between teaching, learning and assessment is easily traced (constructive alignment). The process speaking approach offered above is envisioned to follow a gradual increase in complexity throughout the school year, where learners initially engage in simpler speaking tasks and progressively advance to more challenging ones gradually scaffolding their spoken language proficiency and intelligibility, whatever their starting point may be. Yet, if truth be told, going against the dominance of the testing culture in ELT is a tough row to hoe. It would require a joint effort of the teaching community, educational policy makers, and publishing materials writers.

6. CONCLUDING THOUGHTS

There is considerable evidence throughout the literature (Swain, 2000; Oliver, 2009; Leong & Ahmadi, 2017; Correia, 2021) to demonstrate the significance of spoken production. It is Swain who claims that "output may sometimes be, from the learner's perspective, a 'trial run' reflecting their hypothesis of how to say their intent" (2005, p. 476) whilst El Majidi, Graaff and Janssen say it "can assist language learning through prompting learners to notice their language gaps, testing out hypotheses and reflecting consciously on forms" (2021, p. 3) and Loewen and Sato argue that "it facilitates production practice and, thus, the development of fluency and automaticity" (2018, p. 292). Despite its importance, in Portugal, as in other EFL contexts (see Thornbury, 2005 or Goh, 2017, for instance), there seems to be a mismatch between the perceived value of speaking and the ways it is put into practice.

Underlying speaking practice is a written-based orthodoxy reminiscent of a long writing tradition of teaching and learning a foreign/second language which continues to fall into the trap of considering spoken writing as speech. Unwittingly or not, teachers display a tendency to resort excessively to test-like assessment preparation instead of catering to the learners' real needs, hypothetically compromising their spoken language proficiency and intelligibility improvement. Consequently, extensive speaking occurs mainly as the spin-off of assessment events. Often, scripted dialogues are used, which differ significantly from ordinary spoken language – functions and structures typically occur with unnatural frequency; utterances tend to be very short and overly well-formed; backchannel responses, discourse markers and colloquial expressions are seldom used; and a shared knowledge of context is not assumed. Everyday speech rarely generates continuous correct complete sentences, clearly articulated words, and a lack of stance by the interlocutors. Complications arise from the preference of accuracy over fluency, form over meaning, and grammar rules over language in use. It seems, then, that speaking assessment tasks are not aligned as they should with the ongoing classroom activities used by the teachers. Assessment results are used haphazardly to inform instruction and fail to identify areas for improvement, which makes learners' language learning trajectories hardly traceable. Portuguese EFL teachers appear to be at odds with designing suitable assessment procedures for monitoring students' progress. There is a narrow view of assessment as synonymous with testing, and thus the grading function, which largely contributes to the dominance of summative assessment over formative assessment.

This chapter is an attempt to highlight the significance of the connection between classroom tasks, (speaking) assessment, and language development, adding to the existing body of knowledge whose interest has mainly dealt with the general nature of assessment practices, speaking constructs, rater effects, and factors that affect speaking performance (Fan & Yan, 2020). Despite the wealth of research on speaking assessment, it addresses marginalized topics and fills in some of the gaps recently identified by Fan and Yan (2020). First and foremost, the study contributes to increase the limited research committed to classroom-based speaking assessment; second, it taps on two underrepresented topics: learning-oriented speaking assessment and speaking assessment for young speakers (9^{th} grade students); third, it explores the *utilization* inference "which concerns the communication and use of scores" (Fan & Yan, 2020, p. 6), i.e. how do teachers provide feedback, if any, and how does assessment impact teaching practices (washback). Hopefully, a wide readership from the teaching EFL community, but also educational policy makers and publishing materials writers will find food for thought in this chapter.

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AUTHOR INFORMATION

Full name: Rúben Constantino Correia
Institutional affiliation: CETAPS NOVA FCSH – Centre for English, Translation and Anglo-Portuguese Studies, Portugal
Institutional address: Campus de Campolide CAN - Colégio Almada Negreiros, 1099-085 Lisbon
Short biographical sketch: Rúben Constantino Correia is a Portuguese and English Lower Secondary teacher with almost twenty years of experience. As of September 2022, he started teaching English for Specific Purposes at the Algarve University. At the same time, he is also a CETAPS full member (TEALS team researcher) and an individual member of EALTA – European Association for Language Testing and Assessment. His main research interest is Oral Proficiency and Speaking Skills, supported by other research areas which intersect and contribute to the core that forms speaking – Teacher Education; Interculturality; Assessment; The Common European Framework of Reference; and Affective Variables. He holds a teaching degree from the Algarve University, a Master's in English and North American Studies and a PhD in Foreign Language Methodology from the Faculty of Social and Human Sciences of Nova University of Lisbon.

Chapter #5

COMPUTER GAMING AND ACADEMIC LEARNING – TARGETING THE ROLE OF ESPORT IN SCHOOL

Björn Sjödén[1] & Michael Trotter[2]
[1]*School of Education, Halmstad University, Sweden*
[2]*Department of Psychology, Umeå University, Sweden*

ABSTRACT
The role of computer games in school is a controversial topic. An increasing number of upper secondary schools offer three-year programs with an "esport profile" within aesthetics and media. Marketing suggests that esport can attract students who are interested in playing computer games, but the scholastic value of esport remains to be clarified. Whereas "gamification" is an established term for transforming educational and other formal practices into game-like activities, little has been said about its counterpart "schoolification": how originally playful and informal practices are transformed to fit within school curricula and syllabi for achieving academic goals. We discuss the relevance of esport in secondary education, a working hypothesis is that the potential benefits of esport in academic learning is more about *how* students learn than *what* they learn. Specifically, we present and discuss and propose how self-regulated learning (SRL) as a framework can facilitate skills transfer from esport to academic learning. Using examples from multiplayer games, we elaborate on how co-regulation through social interaction can be used as a means for developing SRL. We conclude by suggesting how esport and educational researchers may use the SRL framework to address empirical questions about esport in relation to academic studies.

Keywords: esport, computer gaming, gamification, schoolification, self-regulated learning.

1. INTRODUCTION

In the ever-evolving landscape of education, the dynamic synergy between computer gaming and academic performance has emerged as a fascinating frontier. This book chapter delves into the intricate relationship between these seemingly disparate realms, partly united in the form of esport where students compete in computer gaming. We consider what can be learned from the practice of esport for enhancing academic engagement, cognitive skills, and overall learning outcomes. Some schools are already offering specific esport training at the upper secondary level, motivating educators' interest in and discovery of ways to channel the energy and enthusiasm that gaming ignites into the traditional classroom.

Drawing parallels between the captivating allure of gaming and the pursuit of academic excellence, we discuss the role of esport in a broad educational context, how to approach it scientifically and practically, and the theoretical foundation that bridges the gap between these domains. We uncover how commercial video games, compared to other educational and serious games, relate to core mechanisms of academic learning, which may not be obvious even to the practitioners themselves. More specifically, this chapter sheds light on how game-inspired principles, such as goal setting, problem-solving, and metacognition, can invigorate traditional teaching methods and bolster student achievement.

From a research perspective, our overarching aim is to lay the foundation for a practice-based collaborative research project between researchers and practitioners – including students, teachers, esport coaches and school leaders – for investigating the relationship between computer gaming and traditional teaching-and-learning activities in the classroom. The opening of an "esport lab" at the university where the first author of this chapter is based, can be considered a progressive move in this direction – which was met with interest and curiosity from media and several organisations – but it was also followed by questions to the effect of "What do we do now?". At an early stage, it became clear that previous research in this area is relatively scarce and that theoretical guidance is needed. Many people, including professionals in school and teacher education, did not see the theoretical rationale for such a project; the very concept of "esport" seemed foreign to some. Data collection posed other challenges, considering that computer gaming typically takes place outside of school, whereas educational activities typically take place in the classroom.

Therefore, this chapter begins by presenting a short overview of what esport is, its distinction from computer gaming in general, its recent historical development and how it is positioned in an educational (local and national) context. A theoretical starting point for the subsequent discussion is the concept of "schoolification", as the theoretical reverse of "gamification", referring to how the informal practices of computer gaming are transformed to fit within formal school curricula and syllabi for achieving academic goals. We then relate previous research and make some crucial observations as to how distinct features of computer gaming and academic studies inter-relate, in terms of higher-order cognitive activities associated with developing self-regulatory skills. Critically, we examine the parallells between self-regulation learned in computer gaming and its potential application to academic studies. We conclude by suggesting how esport researchers and educational researchers may use the framework of self-regulated learning as a common ground for addressing some outstanding, empirical questions about esport and computer gaming in relation to academic learning.

2. BACKGROUND

Our point of departure is the intersection between learning and education in the broadest sense, and the cultural phenomenon of esports. Esport is used as a collective name for all competitions that take place in a virtual environment and "scholastic esports" is the common name of the very diverse research area that deals with this intersection (Harvey & Marlatt, 2021). It can thus be about video games, computer games, Virtual Reality (VR), Augmented Reality (AR) or mobile games; our use of the term "computer gaming" refers to all these forms but with some specific examples of games commonly played in an esport context.

Globally, it is estimated that close to 200 million people practice or follow competitions that take place in virtual, digital environments. In Sweden, where the present research took place, it is estimated that approximately 100,000 young people are organised and active in esports. Considerably more – and not only young people – engage in e-sports on their own and yet more people consider themselves "gamers".

Based on national statistics, there should be approximately 1,000 actively organised esports players just in the immediate vicinity of the university where the first author of this paper is based. Since 2021, the Halmstad university opened an "esport lab", which is adapted for young people with disabilities. A nearby school offers a three-year program on the upper secondary level (high school) focusing on esports, where computer gaming has a pronounced role. For example, on the school's website, their educational program is marketed as stemming from "knowledge of a gamer's needs" in order to "…create a gamer profile linked

to a training program to make you the best gamer you can be" (translated from Swedish, www.lbs.se/programinriktning/e-sport/).

Research on esports has increased exponentially in recent years (Pizzo et al., 2022; Reitman, Anderson-Coto, Wu, Lee, & Steinkuehler, 2020) since the seminal book on video games and learning by Gee (2003), but only rarely is education weighed into the discussion of this phenomenon's culture, industry and/or ecology (depending on which metaphor is used). Therefore, there are good conditions to begin the mapping of how esports and education can fit together at different levels and forms of education. Several variants have emerged on how esports can constitute both goals and means in education at different levels and in different countries (Harvey & Marlatt, 2021; Jenny, Gawrysiak, Besombes,2021; Scott et al. 2021). Above all, the literature on "scholastic esport" (Harvey & Marlatt, 2021) has focused on what is learned in computer games, how digital tools contribute to the motivation of learning, what possible career paths it offers, and thus how curricula, courses and training plans should be designed.

All in all, the vast general interest in esport, its scholastic relevance and local conditions beneficial to research, triggered our interest in further investigating the relatively recent role of computer gaming in traditional educational programs and processes, and the main factors that influence it.

3. HOW CAN ESPORT INFORM ACADEMIC LEARNING?

Two types of transformative processes, significant to digitalisation in the 21st century and important for the present discussion, are *gamification* and *schoolification*. Both terms were coined in the aughties, at the start of the millennium. The former, gamification, has gained more fame, pervading many societal sectors, from education to marketing. The latter, schoolification, is lesser known. Mainly as a pendant to the increasing academic character of early childhood education, schoolification is a term coined to described to denote when curricular content begins to pervade educational institutions, where prior freer forms of learning had reigned. An intensification of adult knowledge transfer is also part of the definition of schoolification (Gunnarsdottir, 2014).

Although well developed as a cultural grassroots phenomenon and a commercially potent industry, esport lacks formalisation and distinction at the education level (Jenny et al., 2021; Scott et al., 2021). This creates a need to understand how features and efforts attract its target group, manage and develop the target group's knowledge, prepare it for further studies, and professional practice within different parts of the sector. In addition, an investigation of these relationships with a focus on specific cognitive concepts and principles (cf. Gee, 2003/2007) could map and discover what scholastic esports has to offer that is not done within the framework of educational programs without computer games and gaming in the syllabus. An important observation, however, is that the learning potential of computer games only marginally resides in the subject content of the games (such as learning some facts about World War II from a game, while most of the time playing the game is spent thinking and acting out on strategies to survive). Rather, to make headway in research on the relationship between computer gaming and academic learning, we first need to distinguish between the "what" of the subject content, and the "how" of the actual learning process. This is the focus of the next paragraph.

3.1. From Learning "What" to Learning "How"

Whereas formal education is typically divided into subject areas (e.g. math, history, biology) and domain-specific skills (e.g. sports, handicraft, creative arts), it can be argued that the scholastic values of computer gaming is more about *how* students learn than *what* they learn. This conceptualisation rests upon the distinction between "knowing how" and "knowing that", famously addressed by the philosopher Gilbert Ryle in 1945 and itself derived from ancient Aristotelean philosophy (Ryle, 1945). Ryle focused on the fact that "knowing that" is insufficient for "knowing how", in terms of actual problem-solving. In his words, "A silly person can be stocked with information, yet never know how to answer particular questions" (p. 16). This observation points to the need of targeting more directly *what we do* with information that we learn or, in other words, how skills (such as answering a question or solving a problem correctly) develop from the required, but in itself not sufficient, knowledge. Computer games may provide just the arena for investigating such information-driven skill acquisition in action.

In the present context, we thus want to direct our attention to what there is more to learn about the "how", in this case with respect to computer gaming, in order to facilitate the "what", in this case, learning the subject content of scholastic knowledge. As noted, the factual content of a game, whether in a historical setting or a futuristic fantasy, is seldom important for learning skills or making progress in the game. Still, the gamer needs to attend to, process and take proper action to various informational sources and events on screen. Above all, students need to make choices (sometimes within fractions of a second, depending on the type of game) as to what, when, where and how to learn.

The function of instant feedback to the player's choices likely has a vast impact on the player's motivation and willingness to make efforts, especially in contrast to non-interactive, non-social environments where no or much-delayed feedback is given (such as when reading a book is eventually followed by a test, and a subsequent test result). It was not surprising when our initial contacts with teachers revealed that students in the esport program were highly motivated gamers, but less motivated in traditional schoolwork. Such observations motivated us to examine how the students approached the different domains of gaming and schoolwork. Research in this field is scarce, but one study (Trotter, Coulter, Davis, Poulus, & Polman, 2022), allegedly the first longitudinal study of its kind, found that the positive psychological development of students enrolled in a high school esport program did not decrease compared to a control group. However, because the study was impacted by the covid-19 lockdown, the specific effects on motivation are hard to distinguish. This points to the fact that the virtual context of esport education has some pedagogic potential to unpack.

Perhaps most importantly from an educational point of view, we wondered whether students could learn to apply some principles from their gaming activities to improve their schoolwork, not by transforming the actual school tasks (reading, writing, doing math, etc.) but rather transforming how students think about, and hence approach, the same tasks. For example, constructs such as winning/losing may be explicit and repeatedly present in a computer game (and often crudely so, as the game character survives/dies), with a clear effect on the player's efforts and motivation to try again. On the other hand, in school subjects such as math or physics, one's construct of success/failure may be an implicit, even unconscious, motivating factor of performance. Hence, the differential effects on students' motivation and skills might not be due to the topic itself, but to the process of how students approach and learn the material. The role of esport in school in school syllabi – its schoolification – would then reside in its potential to offer more, and previously non-existent, ways of interacting with learning material that ideally broadens students' study skills.

A precondition to such successful learning is, however, that there are opportunities to apply similar goals and strategies across settings and disciplinary boundaries. Next, we consider how different types of games scaffold different kinds of learning, before considering how the learner (i.e. the student and gamer) can use learning principles common to both domains. This implies moving from an analysis of the concrete and highly situated level of gaming activities to the metacognitive level of more generally applicable skills involved in self-regulated learning (SRL).

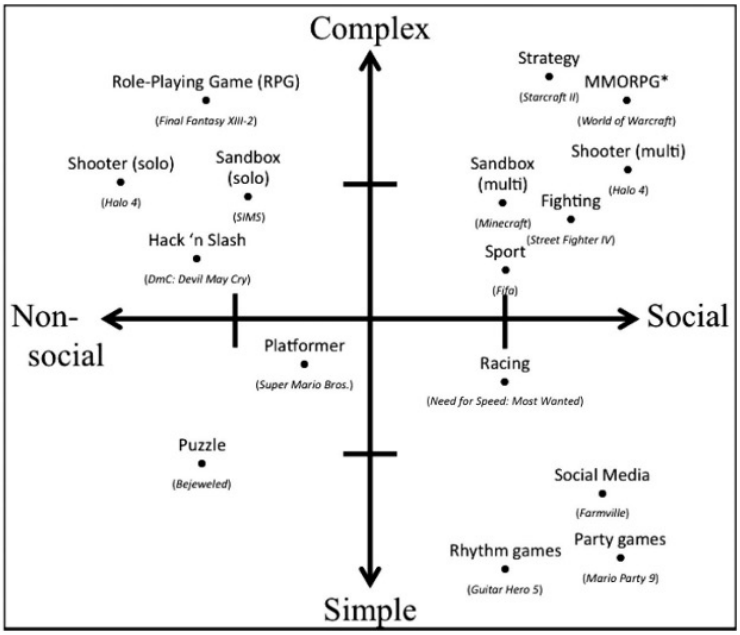
Development of an individual's self-regulatory skills have been linked to a range of outcomes in adulthood, such as elite performance in sport (Kitsantas & Zimmerman, 2002), better academic performance (Li, Ye, Tang, Zhou, & Hu, 2018; Thierry, Bryant, Nobles, & Norris, 2016; Toering, Elferink-Gemser, Jordet, & Visscher, 2009) and health outcomes (Sirois, Kitner, & Hirsch, 2015). In childhood, an individual's ability to regulate their learning is associated with a range of developmental outcomes (academic performance, higher level of adult educational achievement, better ability to cope with stress). Much research has focused on self-regulation in academics and sport (Lee et al., 2021; Toering et al., 2009) domains, however Brevers, King, and Billieux (2020) has called for a better understanding of how self-regulation unfolds within esports. Esports mirrors sports and academic domains, in that those with greater self-regulation outperform their peers with less developed self-regulatory skills (Trotter, Coulter, Davis, Poulus, & Polman, 2021, Trotter, Obine, & Sharpe, 2023). Kleinman, Gayle, and Seif El-Nasr (2021) suggests that esports may be an engaging domain to train SRL skills, which could then transfer into other domains such as academia. However, to date, no research has explicitly explored this possibility empirically. Even the empirical basis for such research warrants some clarification.

3.2. Different Games, Different Learning

Not all games are created equal. Importantly, "gaming" with reference to students' (and others') free-time activity implies commercial video games, which differ in several, critical respects from the digital games typically used in a scholastic or educational context. These latter educational games are often referred to as serious games. Abt (1987, p. 9) defined serious games as games which "have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement". Educational games have been designed for use in a variety of fields (de Freitas, 2017). Granic and colleagues (2014) suggest that a potential flaw of serious games is that they may lack the core engagement element commercial video games are designed around, namely – fun.

Commercial video games made for entertainment are considerably more popular, possibly evidenced by the difference in the size and value of the commercial games industry compared to that of serious games. In contrast, the main objective of serious games is to educate (Garcia-Martinez, 2014). The serious games industry is valued at 7.581 million USD in 2021 (precisionreports.co, 2023), in comparison the video games industry is valued at over 217 billion USD (Grand View Research, 2023). The greater resources generally available to commercial games made for entertainment could be a factor underpinning their success in engaging their audience. There are a great variety of genres and types of commercial games, and the way these games seek to engage, and audience varies. Granic et al. (2014) suggested that the genres of commercial games sit on two axes, the degree of sociality (social interaction) and complexity of the game, as depicted in Figure 1 (from Granic et al., 2014, p. 70).

Figure 1.
Conceptual map of the main genres of video games organised according to their level of complexity and degree of sociality; from Granic et al. (2014).
** MMORPG = Massive Multi-player Online Role-Playing Game.*



Considering the centrality of the social dimension and the fact that esport at its core is a competitive activity, it becomes imperative to distinguish between games played by a single player, and games played by multiple human players, typically over networks at diverse geographical locations. While sociality is a strong motivating factor in general, social interaction also adds to the cognitive and emotional load on the individual player. From a designer's perspective, a major difference between single-player and multiplayer games is that the game designer of single-player games has considerably more control over the game outcomes (Harteveld & Bekebrede, 2011).

A strategy game such as *Starcraft 2*, which involves both a single and multiplayer experience may serve as an illustrative example. In the *Starcraft 2* single-player campaign, the player completes "missions", which begin at a relatively simple level of complexity with a guided tutorial for how to use each of the basic units, and the mission acts as an environment which is structured to enable the player to learn how to use a specific unit. Each new mission typically unlocks and introduces a new unit, and the level design is constructed in such a way that the player must use the new unit to win the match, and in doing so learns how to best use the unit. During the multiplayer experience of *Starcraft 2*, the game's intention is not to guide player strategy or learning, but to encourage choice and autonomy (Harteveld & Bekebrede, 2011).

Hence, in multiplayer games, the onus is on the player to discover the most effective strategies available to them to increase their skill level to achieve victory over their opponents. We propose that the learning strategies used by players of competitive video games (i.e. esports), can be conceptualised through the self-regulated learning (SRL) framework (Zimmerman, 2000, 2013). Next, we examine more closely how SRL skills developed in esports can be transferred into other domains, with some concrete examples.

3.3. Self-Regulated Learning as a Metacognitive Framework for Skills Transfer

Self-regulated learning has been defined as "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning processes" (Zimmerman, 2013, p. 137). SRL is understood to be a cyclical process, which is aimed at reducing the distance between an individual's current state and a goal state, in three distinct phases: preparation, performance and appraisal (Panadero, 2017). Various models of self-regulation or SRL use different names for these phases. One of the most prevalent models of self-regulated learning was proposed by Zimmerman (2000) which has theoretical roots in social cognitive theory. According to this theory, SRL involves a person, their behaviour and their environment. In order to reduce the distance between a desired goal and a current state, a person needs to observe, monitor and adapt both their behaviour and the environmental conditions that influence this goal to increase performance. We suggest that these same mechanisms contribute to how skills trained and developed in computer gaming can transfer to other domains, and academic learning in particular, on the metacognitive level.

Personal or covert self-regulation involves monitoring internal states such as emotions, thoughts or feelings and their influence on performance, such as self-talk or negative emotions (Zimmerman, 2013). Zimmerman's (2000) model has three phases: forethought, performance and reflection. First, the forethought phase is characterised by the setting of goals and choosing task strategies aimed at achieving goal-directed behaviour. This phase is influenced by self-motivational beliefs such as self-efficacy and outcome expectations. If a person believes that their chosen goals or strategies can be achieved and will result in a desired outcome, then there is a greater likelihood of more effort and more effective goal setting.

Highly self-regulated individuals have hierarchically organised goals, with more proximal goals serving as stepping stones to more distal goals. These goals provide evidence that the individual is making progress towards the more distal goal (Zimmerman, 2000). Furthermore, these goals can be either focused on an outcome or a process (Keith & Jagacinski, 2023). For example, a *Counterstrike* player might set a distal outcome goal to improve their kill/death ratio (KDR). To achieve this outcome goal the player might also set a process goal of being more active in team communication to better coordinate their position during matches. This process goal, might lead to achieving more proximal outcome goals, such as winning individual fights with the opposing team, which then ultimately improves the players outcome goal of improving their KDR.

Kleinman et al. (2021) found that in *League of Legends*, experts and non-experts set more outcome goals than process goals, compared to novices who only set process goals. In an academic context, students might set a distal outcome goal to gain entry into a desired higher education university degree. A process goal might be to improve note-taking and essay writing skills to accomplish a proximal outcome goal of achieving a higher grade on a current written assignment. It may be easier to motivate an individual to learn self-regulated learning processes in an esport environment if they have greater self-efficacy in playing video games than in school work. Once players are confident in setting effective goals and strategies in an

esport context, teachers or coaches can demonstrate how these same processes can be employed in an academic context.

Second, in the performance phase, task strategies are mobilised in the pursuit of a goal, while an individual also records key aspects of their performance to enable effective self-reflection. Some strategies include self-instruction (self-talk), imagery and attentional focusing (Zimmerman, 2000). For example, using our previous example, a *Counterstrike* player may choose to focus their attention on the process of being more active in team communication. By increasing participation in team communication, the player achieves the proximal outcome goal of being in a better position on the game-map to win fights with the opposing team. Further, players may use imagery as a task strategy, by building mental representations to learn a skill or overcome a negative emotional state (Cumming, Bird, Brown, Kolitsida, & Quinton, 2023). Munroe-Chandler, Loughead, Zuluev, and Ely (2023) developed an imagery intervention with *League of Legends* players to reduce players' anxiety to better regulate their emotions. They suggested that players who are seeking to gain better control over their emotions during important moments in a match, (i.e.,when their character "dies") could use imagery to regulate their frustration or anxiousness and return to having a clear mind before returning to the game and setting their next goal. Previous research has shown that esports players with higher ranks more frequently use task strategies such as imagery, arousal control and self-talk (Trotter et al., 2021).

Self-regulatory task strategies such as attentional control and self-talk have been shown to be effective at increasing academic performance. Sánchez, Carvajal, and Saggiomo (2016) found students with worse academic outcomes exhibited less positive and more negative self-talk than their more academically successful peers. Sánchez et al. (2016) further suggested that an individual's predisposition to positive or negative self-talk tends to transfer into other life domains. In a meta-analysis of two decades of SRL research, Li et al., (2018) found that effect sizes for SRL task strategies were relatively large, suggesting their importance to academic performance. These strategies, therefore, could be developed in an esports context, where the process of applying well-known psychological strategies (e.g., self-talk, imagery) could be practised with the intention of learning transfer into other domains such as academia.

Third, in the reflection phase, the individual reflects on her goal-directed behaviour. This occurs either in comparison to a previous performance, a normative comparison, a set standard, or as a collaborator.

Players then make judgements regarding the causal attributions of the outcome and subsequently make adaptive or defensive inferences regarding subsequent approaches to self-regulation attempts. In esports it could be argued that it is only possible to evaluate one's performance against previous performance, a normative standard or their role in group processes, as formal measures of mastery found in standardized testing doesn't exist in esports.

Games such as *Counterstrike: Global Offensive* have elements of their design that promote certain types of self-evaluation. For example, at any time during a match, a player can hold down the 'Tab' key and see their own and their teammate's KDR. Players also move up and down this table of statistics based on the number of points they have earned (based on their overall damage or completing objectives) promoting normative comparison with teammates. Negative normative comparisons can overshadow personal improvement, which may be evident when comparing efforts against previous performance. If we look at our previous example, even though the *Counterstrike* player has improved their communication skills, they may still lose more fights against their opponent than their teammates. However, if the players' performance was framed through how they performed their role in the team, it

might be identified that the improvements in their individual communication led to their teammates performing more effectively, despite not personally achieving as many kills compared to other teammates. If the players attempts were judged solely on their own KDR they might judge their efforts as being ineffective, however by evaluating how they performed their role as part of the team their efforts to improve may be seen as successful.

In academia, reflection has been widely recognised as an important part of the learning process (Radović, Firssova, Hummel, & Vermeulen, 2023). Li et al. (2018) found that the self-reflection phase of SRL was as important as the performance phase for Chinese students. Previous research has shown that university students whose success is measured based on a comparison to their previous performance are less likely to have their performance negatively affected by situations outside of their locus of control (Was & Greve, 2021). Once an individual has reflected on their performance, they then attribute the outcome to either their effort or ability. More self-efficacious individuals are likely to attribute errors to a lack of effort rather than ability and subsequently persist longer to achieve their goals. Those who are self-doubters are likely to attribute failure to a lack of ability and are more likely to give up. As with the other phases of the Zimmerman (2000) model of self-regulated learning, within an esports context, teachers could foster more effective and adaptive approaches to self-reflection and self-regulation, while highlighting how these methods can also be used to build competence and success in other domains, such as academia.

In summary, self-regulation is achieved when the skill can be used adaptively across changing personal and environmental conditions. Stress might be one particularly noteworthy condition, which beset students and esports players alike. Poulus, Coulter, Trotter, and Polman(2020) reported that more elite esports athletes employed adaptive strategies (e.g., positive reframing, active coping, planning) to regulate their stress.

Critically, without observation and emulation of the skill with social assistance self-regulation cannot occur. Assistance from peers, parents, teachers, coaches or a capable other is critical for developing skills that cannot be learned alone. In line with Vygotskian theory, self-regulation has been suggested to first be developed through co-regulation (Hadwin & Oshige, 2011), that is, through the gradual appropriation of interaction with others. According to this theory, students will only transition to self-regulated learning from co-regulated learning with the help of a capable other. This makes an important point with respect to the collaboration and competitive practices from which players learn multiplayer games.

4. CONCLUSIONS AND OUTSTANDING QUESTIONS

By embracing the interactive nature of games, educators are empowered to cultivate a dynamic learning environment that not only resonates with the modern learner but also nurtures the essential skills and processes needed for success in an increasingly interconnected world. As with any change process, however, it assumes that the individual takes responsibility for their learning and learns how to self-regulate with respect to their own goals and adaptation to the environment. Computer gaming provides a particularly dynamic, rich and socially complex environment in which to study such processes empirically, besides having value in its own right as a naturally appealing learning environment for youth worldwide.

We have argued that in esports, each phase of self-regulation is important, where players can learn specific skills to improve their in-game performance. On the metacognitive level of observation, self-monitoring and adaptation, these same skills can be used in a variety of other domains including academia. An observation from our reading of the literature is

that the research on reflection in academic contexts was not as concrete as in sports. This is notable because reflective practices in sports are very predictive of performance above all other phases of self-regulation, whereas the evidence in academia is seemingly less conclusive. More research would be needed for clarifying the value of reflective practices in esport specifically.

As researchers within education and psychology, rather than esports program developers, we conclude that some major questions about the scholastic role of esport remain unanswered and thus warrant further investigation. Our proposal is that esport researchers and educational researchers may find common ground in using the framework of self-regulated learning for addressing questions such as the following:

- How do the students themselves perceive their esport performance in relation to academic performance?
- How do students perceive fear of failure, gains of winning, competition and success, across esport and traditional school topics?
- How do students collectively regulate their goals and behaviours in esports contexts, in comparison to classroom contexts?

Scholastic esport programs may provide a fruitful basis for empirically examining these and similar questions. The results would make substantial progress towards clarifying the role of esport in relation to larger educational goals and knowledge needs, such as those formulated in the Digital Competences Framework by the European Union.

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AUTHORS' INFORMATION

Full name: Björn Sjödén, Dr.
Institutional affiliation: School of Education, Humanities and Social Sciences
Institutional address: Kristian IV:s väg 3, 301 18 Halmstad
Short biographical sketch: Björn Sjödén is Assistant Professor in Educational Science at Halmstad University. His research pertains to educational software on all levels of the teacher education program, from a cognitive and learning science perspective.

Full name: Michael Trotter, Dr.
Institutional affiliation: Department of Psychology, Umeå University, Sweden
Institutional address: Universitetstorget 4, 901 87 Umeå
Short biographical sketch: Michael Trotter's is a sport psychology researcher whose work spans sports & health psychology, with a focus on the impact of health and psychology on esports athletes' performance. A significant aspect of Michael's research is his international collaborations across Asia, Europe, and Oceania, often involving industry partners like the Australian High Schools, professional esports organizations and sports organizational federations to bridge research with real-world issues.

Chapter #6

ASSESSING COMPLIANCE WITH BLOOM'S TAXONOMY: AN EXAMINATION OF SUMMATIVE ASSESSMENT PAPERS FOR FINAL YEAR B-ED STUDENTS

Mokete Letuka
Department of Educational and Professional Studies, Faculty of Humanities, Central University of Technology, Free State, Bloemfontein 9300, South Africa

ABSTRACT
Summative assessment papers must be compiled in accordance with Bloom's taxonomy of the cognitive domain. For final year student teachers, the recommendation is that eighty percent of the question paper must be pitched at Bloom's taxonomy's upper cognitive levels and only twenty percent of the question paper must be pitched at Bloom's lower cognitive levels. This distribution is designed to assess higher order thinking and thus instill, promote, and reinforce independent and critical thinking, as well as problem-solving skills in final year students. To determine whether examiners comply with this recommendation, I analyzed ten question papers from the faculty of humanities through document analysis. The study found that some examiners pitch their question papers for final year student teachers entirely at Bloom's lower cognitive levels and only a few distribute the questions close to the required recommendations. Of concern was that some examiners inappropriately used action verbs belonging to Bloom's higher levels. It is recommended that examiners be re-trained in setting question papers in line with the revised Bloom's taxonomy protocol and the correct use of action verbs. It is recommended also, that main assessment papers must be quality-assured in terms of the levels of questioning before they are administered.

Keywords: assessment, bloom's taxonomy, lower order thinking, problem solving skills, higher order thinking.

1. INTRODUCTION

Undergraduate final year students are at a very critical stage of their journey to becoming qualified school teachers. Their summative assessment must therefore be of a very high standard that prepares them for the eventual world of work and their careers. This essentially means that the quality of their summative assessment papers must be very good, i.e., the questions should mostly be pitched at Bloom taxonomy's high cognitive levels, namely, analysing, evaluating, and creating (Anderson & Krathwohl, 2001).

At the Central University of Technology (CUT), summative assessments for fourth year Bachelor of Education (B-Ed) students, are conducted twice per annum; in the periods between May and June, as well as November and December. The Central University of Technology (CUT), in its assessment manual, prescribes that fourth-year summative assessment papers be pitched eighty percent at Bloom's high cognitive levels, and only twenty percent at Bloom's lover cognitive levels (Hay et.al. 2004).

It has been noted by the assessment quality assurance committee that most summative assessment papers do not meet the expected standards in terms of the cognitive levels of questioning. Senior management at the CUT has in recent times reiterated the importance of setting summative assessment papers at the correct levels in terms of Bloom's taxonomy of the cognitive domain. For this reason, this study sought to investigate whether examiners, when setting summative assessment papers, comply with the recommendations as outlined in the CUT's assessment manual.

2. BLOOM'S TAXONOMY OF THE COGNITIVE DOMAIN

Granello (2001) asserts that Bloom's taxonomy is one of the first models created to provide teachers with a systematic classification of cognitive operations. Bloom's taxonomy of the cognitive domain is a six-level approach to the intellectual expectations of the classroom and classroom assessment (Booker, 2007).

This taxonomy indicates six hierarchical levels of cognitive complexity that are ordered from the least to the most complex level as follows: knowledge, comprehension, application, analysis, synthesis, and evaluation (Granello 2001).

A revision of these levels has been conducted to suit the demands of the modern-day assessment needs.

2.1. Revised Bloom's Taxonomy

Bloom's taxonomy was revised and slightly modified to suit the needs of the constantly changing dynamics of teaching and learning around assessment, as follows:

The lowest level was changed from **knowledge** to **remembering**, **comprehension** was changed to **understanding**, **application** to **applying**, and **analysis** to **analyzing**. **Evaluation** was moved a level down and renamed **evaluating**, and finally **synthesis** was moved to the top of the structure and changed to **creating** (Wilson, 2016. Below is a diagrammatical representation of the revised Bloom's taxonomy adopted from (Schultz, 2005).

Figure 1.
Rearrangement of Bloom's taxonomy from the old version to the revised version.

In this structure, the lower levels, remembering, understanding, and applying, are representative of lower-order thinking and according to the CUT's assessment recommendations, must constitute twenty percent of the B-Ed fourth year summative assessment paper. The upper levels, analyzing, evaluating, and creating are representative of higher-order thinking, which is where eighty percent of the questions in a fourth-year B-Ed summative assessment paper should be pitched.

Table 1 below illustrates so commonly used action verbs that characterize each of Bloom's cognitive levels as described above:

Table 1.
Action verbs across Bloom taxonomy levels in the cognitive domain.

REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
Choose	Distinguish	Act	Analyze	Assess	Create
Mention	Defend	Apply	Appraise	Arrange	Design
List	Classify	Experiment	Divide	Attach	Develop
Outline	Associate	Interview	Dissect	Critique	Collect
Identify	Demonstrate	Develop	Break down	Defend	Combine
Arrange	Describe	Identify	Deduce	Grade	Compile
Define	Illustrate	Generalize	Group	Prepare	Generate
Lable	Give examples	Modify	Examine	Manage	Invent
Memorize	Identify	Explain	Differentiate	Invent	Improve
Locate	Contrast	Implement	Inspect	Judge	Formulate
Name	Match	Employ	Conclude	Mediate	Facilitate
Match	Locate	Debate	Criticize	Estimate	Categorize
Indicate	Extend	Calculate	Correlate	Probe	Choose
Tell	Estimate	Complete	Diagnose	Reconcile	Collect
Select	Inteprete	Modify	Debate	Rate	Make
Memorize	Observe	Back up	Compare	Decide	Modify
Duplicate	Compare	Adapt	Attach	Explain	Originate
Reproduce	Extrapolate	Dramatize		Evaluate	Organise
Quote	Differentiate	Discover			Plan
Copy	Convert	Compute			predict
State		Interview			

Adapted from Stanny (2016)

2.2. Lower Order Thinking (LOT)

The recall or remembering of facts as well as the application of knowledge to situations and contexts that are recognizable to learners or students, is what defines lower order thinking (Thompson, 2008). This alludes to learners, in their attempt to answer questions, reproducing the memorized concepts and mentioning facts word for word. This kind of thinking cannot be applied in unfamiliar situations or to solve unrecognizable problems.

Qasrawi and Abdelrahman (2020) opine that modern day education must take students far beyond memorizing and reproducing the content but bring them to a place where they are able to solve unfamiliar problems using the knowledge and insight that they have gained. Abosalem (2016) reiterates the notion that the assessment of lower order thinking entails asking learners questions that prompts simple applications and routine steps to arrive at the answer.

According to Khan and Inamullah (2011), lower order questions in a question paper seem to always take the shape of closed questions for which the response or answer is already known. A typical example could be, "who is the president of South Africa?". Such a question does not require learners to think deeply about the answer, but to go into their memory banks to try and recall the answer. Such questions do not require students to think critically as they do not pose a problem to be solved.

2.3. Higher Order Thinking (HOT)

Assessing higher order thinking involves posing questions that allow students to express their opinions and explore their experiences on the content in a manner that demonstrates understanding of the content (Stayanchi, 2017). Abosalem (2016) asserts that higher order questions request students to interpret, analyze, manipulate information as well as substantiate facts. All these action verbs prohibit students from following routine steps to get to the answer as they must think deeply and critically to provide answers that convince the teacher that they have a deeper understanding of the content.

Thompson (2008) is of the perception that assessing for higher order thinking in a summative assessment paper insinuates that the questions may have information that is similar to what students dealt with during teaching and learning but present an element of newness and unfamiliarity for them. Sagala and Andriani (2019) classify HOT into four main categories, namely, problem-solving, critical thinking, creative thinking and decision making. To assess students' competence in applying these categories, teachers must challenge students to tackle questions that are contextual but unfamiliar and do not require routing steps to answer. According to Bosica, Pyper, and MacGregor (2021) problem-solving and critical thinking skills are usually associated with higher-order thinking.

2.4. Problem-Based Learning (PBL) for Problem-Based Assessment (PBA)

McPhee (2002: 60) has an assertion that it is much more beneficial for students to learn through discovery rather than being fed information by instructors or lecturers. Students should therefore be presented with problematic scenarios to resolve by applying certain principles of even formulae and be encouraged to work in groups to try and come up with solutions, with the lecturer facilitating discussions. The concept of PBL emphasizes the premise that students must work in small groups and be able to identify critical issues in a problematic situation, be self-directed and self-disciplined, as well as be able to incorporate information or knowledge from other disciplines to solve problems (Filipenko, Naslund, & Siegel, 2016:2). Even though PBL puts most emphasis on group interactions and experiential work to solve presented problems, the type of questions given to students in their groups for experiential work may be used in summative assessment as they stimulate critical thinking. According to Savin-Baden (2004: 224), given that PBL is a learning approach characterized by experiential learning, other forms of assessment including summative assessment must reflect some principles of PBL.

2.5. Critical thinking (CT)

Critical thinking is understood to be referring to "pondering on thinking in a systematic manner", which has an ultimate purpose of achieving a particular goal or solving a specific problem, as well as making decisions about what to do (Franco et al., 2018: 132). Lai (2011: 2) argues that the assessment of students' critical thinking skills must be characterized by open-ended questions that are related to real-world situations and are not confined to one correct answer or argument. These are the type of questions that do not require students to

only remember or recall previously learned content but apply deep thinking to get solutions. According to Bloom's taxonomy, the action verbs associated with the demands of critical thinking are for example, analyze, debate, distinguish, argue, criticize, arrange, assemble, design, develop, defend, construct, etc. (Stanny 2016: 5). Typically, these are some of the action verbs that must characterize open-ended questions meant to assess students' critical thinking.

3. PURPOSE OF THE STUDY

Senior management at the CUT has in recent times reiterated the importance of setting summative assessment papers at appropriate levels in terms of Bloom's taxonomy of the cognitive domain. For this reason, this study sought to investigate whether examiners, when setting summative assessment papers for final year B-Ed students, comply with the recommendations as outlined in the CUT's assessment manual. This study sought to judge the overall quality of main assessment papers in terms of Bloom's taxonomy and suggest ways to help lecturers comply with the basic rules of test/examination construction in terms of Bloom's taxonomy when setting main assessment papers.

4. METHODOLOGY

The aim of this study was to investigate whether examiners for B-Ed final year students comply with the CUTs stipulations (80% higher order thinking and 20% lower order thinking) when they compile summative assessment papers. To carry out this investigation I analyzed ten B-Ed fourth year summative assessment papers set by ten lecturers at the Central University of Technology.

A qualitative intrinsic case study research design used in this study was intended to address the aim of this study. Suresh (2015:1) reports that a case study involves a thorough observation of any social phenomenon, be it an individual, a family unit, an ethnic group, or an institution. This study is a case study conducted at the University of Technology, which is an institution of higher education. A case study is a research approach that makes the investigation of a phenomenon within its context easy, using different sources of data.

4.1. Data Collection

Document study was used in this study to investigate the compliance of examiners to Bloom's taxonomy. Karppinen and Moe (2012) describe documents as sources of information that can divulge the intentions and interests of their authors, and also reveal facts about the processes they describe.

There are documents in companies and institutions, such as minutes of meetings, agendas and newspapers, which are never compiled for the purpose of research (Strydom & Delport 2005:315). As soon as these documents are collected and evaluated or analyzed for the purpose of research, then the method of document study comes to the fore. The main data gathering strategy that the researcher chose was the collection of documents, specifically summative assessment instruments in the form of examination papers.

In this study, the documents in question are ten summative assessment papers, and the information they are meant to provide is the extent to which they assess higher order thinking and lower order thinking. I collected ten 2022 summative assessment papers from ten lecturers in the faculty of humanities at the CUT for analysis and named the papers A, B, C, D, E, F, G, H, I and J.

5. FINDINGS

After completing the analysis of all ten summative assessment papers was completed, the results presented in Table 2 were obtained:

Table 2.
Distribution of questions across Bloom's cognitive levels with totals for LOT and HOT.

PAPER	Remembering	Understanding	Applying	Total: LOT	Analysing	Evaluating	Creating	Total: HOT
A	52%	30%	7%	89%	7%	4%		11%
B	20%	17%	47%	84%	16%			16%
C	12%	70%		82%	8%	10%		18%
D	30%	11%	49%	90%	10%			10%
E	10%	19%	30%	59%	21%	20%		41%
F	11%	20%	10%	41%	34%	25%		59%
G	17%	63%		80%	20%			20%
H	8%	74%		82%	18%			18%
I	10%	8%	10%	28%	40%	32%		72%
J	21%		79%	100%				0%

It was discovered that all ten question papers addressed the lowest cognitive level (remembering) and none addressed the highest level (creating). All ten question papers required students to mention, name, state, or outline, which are, according to Bloom's taxonomy, used to test students' ability to recall information. Eight out of ten question papers that were analyzed (highlighted in yellow) had the highest weights in the lower band.

A typical example was question 2.1 of paper B in which students were required to "Mention two other factors on which a force on a current-carrying conductor depends".

Paper A addressed remembering, understanding, applying, analyzing, and evaluating were addressed. The highest level, namely, creating, was not addressed in this paper.

Below is an example of a "Remembering" question from paper A, together with its memorandum:

List *and* ***discuss*** *two (2) ways in which curriculum can be thought about (6).*

Memorandum:

Narrowly: √ as the pieces of paper on which curriculum content, objectives, and so on are written for teachers to use in their teaching.√√

Broadly: √ as the sum of the plan and all that happens in schools, including the experience and consequences of teaching and learning.√√

"List" is an action verb used to test students' memory.

"Discuss" is an action verb used to test students' ability to apply their understanding of the content, but the memorandum shows that this action verd was used inappropriately because the answer appears in the textbook exactly as it is on the memorandum, proving that this is another "Remembering" task.

Out of the ten papers that were analyzed, only one paper (I) had over seventy percent of the whole paper pitched at one of the higher levels, namely evaluating.
Below is a typical "Evaluating" question together with its memorandum from paper I:

One of the most important trends and forces that shape educational policies and have an impact on South African Schools is "New technologies, especially information technology."

Justify this trend with the aid of two practical examples in a school setting. (10)

Memorandum:

> *Students may make any two practical examples that demonstrate the importance of teachers and other personnel equipping themselves with the knowledge and skills to use or apply IT in the classroom or elsewhere within the school. Any two practical examples along these lines! (5 marks each)*

The action verb "Justify" is used to test the students' competence in "Evaluating" any process, circumstance, decision, assertion, etc.

Paper F came close with 59% in the higher band and 41% in the lower band. Paper J was the only paper that was pitched only in the lower band. It addressed only "Remembering" and "Applying" and none of the higher order thinking levels.

The overall average percentage of questions pitched at Bloom's lower cognitive levels, assessing lower order thinking for all ten papers was **73.5%**, while that of the higher levels was only **26.5%**.

5.1. Discussion of the Findings

The findings of this study resonate with the results reached by Mahroof and Saeed (2021:93) that most examiners place maximum focus on Bloom's lower order thinking skills when setting examination question papers. This study found that examiners place much emphasis on lower order thinking skills when they compile summative assessment papers for B-Ed fourth year students, and neglect higher order thinking skills. There were papers that were pitched as high as 80% and 100% at Bloom's lower cognitive levels. This evidence shows that most examiners tend to ask lower order thinking questions that outweigh higher order thinking questions. This has the challenge that students are not assessed on their critical thinking skills, and neither are they assessed on their ability to solve unfamiliar and unprepared problems. Some examiners tend to use certain action verbs incorrectly or inappropriately when phrasing their questions. This was evident in one of the questions where students were asked to "discuss" a certain aspect, and the memorandum revealed that students were expected to recall and reproduce previously learned content.

6. CONCLUSION AND RECOMMENDATIONS

Kumara, Brahmana, and Paik (2019) asserts that the quality-assurance of assessment papers in the teaching and learning process is an essential exercise. This study aimed at judging the quality of summative assessment papers for final year B.Ed. student teachers I alignment with Bloom's taxonomy of the cognitive domain. As a result of the findings of

this study, which point out the non-compliance of examiners to Bloom's taxonomy when setting assessment papers, the following recommendations have been made:

- The study highlighted the need for examiners to constantly and consistently consult and comply with the recommendations of the CUT regarding the distribution of questions when compiling summative assessment papers.
- More questions that assess higher order thinking such as evaluate and create must be included in main assessment papers, especially for final year students to develop their critical thinking and problem-solving skills.
- Main assessment papers must be quality-assured in terms of the level of questioning before they are administered.
- Examiners must be trained on striking the correct balance between lower-order questions and higher-order questions for different level student groups.

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AUTHOR INFORMATION

Full name: Mokete Letuka
Institutional affiliation: Central University of Technology (CUT)
Institutional address: Private Bag x20539, Willows, Bloemfontein, 9300, South Africa
Email address: mletuka@cut.ac.za
Short biographical sketch: Mokete Letuka holds a Master of Education (M. Ed) degree and is awaiting final feedback on his PhD study. He is currently an undergraduate lecturer in the Department of Educational and Professional Studies (DEPS) under the faculty of Humanities, at the CUT. He is a member of the teaching practice committee in the DEPS. His research interest is around assessment in education, teaching practice, and micro teaching. Mokete Letuka enjoys attending international conferences on education and presenting as well as publishing papers.

Chapter #7

RTI TIER 2 EXECUTIVE FUNCTION PROGRAM FOR 1ST GRADE BRAZILIAN SCHOOLCHILDREN

Graziele Kerges-Alcantara & Simone Aparecida Capellini
Investigation Learning Disabilities Laboratory (LIDA) at Department of Speech and Hearing Science, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Marília, São Paulo, Brazil

ABSTRACT
Objectives: To develop a second-tier Response to Intervention (RTI) program for the development of executive functions in first-year elementary schoolchildren and to analyze the clinical significance of the program via a pilot study. **Method:** This study was developed in two phases: elaboration and application of the RTI program for Brazilian schoolchildren; and a clinical significance analysis of the children's performance in pre- and post-test situations. The initial sample comprised 71 children (age from 6 years to 6 years and 11 months of both sexes) from two Brazilian public schools. These were submitted to a pre-assessment protocol. Risk for difficulty in executive function was presented by 18/37 of the participants that completed the pre-assessment protocol, and these were selected for the intervention program. **Results:** There was a reliable improvement in the components of executive function inhibition, working memory and alternation, for some children and in rhyme identification tasks, phoneme production, and phonological working memory, although the program does not focus on its development. **Conclusion:** The program we elaborated demonstrated applicability and can be used by educational speech therapists, school psychologists and educators as a scientific evidence-based intervention tool to support the development of executive functions in second-tier RTI programs.

Keywords: executive functions, intervention studies, learning, response to intervention.

1. INTRODUCTION

Studies have been published both in Brazil (Cardoso, Dias, Seabra, & Fonseca, 2017; Gonçalves et al., 2017) and internationally (Catts & Tomblin, 2001; Shuai et al., 2017; Rudasill, Acar, & Xu, 2022; Van der Ven, Kroesbergen, Boom, & Leseman, 2012), on the use of early interventions for the development of executive functions and for learning problems, as well as the performance of those skills involved.

However, there are still few studies that focus on the development of executive functions among at-risk students for learning difficulties using the Response to Intervention (RTI) model (Dvorsky, Becker, Tamm, & Willoughby, 2021; Kuhn, Willoughby, Vernon-Feagans, & Blair, 2016; Rodríguez, Areces, García, Cueli, & Gonzalez-Castro, 2021).

2. BACKGROUND

Executive functions (EF) are considered higher-order cognitive resources that command lower-level processes. They are directly related to the ability to learn, since for the student to be able to acquire reading and writing skills, it is essential that there is planning, attention, behavior regulation and motivation (Diamond & Lee, 2011).

Executive functions have been studied from perspectives that aim to define their components for classification and evaluation purposes, and the term executive functions is used to designate a wide variety of cognitive functions (Hamdan & Pereira, 2009).

The course of neurobiological development is progressive, through which its components are consolidated at different stages, with environmental factors acting in conjunction (Dawson & Guare, 2010; Dias & Seabra, 2013). Thus, in addition to the ontogenetic development of executive functions, from around 12 months of age to early adulthood (Romine & Reynolds, 2005), studies have shown that there is a variation between the development of its individual components, or that is, some components consolidate before others (Dawson & Guare, 2010; Diamond & Lee, 2011; Miyake et al., 2000).

This model, proposed by Miyake et al. (2000), which has recently received acceptance in the literature (Diamond, 2013; Diamond & Lee, 2011; Sullivan, Davis, & Koh, 2022), considers three essential components related to executive functions: inhibition, working memory and shifting, thereby demonstrating that, via their integration, they allow other skills to emerge, such as planning, decision making and problem solving, among others.

Knowing the milestones of ontogenetic development, as well as the evolutionary course of the components of executive functions, allows us not only to evaluate, but also to develop strategies for early interventions for their development. Studies have shown that executive functions can be used as an important predictor of school readiness, because they exert a great influence on academic performance since they are associated with adjustment and cognitive, emotional, behavioral and social development (Blair & Ursache, 2011; Diamond, 2013).

Thus, the literature has advocated a combined approach that includes assessment and intervention addressing the areas of cognitive processing, which may underlie learning processes in the various areas of reading, writing and mathematics (Howard, Johnson, & Pascual-Leone, 2014, Kerges-Alcantara & Capellini, 2020). Studies have defended the relationship between executive functions and academic skills in assessment and intervention situations (Willoughby, Hudson, Hong, & Wylie, 2021) contributing to individualized instruction projects that are fundamental to special education (Rodríguez et al., 2021).

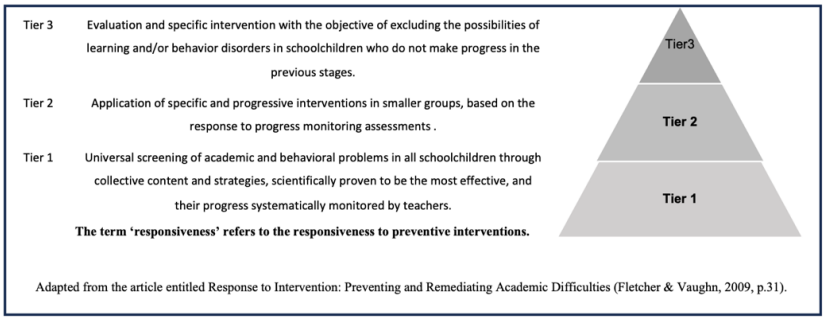
RTI is a multi-tier educational and behavioral model where the activities developed seek the identification and early intervention in at-risk schoolchildren for learning and behavioral difficulties, as well as diagnostic models of learning and behavior disorders (Andrade, Andrade, & Capellini, 2014; Fletcher & Vaughn, 2009; Fuchs & Fuchs, 2006).

The RTI model is designed to offer resources that allow more efficient care programs to provide a faster response to the needs of schoolchildren with learning and behavioral problems (Andrade et al., 2014; Fox, Carta, Strain, Dunlap, & Hemmeter, 2010; Jiménez, Gutiérrez, & de León, 2021), having been widely used in international and national literature (Andrade et al., 2014; Berkeley, Scanlon, Bailey & Sutton, 2020; Brito, Seabra, & Macedo, 2018; Mellard & Johnson 2007; Fuchs & Fuchs, 2006; Grosche & Volpe, 2013; Marino & Beecher, 2010; Miranda, et al., 2019; Vellutino et al., 1996).

The RTI model is composed of three tiers: (1) universal screening of academic and behavioral problems in all schoolchildren through collective content and strategies, scientifically proven to be the most effective, and their progress systematically monitored by teachers; (2) application of specific and progressive interventions in smaller groups, based on the response to progress monitoring assessments (Fletcher & Vaughn, 2009), that is, the responsiveness to preventive interventions, of those schoolchildren who did not

respond positively to universal screening and therefore are identified as at-risk for learning problems and eligible to the second tier; and (3) evaluation and specific intervention with the objective of excluding the possibilities of learning and/or behavior disorders in schoolchildren who do not make progress in the previous stages (Al Otaiba et al., 2011; Fletcher & Vaughn, 2009; Fuchs & Fuchs, 2006). The RTI model's structure is shown in Figure 1.

Figure 1.
Three-tier structure of the RTI model.



The term 'responsiveness' refers to the response to preventive interventions. Therefore, the RTI is a model focused on prevention, carried out in tiers (several phases of model implementation), where the monitoring of a student's "responsiveness" or "non-responsiveness" to early intervention programs will determine whether he or she will be referred to specialists, who in turn will conduct the individualized remedial intervention and diagnosis (Andrade et al., 2014; Fuchs & Fuchs, 2006; Wixson & Valencia, 2011).

Corroborating this, the current edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR) included in the diagnostic criteria for learning disorders a proposal for a response to intervention, based on the premise that existing environmental variables, as well as the time and mode of response to the intervention, can generate false positives for diagnosis of dyslexia. Consequently, this manual recommends that initially a diagnostic hypothesis is established, which will then be confirmed or refuted after a minimum period of six months of scientifically based intervention (American Psychiatric Association, 2023).

Based on the hypothesis that an RTI Tier 2 intervention program, with executive functions in schoolchildren can help to identify at-risk students for executive function and learning difficulties; this pilot study aims to develop and analyze the clinical significance of a RTI Tier 2 executive function program for 1st grade level schoolchildren of Elementary School I.

3. METHOD

This study was realized following approval by the Research Ethics Committee. This is a quasi-experimental study developed in two phases: Phase 1 the elaboration of the RTI Tier 2 executive functions program for schoolchildren; and Phase 2 an analysis of the program's clinical significance.

The theoretical basis for the elaboration of the RTI Tier 2 intervention program, called RTI-FEx was the theoretical model proposed by Miyake et al. (2000), considering the three main components of executive functions: inhibition of prepotent responses ‘‘inhibition’’; updating and monitoring of working memory representations “working memory”; and shifting between tasks or mental sets ‘‘shifting”.

Each of the components of executive functions was considered as an objective of the program, developed for application in a school environment and in the group modality. For each objective, strategies were developed for this study, based on gold standard instruments described in the national and international literature, and intended for the assessment of executive functions (Strauss, Sherman, & Spreen, 2006; Zimmermann, Cardoso, Kristensen, & Fonseca, 2017), in addition to intervention programs in executive functions published in the national literature (Cardoso, et al., 2017; Dias & Seabra, 2013).

Thus, RTI-FEx was composed of 10 strategies, distributed over 9 sessions with an average duration of 40 minutes each, to be carried out on a weekly basis over a nine-week period, progressively considering the three main components of executive functions: inhibition; working memory; and shifting.

Phase 2 of this research was a pilot study to determine the applicability of the program developed in Phase 1. The pilot study sample initially comprised 71 schoolchildren that were authorized to participate in the research from the 1st grade level of Elementary School I, of both genders, aged between 6 years and 6 years and 11 months, from two public schools in the city of Marília, São Paulo, Brazil.

The 71 schoolchildren were submitted to an assessment to identify those at-risk for difficulties in executive function. The following instruments were used as evaluation procedures in pre- and post-testing situations: Assessment Attention Cancellation Test (TAC); Trail Making Test (Parts A and B); Protocol for Early Identification of Reading Problems – IPPL; Five Digits Test – FDT; and Wechsler Scale Digits Subtest – WISC IV. The criterion used to identify at-risk schoolchildren was performance levels classified as below average in all instruments applied in pre-testing situations.

Only 37 of the 71 schoolchildren completed the pre-assessment procedures and of these 18 were identified as being at-risk for difficulties in executive functions and learning and as such met the inclusion criteria for the second-tier intervention. Of the 18 schoolchildren who completed the pre-testing assessment and were referred to the intervention program developed in phase 1 of this study, only eight schoolchildren completed the program and underwent the application of post-assessment procedures.

Therefore, the sample for the pilot study of phase 2 in this research comprised eight schoolchildren from the 1st year of Elementary School I, aged between 6 years and 6 years and 11 months, of both sexes, from two public schools in the city of Marilia, Sao Paulo, Brazil.

3.1. Results

The results of this study were analyzed using the JT Method (Jacobson & Truax, 1991) for single-case analysis. This method provides a comparative analysis between pre- and post-intervention scores and aims to determine whether the differences between them represent reliable changes and whether they are clinically relevant.

The JT Method results in two complementary processes: calculation of the reliability of changes that occurred between the pre- and post-intervention assessment, described in terms of a Reliable Change Index (RCI), and analysis of the clinical significance of these changes. The difference is calculated based on the difference between pre- and post-test divided by the standard error of the difference. In this way, the change from pre- to

post-testing can be a reliable positive (when there is improvement); reliable negative (when there is worsening); with clinical significance (which makes or will make a difference in the clinical scope); and there may also be no change.

To analyze the results of the clinical significance of the performance of schoolchildren in pre- and post-testing situations after application of the intervention response program RTI-FEx, they were named S1 to S8.

Table 1 and Table 2 show the Reliable Change Index (RCI) of each student based on their performance in the instruments used in pre- and post-testing situations.

Table 1.
Performance of schoolchildren in pre- and post-testing situations.

Instruments used in the pre- and post-assessment protocol						
Student	**FDT**	**TAC1**	**TAC2**	**TAC3**	**DIG**	**TTB**
1	RPC	RPC	-	RPC	RPC	RPC
2	RPC	RPC	-	RPC	-	-
3	-	RPC	-	RPC	-	-
4	RPC	RPC	-	RPC	-	RPC
5	RPC	RPC	-	-	-	-
6	-	RPC	-	-	-	-
7	RPC	RPC	-	RPC	-	-
8	-	RNC	-	-	-	-

RPC = reliable positive change; RNC = reliable negative change; FDT = five digit test; TAC1 = attention cancellation test part 1; TAC2 = attention cancellation test part 2; TAC3 = attention cancellation test part 3; DIG = digits subtest; and TTB = trail test part B

Table 2.
Performance of schoolchildren in the tests of the Early Identification Protocol for Reading Problems used in pre- and post-testing situations.

Evidence of the Protocol for Early Identification of Reading Problems – PEIRP													
Student	**AK**	**RP**	**RI**	**SS**	**PWF**	**PS**	**PA**	**IPI**	**PWM**	**FAN**	**SR**	**WPWR**	**LCP**
1	-	-	-	-		-	-	-	RPC	-	-	-	-
2	-	-	-	-	RPC	-	-	-	-	RNC	-	-	-
3	-	-	-	-		-	-	-	-	-	-	-	-
4	-	-	-	-		-	-	-	-	-	-	-	-
5	-	-	-	-		-	-	-	-	-	-	-	-

6	RNC	-	RPC	-		-	-	-	-	-	RNC	-	-
7	-	-	-	-		-	-	-	-	-	-	-	-
8	-	-	-	-	RNC	-	-	-	RNC	-	-	-	-

RPC = reliable positive change; RNC = reliable negative change; AK = alphabet knowledge; RP = rhyme production; RI = rhyme identification; SS = syllabic segmentation; PWF = production of words from the given phoneme; PS = phonemic synthesis; PA = phonemic analysis; IPI = initial phoneme identification; PWM = phonological working memory; FAN = fast automatic naming; SR = silent reading; WPWR = words and pseudowords reading; and LCP = listening comprehension of sentences from pictures

3.2. Discussion

The inhibition component was evaluated using the Five-Digit Test (FDT) and the Attention Cancellation Test (TAC). During the application of the FDT, all the schoolchildren were unable to perform the task in a pre-testing situation because they presented difficulty in understanding the instructions of the procedure required to perform the task. It is underscored that the instrument is intended for the evaluation of this component in the age group of this study (Sedó, Paula, & Malloy-Diniz, 2015). The same task was proposed in a post-assessment situation, where S1, S2, S4, S5 and S7 were able to perform the task, albeit presenting a performance suggestive of clinical deficit.

Although it is not possible to say that the gains in inhibition can be attributed to the intervention from the application of the FDT, as the schoolchildren were not able to perform the task in the pre-testing, there is a second test used to evaluate the inhibition component, the attention cancellation test, an instrument that assesses selective attention, which according to the literature is one of the skills involved in executive functions, fundamental to adaptive and purpose-oriented functioning (Friedman & Miyake, 2017). Also, according to the literature, the inhibition component includes the concept of selective attention, as it allows for the inhibition of overbearing responses and attention to irrelevant stimuli (Dawson & Guare, 2010).

In this task, which consists of three matrices printed with different stimuli, a performance improvement was observed in Part 1 of the test designed to assess selective attention (S1, S2, S3, S4, S5, S6 and S7) and in Part 3 of the test, also intended for the evaluation of selective attention, but with a demand for alternation (S1, S2, S3, S4 and S7), since it is necessary to change the focus of attention in each line.

The second part of the test presents a greater degree of difficulty, through an activity similar to the first, but using a target stimulus composed of double figures. Here, the student must mark the target figures, for example, a cross and a star, which must necessarily be in that order, thus raising the task's level of complexity (Seabra & Dias, 2012).

This is a pilot study and as such the data are preliminary, therefore it cannot be said that the improvement in this component are due to the intervention alone or in part due to the schooling process to which the schoolchildren in this study continued to be exposed during the academic year. It is worth noting that, according to the literature in addition to the ontogenetic development of executive functions, from around 12 months of age to early adulthood (Romine & Reynolds, 2005), there is a difference between the development of the various components, that is, some would consolidate before others (Miyake, et al.,

2000; Dawson & Guare, 2010; Diamond & Lee, 2011). Based on the theory proposed by Miyake et al (2000), inhibition is the first component to be consolidated.

The working memory component was evaluated using the Digits Subtest, which is an integral part of the Wechsler Assessment Scale (Wechsler, 2012). Although the results presented, from the comparison between pre- and post-testing through the described subtest, were indicative of reliable change for student S1, it is important to emphasize that the student was not able to perform the second part of the task during the pre-test situation, thus presenting a raw score for only the first part of the subtest. In the post-testing situation, the same student, in addition to presenting an improved score in the first part of the test, not only managed to perform the second part, but also presented a performance classified as preserved from the score and classification of the instrument itself, suggesting a gain in test performance for tasks involving working memory, information transformation, mental agility, and visual and spatial images.

The alternation component was evaluated through the Trail Making Test: parts A and B. Regarding the indicator of reliable change, there was a reliable change for two schoolchildren, S1 and S4, and in relation to S4, it is not possible to affirm that the gains in alternation can be attributed to the intervention from the application of the test, since the student was unable to perform the task in the pre-test, due to not mastering the alphabetical order evaluated in part A, this making it impossible to measure performance in alternation. During post-testing, the same student was able to perform both parts of the test (A and B), which in turn may reflect a gain from schooling.

According to national and international literature, studies carried out on early identification of at-risk schoolchildren for reading difficulties present the response to intervention (RTI) as a means to identify and intervene in an early manner, using the phonological basis and the grapheme-phoneme mechanism (Fadini & Capellini, 2011; Hulme & Snowling, 2014), revealing, however, that metaphonological skills, phonological working memory, rapid automatic naming and reading are predictive skills for reading development, which must be taught in the first two years of literacy, justifying the absence of indications of gains from the pre- and post-test in the tests knowledge of the alphabet, rhyme production, syllabic segmentation, phonemic synthesis, phonemic analysis, identification of the initial phoneme, rapid automatic naming, silent reading, reading words and pseudowords, as well as listening comprehension of sentences based on pictures, since the intervention program did not focus on specific instruction aimed at these skills.

In the Rhyme Identification Test, there was an indication of reliable change for the student S6, and also an indication of reliable change in the Word Production from a given Phoneme Test, presented by student S2. Knowledge of major phonological units such as onset-rhyme develops independently of reading instruction, and can be observed in children aged between three and five years (Capellini, Cesar, & Germano, 2017; Badian, 2001), when developing skill categorizing words, involving the act of attending to their constituent sounds, this can have a considerable effect on their future success in learning to read and write (Bradley & Bryant, 1983). Thus, considering selective attention as the ability to select only that which will be important for a given task at a given moment, thereby focusing attention and avoiding being distracted by the various stimuli present in the environment (Van Moorselaar & Slagter, 2020), we can relate this finding to the gains shown.

In the phonological working memory test, there was an indication of reliable change for the student S1, the same student who showed an indication of reliable change in the comparison of pre- and post-testing from an instrument that aims to assess working memory from verbal stimulus. According to the literature, the phonological working memory system is considered responsible for the temporary storage of information

(Baddeley, 2017), the storage and manipulation of information during a short period occurs through working memory, a necessary skill for the cognitive and effective functioning of everyday activities, such as performing tasks at school. Thus, the results suggest a relationship between the development of executive functions, promoting reading skills, according to the literature (Blair & Diamond, 2008; Meltzer, 2010), which has emphasized the importance of promotion of early development of executive functions and its relationship with school readiness, as well as its important predictive power for reading performance during the schooling process.

However, it cannot be affirmed from the preliminary data that the gains presented are entirely due to the intervention, since the improvement observed may also be related to the schoolchildren's neurodevelopment and schooling. Likewise, since it is a pilot study, there was no comparison of the study group with a control group. Therefore, future research will perform an effectiveness analysis study.

Regarding the analysis of the clinical significance of the program in a pilot study, there is an indication of improvement in the components of executive functions and in the predictive skills for reading acquisition; however again, without a control group, it was not possible to attribute the improvement exclusively to the intervention program.

Regarding the aim of elaborating a RTI tier 2 intervention program for the development of executive functions in schoolchildren from the 1st grade level of Elementary School I, it can be said that the objective was partially completed, since we demonstrated the need to include ecological tests to facilitate the generalization of cognitive gains in the performance of tasks by schoolchildren.

Regarding the hypothesis of this study, that an RTI tier 2 intervention program for the development of executive functions in schoolchildren from the 1st grade level of Elementary School I can help in the identification and early intervention in schoolchildren at-risk for learning difficulties was partially confirmed, because in the pilot study there was an indication of improvement in the performance of rhyme identification skills, word production from given phoneme and phonological working memory. However, the limitation in the sample size of the pilot study did not allow us to attribute clinical significance to the effects generated by the program alone, since there are also educational and neurodevelopmental effects to be considered. Thus, future studies will be conducted to expand the sample in order to verify the effectiveness of this intervention.

The results showed that there was a reliable improvement in the components of executive function inhibition, working memory and cognitive flexibility for some schoolchildren in this study. In tasks of rhyme identification, production from the phoneme, and phonological working memory, the results also showed that there was a reliable improvement, although the program did not focus on its development.

4. FUTURE RESEARCH

The limitation in the sample size of this pilot study did not allow us to attribute clinical significance to the effects generated by the program alone, since there is also the role of educational and neurodevelopmental effects to be considered. Thus, future studies need to be conducted with a larger sample size and control group to quantify the effectiveness of this intervention.

5. CONCLUSION

The program developed for this study proved to be applicable and can be used as an intervention instrument based on scientific evidence that promotes the development of executive functions and learning in RTI tier 2.

It was also possible to conclude that from the analysis of the clinical significance carried out to analyze the results of the program designed for this study, there was an indication of improvement in the components of executive functions and in the predictive skills for reading acquisition, since there were positive changes in the schoolchildren's' responses, when comparing performance in pre- and post-testing situations.

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AUTHORS' INFORMATION

Full name: Graziele Kerges-Alcantara
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Marilia, São Paulo, Brazil
Institutional address: 737 Hygino Muzzi Filho. Zip code: 17.525-900. City: Marília. State: São Paulo. Brazil
Short biographical sketch: Doctor in Communication Sciences and Disorders at São Paulo State University (UNESP), Brazil. Member at Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Marilia, São Paulo, Brazil.

Full name: Simone Aparecida Capellini
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Marilia, São Paulo, Brazil
Institutional address: 737 Hygino Muzzi Filho. Zip code: 17.525-900. City: Marília. State: São Paulo. Brazil
Short biographical sketch: Full Professor at Department of Speech and Hearing Sciences, Education Graduate Program and Speech Language Pathology Graduate Program, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Marilia, São Paulo, Brazil. Coordinator at Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Marilia, São Paulo, Brazil.

Chapter #8

THE TRANSITION FROM CONCRETE TO FORMAL THINKING

Ghada Wattad & David Chen
Tel Aviv University, School of Education, Tel Aviv, Israel

ABSTRACT
In the current study we have investigated the development of logical and mathematical reasoning among a mature sample following Piaget's theory of cognitive development. The purpose of the current study is examining if continued biological development and/or continued accumulation of life experience, learning and education can develop thinking that contributes to the transition to the formal operational thinking stage. Research was designed to test whether knowledge content (domain) affects learning by studying cognitive distribution in three domains. The study further explores the premise that schooling is the main factor that precipitates the transition to formal thinking. The research is based on two kinds of populations: The first consists of one thousand literate adults aged between 18 and 76 (M= 39). And the second of one hundred and three illiterate adults. The findings indicate that, there was not any continuation of the formal cognitive development during the entire adult life. Only about 25% of the population continues to the formal operational stage, and this is before the age of 20. learning was affected by domain specificity. In addition, about one-fifth of the illiterate population that never attended school do achieve formal thinking.

Keywords: cognitive development, formal thinking, concrete thinking, domain specificity, mathematical reasoning, genetic regulation.

1. INTRODUCTION

The current paper is based on the theory of cognitive stages by Piaget and Inhelder (Inhelder & Piaget, 1969; Piaget, 1972) which deal with the cognitive development of children in their transition from the concrete operational stage into the formal one. According to Piaget, the course of development is linear and continuous. The stages of cognitive development are universal - shared by children of all cultures and races.

Piaget also mentions high thinking schemes such as probabilistic thinking, equilibrium, proportion, isolation and control of variables, which develop with the progression of the cognitive level and maturate during the formal operation stage (Piaget & Inhelder, 1975). Hence, the ability of the student to apply those high thinking schemes, as those required for "scientific thinking," depends on the age of the student. The theory of cognitive development is considered a universal theory, which is valid for the entire population.

While Piaget focused on the cognitive development of the individual, a series of extensive studies, which were conducted around the world found that cognitive development has a universal pattern until the end of the concrete operational stage at the age of about 12. (Alon, 2003; Herbst, 2006; Habib-Allah & Babai, 2007; Naser, 2007, Green, 1983, Shayer & Adey, 1981). Only part of the whole population continues to move to the formal operational stage.

At the basis of this research lies the following question: does the section of the population who could not succeed in moving into formal thinking until the age of 17, develops this ability at an older age? If so, then this means postponing cognitive maturation to a later age. If the answer is no, then what is the role of all the learning and the experience acquired during elder life? The present study examined the distribution of cognitive levels among adult populations, as opposed to studies that examined the average of cognitive levels among youth population (12-17).

2. LITERATURE REVIEW

Piaget's theory of cognitive development defines the successive and universal developmental stages of the cognitive system. The order of the stages is fixed and extends from birth to the end of adolescence. Recently conducted studies have shown that two-thirds of the population reaches the end of the concrete operational stage and only about one-third continues to the formal and post-formal stages of development (ages 12-20).

2.1. The Transition from Concrete to Formal Thinking in the Broad Population

Shayer & Adey's (1981) study of the cognitive levels, which included 12,000 students from junior and high schools in England, found that only about 30% of students achieve the formal operational stage, while 70% of students remain at the concrete level of thinking. These findings show that not all junior and high school students reach the formal level of thinking as suggested by Piaget.

The research also found a contradiction between the requirements of the curriculum and the level of cognitive ability of students, which can explain the learning difficulties and the low proficiency among students in subjects that require abstract thinking.

Green's study (1983), that includes 3,000 students aged 11-16 in East Midlands, England, showed that most students do not acquire the formal operational stage until the age of 16. Several studies conducted in countries such as Australia, Pakistan and Israel show that less than 25% of ninth graders are at the formal level of thinking, while the vast majority of them are in the pre-formal stages of thinking (Iqbal & Shayer, 2000; Shayer & Adhami, 2007; Endler & Bond, 2001; Huppert, 2002).

2.2. Domain Specificity Content and Cognition

Various theories have emphasized the influence of specialized cognitive systems for different content domains. Carey and Spelke's 'Core Knowledge' theory (Carey & Spelke, 1996) and Fodor and Chomsky's Descriptive Modularity' theory (Fodor, 1983) are very well known in this regard.

Core Knowledge Theory believes that children are born with innate cognitive mechanisms. Those mechanisms are seen as learning traits with evolutionary and survival value that help the children acquire valuable information concerning their environment. A newborn toddler can distinguish between a living creature and a non-living one and also the ability to differentiate between human faces and inanimate objects. These are traits that children are born with, which help them survive. These mechanisms develop and change while interacting with the environment, life experience and contradictory evidence. However, the scientific community is widely divided around the very nature of the construct of intelligence. Steven Pinker (2002) in his book "blank slate" is describing the modern denial of human nature by ignoring the major role that biological principles undertake in regulating human behavior. The Bell Curve (Herrnstein & Murray, 1994) have summarized the best of

the research evidence for the unitary regulation of cognition by the g factor and the central role of heredity in it. A different perspective was presented by Gardner in his Multiple intelligence "MI" model in which he suggested that a neurological infrastructure of the brain is the basis for ten separate and independent intelligences.

Fodor (1983), in The Modularity Theory of Mind, claims that cognition consists of separate components that function independently with interfaces between them or some of them. According to this perspective, cognition is not a construct of mental processes that result from a cooperative activity of the general recognition mechanisms; rather, it consists of specific independent mechanisms. The human linguistic ability itself is also modular. It is composed of various systems that function independently, still with interfaces among them. After half a century of research, the modularity of linguistic ability has gained significant confirmation. An innovative addition to Fodors construct is A Thousand Brains (Hawkins, 2021). The treatise on intelligence by Stephen J. Ceci (1996) assembled much of the contradictory research denying the very existing of g and the major role that heredity takes in regulating intelligence. To this very day the scientific community is still divided between the models of intelligence described so far.

2.3. Illiteracy and Ignorance

Illiteracy is the inability to read and write. There is a state of functional illiteracy, where a person acquires initial reading and writing skills, but they could be more effective in daily life behavior. According to UNESCO - 2013, there are nearly 906 million illiterate people worldwide. The number of illiterate people in Israel in 2011 reached 122,449 (33,827 men and 88,622 women) (UNESCO, 2013). Approximately 5% of the population in the States is illiterate, as defined by the US government. According to the British government, 7 million citizens are illiterate. In Arab countries, more than 25% of males and 50% of women were illiterate in 2000. Most of the learning in these populations is informal and concrete. Oral calculation is very common among illiterate people ensuring proper functioning. However, writing calculation is formal, usually requires an algorithm, and refers to the absolute numerical values unrelated to context (Carraher, Carraher, & Schliemann, 1985; Smagorinsky & Coppock, 1995). Nunes (2010) have found that students tested orally on the subject of 'gain and loss' received higher scores than those tested in written tests (Nunes, 2010).

Extensive studies in England show that genetic factors strongly influence mathematical functioning at age 7. In a study of 3,000 same-sex twins aged 7, which aims to examine the influence of genetic variables on performance in mathematics, reading and general intelligence (g), it was found that there was a genetic overlap between mathematics, reading and intelligence. These findings indicate that most of the genes that contribute to individual differences in mathematics are the same that affect reading and intelligence. These findings do not correspond with the results of the genetic studies, which indicate that one-third of the genetic variance in math is unrelated to reading and general intelligence (g); there are specific genes for mathematical performance (Kovas, Harlaar, Petrill, & Plomin, 2004). Some human traits are determined by the polymorphic mechanism, i.e., a single gene determines two or more phenotypes; for instance, human blood type is determined by a single gene with three alleles ABO. However, most personal behavior traits are very complex and controlled by many genes. These features, such as weight, height, skin color, IQ, etc., are polygenic (Wattad & Chen, 2023a).

Searching for specific genes that influence IQ is part of the Human Genome Project. While defects in single genes, such as the Fragile X gene, can cause mental retardation, the heritability of the general cognitive ability (g) is probably influenced by a group of genes that

control this characteristic (cognition); information about the location of those genes on the chromosomes and which chromosomes are they laid on, is still missing. This group of genes is called Quantitative Trait loci (QTLs). Future identification of QTLs will allow a deeper understanding of IQ, development, and interaction between the gene and the environment (Fisher, 2006).

A major question regarding universal education is what drives cognitive development- Schooling or genetics? All over the world, educational policies and practices assume that schooling is the key to cognitive development. If this is true, all illiterate adults who never attend school will lag in their cognitive development and not attain formal thinking. This question was put to test in this study.

3. METHOD

The research sample consisted of 1000 adults from different strata of society. The research population is heterogeneous in terms of gender, sector, education, age and occupation. The average age of the sample was 39. In addition, second sample included 103 illiterate subjects, ages 40-90. The study population is heterogeneous in terms of socioeconomic status, place of residence, and work. The questions were read and explained by the researcher by demonstrating the questions. The subjects answered the questions orally, and the answers were recorded by the researcher.

For data collection purposes, we used a quantitative-correlative layout to examine the cognitive level according to Piaget's cognitive theory and to understand the functional relationships between the cognitive level and other background variables.

We used a series of three tests developed by "Mathematics and Science Perceptions in High School" at Chelsea College, University of London, between 1973 and 1978. We received the tests directly from Prof. Shayer, with guidance and counseling regarding the transfer and the processing of the data. These tests were validated and adapted to fit the norms of the population in the U.K.

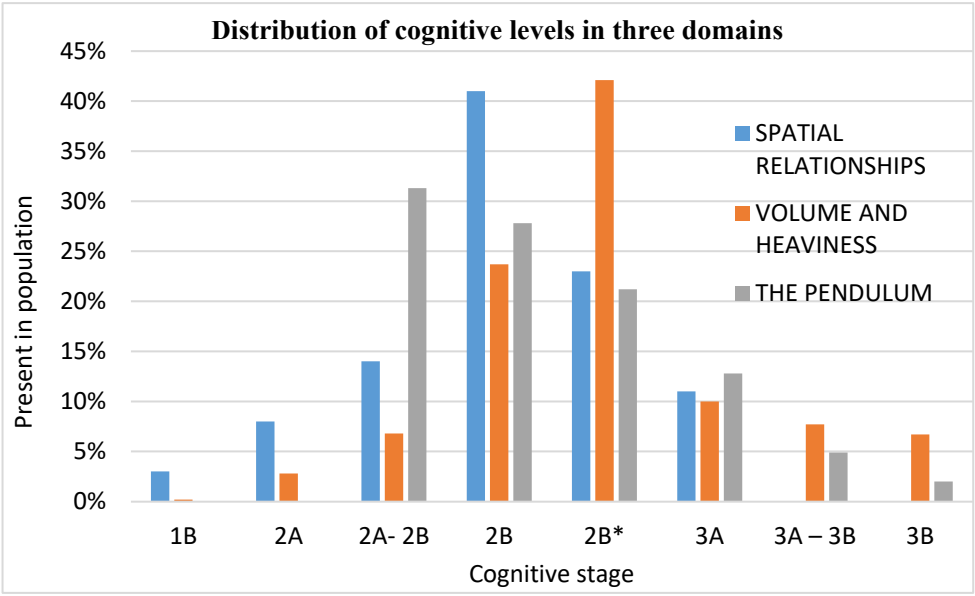
4. FINDINGS AND DISCUSSION

The findings of the current study indicate that the entire sample reaches the concrete operational stage according to Piaget's theory of cognitive development. Less than 25% of the participants continue to proceed to the formal and post-formal stages. In the domain of "spatial perception", about 11% of all subjects perform at the level of formal thinking, while the rest of the adults are in the transition phase and at the concrete stage of thinking. In the domain of "conservation", 25% of all adult participants are at the level of formal thinking and the rest (75%) are in the transition phase and at the concrete operational stage. In the domain of “isolation and controlling variables”, 19% of all subjects are at the level of formal operational stage and the rest of the participants are in the transition phase and at the concrete operational stage. On average, 18% of the sample goes through formal operational stage. Table 1 presents these results.

Table 1.
Cognitive stages in three domains.

Cognitive stage	**The cognitive level**	**Percent pf total sample Test 1**	**Percent of the total sample Test 2**	**Percent of the total sample Test 3**
	1B	3%	0.2%	
Early concrete	2A	8%	2.8%	31.3%
Mid concrete	2A- 2B	24%	6.8%	
Mature concrete	2B	41%	23.7%	27.8%
Concrete generalization	2B*	13%	42.1%	21.2%
Early formal	3A	11%	10%	12.8%
Mid formal	3A – 3B		7.7%	4.9%
Mature formal	3B		6.7%	2%
	Total	100%	100%	100%

Figure 1.
Distribution of cognitive stages in three domains.



The distribution of levels of thinking among adult population (Figure 1) is like that among junior and high school students, as reported in population studies conducted in Israel and abroad. The distribution remains stable even at adulthood. According to the data of the current study, more than 75% of the subjects are at the transition stage and at different stages of the concrete operational level in the three fields of content. In other words, the addition of up to 50 years of education and life experience **did not lead to further cognitive development processes** and did not promote most of the population towards the formal operational stage. This means that the main control over cognitive development is found in the individual's hereditary components.

It can be concluded that cognitive development is stabilized at the end of junior-high school and through high school. Age, life experience, and academic studies do not contribute significantly to the transition to the formal operational stage. This finding may be an obstacle to achieving the goals of Cognitive Acceleration Projects and Programs. According to our findings, the ability of thinking did not develop during the school years beyond the concrete stage, and the education system failed to contribute significantly to raising the level of thinking for about two-thirds of the population.

The personal data of the interviewees are not involved in determining the level of thinking. This finding reinforces the universal significance of the hereditary factor. Apparently, the individual's ability of thinking is not significantly influenced by the environment, culture, age and sex. The main difference in cognitive development is interpersonal variance. Formal learning and education can be a mediating factor in the learning process and can significantly contribute to students' coping with the difficulties encountered during learning, yet they cannot develop mechanisms that facilitate the transition into the formal operational stage. The practical conclusion is to consider placing an emphasis on adapting teaching environments to the concrete capacity of thinking alongside the attempts to produce cognitive acceleration.

The prevailing perception in educational theory is that teaching and learning are what enable and create cognitive development. Several projects were designed to promote students' general thinking skills in order to overcome their cognitive disabilities, such as programs for cognitive acceleration, and various teaching and learning methods (explicit teaching, inquiry, constructivist learning and so on). Despite all the efforts, the evaluation studies present a hard picture of the distribution of student achievements. The average number of students reaching proficiency in STEM remains low, and the variance in achievements in all science subjects is very high. According to the findings of the current study and previous studies (Shayer & Adey 1981), the cognitive development is held among more than 70% of the population at the concrete operational stage at the age of 12-13, and only a small portion moves to the formal operational stage. This can explain the difficulty many students experience when dealing with abstract topics. This possibility attributes a significant part of the students' difficulties to the biological-developmental factor and not to the environmental factor. A study that focused on the question of whether cognitive abilities continue to develop throughout adulthood indicates similar results (Wattad & Chen, 2023b).

The findings of the current study are in line with the findings of previous studies conducted in Israel and around the world. Those studies examined the cognitive level in adolescence in which the percentage of students who existed in the formal operational stage was less than 30% (Alon, 2003; Habib-Allah & Babai, 2007; 2006; Naser, 2007; Shayer & Adey, 1981). These studies do not fit Piaget's (1971) theory of cognitive development, which assumes that the entire population was supposed to be in the formal operational stage. Analysis of findings from the international Pisa research indicates that, about two thirds of

the world population belong to quality groups one two and three that represent the low achieving section of the proficiency scale (Chen & Wattad, 2023).

The fact that only a small percentage of the population attain the formal operational stage can explain the difficulties most of the student population has when dealing with subjects that require abstract thinking such as mathematics, physics and chemistry. it seems that such a problem can exists regarding abstract concepts in the humanities and social sciences. This finding also indicates a discrepancy between students' cognitive abilities and the requirements of the curriculum. Teachers who instruct their students to acquire research and problem-solving skills must be aware of the distribution of their students' thinking levels.

The main conclusion of these results is that the process of cognitive development is driven primarily by an innate factor.

The findings of the current study led us to suggest the possibility that there are two genetic control systems that control the development of cognitive thinking. The first is the SPC (Sensorimotor, Preoperational and Concrete). These capacities are universal and are genetically controlled by a Quantitative Trail Loci (QTL1). The second system, FPF (Formal and Post Formal). It is found in only a quarter of the population and is controlled by a separated control system QTL2. The existence of such control system needs further study at the molecular biology level.

4.1. Domain Specificity Dependence

The findings of the current research second the 'Modularity of the Mind' theory. This theory claims that cognition consists of separate components that function independently. Fodor argues that 'module' is the innate cognitive ability with the unique expertise to process a particular data type within a specific processing system (Fodor, 1983). According to this approach, cognition is not constructed of mental processes which are the result of a joint operation of the general recognition mechanisms, but rather it is constructed of specific independent mechanisms. The findings of the research indicate a significant variance in the distribution of the levels of thinking among the three content domains. Namely, the thinking ability of the participants depends on the content. According to the 'Modularity Theory,' while performing the test, the participants activated different internal modules depending on the content of the task. Although the second and the third tests dealt with a content domain that relates to science in two different subjects, there were gaps in the results and the achievements of the participants in both tests. These findings also support the research findings of Wattad and Chen, who examine the influence of content area on adult cognitive abilities (Wattad & Chen, 2023a).

These findings negate the concept of one general intelligence factor that serves all content domains. This view argues that a positive relationship exists between all the intelligence tests a person have and that one cognitive factor underlies the process of solving many problems.

Core Knowledge is another theory that emphasizes the existence of basic knowledge systems that specialize in different domains. This theory believes that children are born with innate cognitive mechanisms which help them survive. Human beings have been awarded many systems for representing and reasoning (Carey & Spelke, 1996; Spelke, 2003).

4.2. Proposal for a Genetic Model of the Regulation of Cognitive Development

Assuming that the hereditary factor is the main driving force of cognitive development, we propose the following model of inheritance-cognition relationships as an important component in the cognitive development processes. This model combines our findings with the relevant findings of behavioral genetics (Krapohl et al., 2014).

We propose that there are two genetic control systems that control the development of cognitive thinking. The first one is the SPC (Sensorimotor, Preoperational and Concrete) - a control system responsible for the emergence of cognitive abilities in the first three stages of the individual's development.

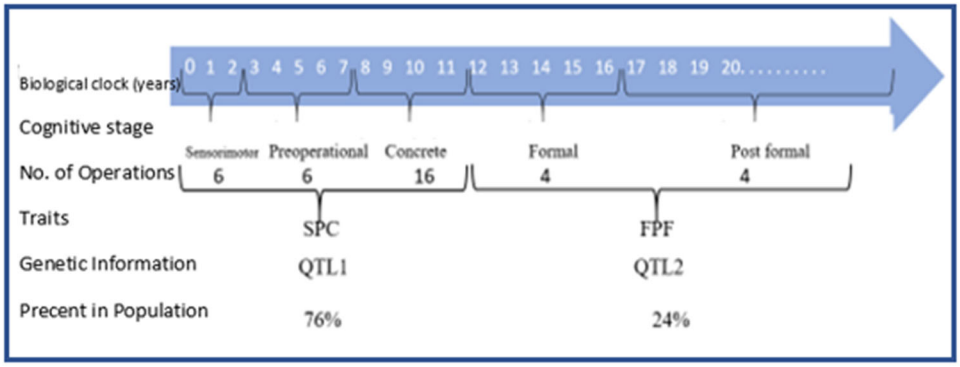
This system is universal. The entire research population has reached the concrete stage of thinking and has acquired the cognitive abilities from previous stages. These features and capabilities appear in a regular order of time,

The second system is FPF (Formal and Post Formal). This control system is responsible for the development of more complex, formal and post-formal thinking abilities. This control system is found in only about a quarter of the population. In other words, formal and post-formal cognitive abilities are not universal.

This study deals with the development of cognitive abilities, which are called "Traits". Most of the behavioral features are complex (love, talk, think ...) and are controlled by a polygenic system (many genes that control one feature). Studies in molecular genetics indicate that there is a group of genes that control properties that are situated in unknown chromosomes. This group is called QTL (Quantitative Trait Loci). This is a variable that includes a genetic information unit without defining a specific gene or its location on the chromosomes.

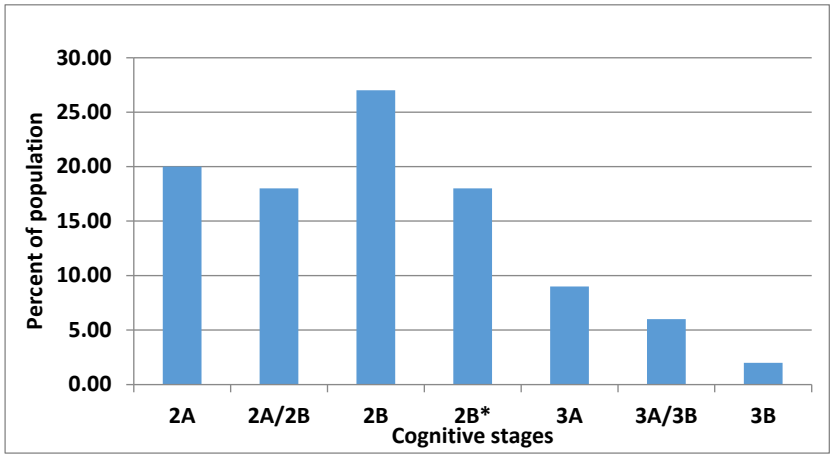
From the findings of the current study and broad population studies, all people undergo three cognitive stages up to the age of 11-12 (SPC). The stages are universal. Each stage is different from the rest and is controlled by a polygenic control system. According to Piaget, during the first three stages of development, the individual acquires up to 28 cognitive traits. Our theoretical assumption is that these traits are inherited by QTL1. Only a quarter of the population develops the features of abstract thinking FPF, which is controlled by a separate control system QTL2. In other words, the QTL2 genetic system is found only in a relatively small part of the population (see the following figure 2).

Figure 2.
A theoretical model of genetic control over cognitive development.



4.3. Literate and Illiterate Population

Figure 3.
Distribution of levels of thinking among the illiterate population.



The distribution of the cognitive levels of the illiterate participants in the test (Figures 3, 4) shows that everyone reaches the stage of concrete thinking, 18% reach the stage of transition from concrete thinking into formal, but 17% do undergo the formal thinking stage. The findings that a significant part of the population reaches the formal thinking stage (3A, 3A/3B, 3B), even though they never went to school, suggest that an innate regulation mainly drives cognitive development.

Figure 4.
Comparison between the distribution of cognitive levels of literate and illiterate groups.

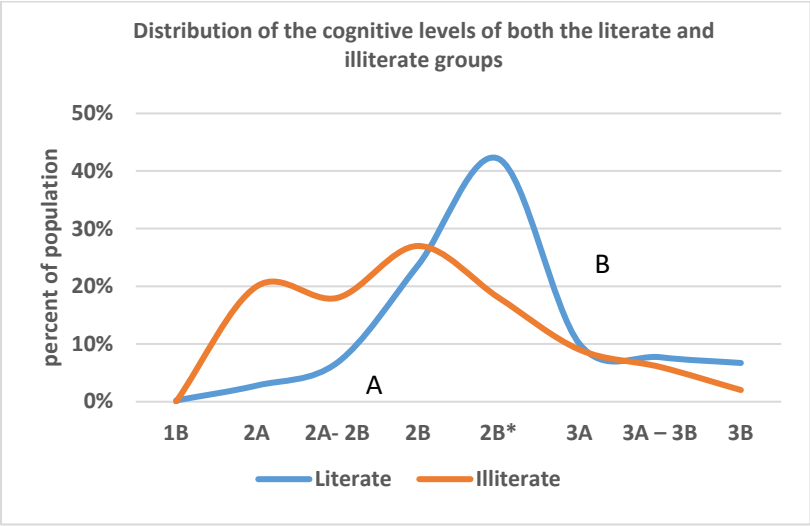


Figure 4 compares the distribution of the cognitive levels of the literate and illiterate groups. When comparing the distribution of cognitive levels between the two study groups, the experimental group (N = 103 illiterate) and control group (N = 1000 literate), it was found that the percentage of the subjects who developed formal thinking was 17% for the illiterate population and 24% for the literate. In other words, the percentage of the illiterate subjects who moved to the formal thinking stage is close to that of the literate, especially at levels 3A and 3A-3B; the small difference left was at level 3B. It can be argued that the people who continued to formal thinking at school contained the genetic component, the hereditary basis for formal cognitive tools that enabled them to move to formal reasoning. School and formal education helped these capabilities to develop phenotypically. These findings do not support the approach of the socio-cultural research, which claims that all humans are born with the same cognitive capacities and social environment, and the internalization of cultural tools brings to the development of high mental functions (Luria, 1979; Ong, 1982; Vygotsky & Cole, 1978)**.**

Another important difference is that 18% of the illiterate participants are in a transition stage, while most of them are still in the early sub-stages of concrete thinking, as opposed to a high percentage (42%) of the literate participants in the transition stage from the concrete to the formal. This finding can be explained by the effect of school on the development of cognitive abilities. The school seems to significantly contribute to transferring most of the students to the end of the concrete and transition phases. There are sub-stages and different performance levels within the concrete stage. It seems that the school catalyzes the students' full potential and capabilities to help them reach their highest level of thinking. In other words, the school contributes to promoting thinking within the concrete stage framework; however, its effect is unable to push development beyond biological constraints**.**

Acquiring formal operations by a significant portion of the illiterate participants indicates the strong influence of the genetic factor on cognitive development. The current study's findings are consistent with results from twin studies that examined the correlation between the levels of intelligence and genetic relationship (Kovas et al., 2004). A study examining the genetic influence on academic achievement at the age of 16 found that 58% of the variance, in general, was influenced by heredity. This data proves that individual differences in educational achievements do not result from the quality of teaching or the teachers. Most of the variance can be attributed to genetics (Krapohl et al., 2014). We can attribute the development of formal operations among illiterate people to hereditary factors; their lack of literacy and integration in formal education did not prevent them from developing and moving to formal reasoning.

5. FUTURE RESEARCH DIRECTION

- Developing appropriate pedagogy for concrete learners.
- Experimenting digital media to enhance abstract thinking;
- Adapting the curricula to individual cognitive stages;
- Using molecular biology to pursue the genetic model of cognitive regulation.

6. CONCLUSION

The findings that only a small percentage of the population develops to the formal operational stage can explain the difficulties the majority of the population has when dealing with subjects that require abstract thinking such as mathematics, physics and chemistry. This

finding also indicates a discrepancy between students' cognitive abilities and the requirements of the curriculum. Teachers who Teach their students to acquire research and problem-solving skills must be aware of the distribution of their students' thinking levels. Piaget stressed that the level of conflict or the size of the gap between the child's existing cognitive structure and the new information or the learning task should not be too large, and if so, the child cannot cope with the conflict at all.

There are many studies that attempted to teach people ‘thinking’. A series of intervention programs for development of thinking and cognitive acceleration have been developed. Yet, the idea that people can significantly improve their thinking capacities for a long term remains controversial.

Based on our research, we suggest distinguishing between cognitive development and cognitive growth. Cognitive development is universally regulated intrinsically by the genome (Innately) and thus cannot be "accelerated". However, cognitive growth is the product of learning and continues over time. It is the kind of knowledge acquired that is constrained by the developmental stage and the specific modules that were differentiated. If our findings are correct, it requires a whole reform in education strategies.

The modularity of the brain is an innate hereditary system. The environment is limited in affecting it, nor can we change it. It exists within the cognitive structures of the individual an effective metaphor for the products of the cognitive development can be described a s a toolbox (operations), which is used to solve different problems. Up to the concrete stage, 36 toolboxes or operations were developed, which are responsible for solving problems such as classification, retention, ordering, connection, etc. At the formal reasoning stage, a group of operations called INRC is added to the toolbox, enabling abstract logical thinking and making combinations of operations for solving infinite problems**.**

'Modularity Theory,' the core knowledge and the metaphor of the "toolbox," indicates the effect of the learned content domain on the participants' way of performance and, later on, the distribution of the thinking levels within the population. A fact that exists within the scientific community is that scientists at the level of formal and post-formal stage level lead and specialize in specific content domains and not in all domains of knowledge. Nobel Prize is awarded according to the domain of expertise: physics, chemistry, physiology, medicine and literature. In other words, even those who reach higher levels of thinking have a special ability in a defined content domain and not all the domains**.**

The main conclusion of these results is that the process of cognitive development is largely driven by an innate factor, or, in other words, a hereditary factor. If it was the environmental factor, it would not be possible to explain how illiterate people who never attended school have reached formal thinking stage.

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AUTHORS' INFORMATION

Full name: Ghada Wattad
Institutional affiliation: Tel Aviv University
Institutional address: Tel Aviv, Israel
Short biographical sketch: Dr. Ghada Wattad. Researcher, Tel Aviv university. Lecturer at Levinsky Wingate College for academic teacher training and Special education teacher in Nazareth. Research interests: educational innovation, child development, educational knowledge technologies**.**

Full name: **David Chen**
Institutional affiliation: Tel Aviv University
Institutional address: Tel Aviv, Israel
Short biographical sketch: Professor David Chen. Former Dean Tel Aviv university school of education. Ph.D. in Biophysics, Weizmann inst of science. Research interests: Scientific theory of education, STEM education, Learning science.

Chapter #9

EDUCATING THIRD CULTURE KIDS AND CROSS CULTURE KIDS: STUDENTS WITH HIDDEN AND APPARENT DIVERSITY

Patricia A. Stokke
EdD, MA, BS, West Valley College, USA

ABSTRACT
This chapter discusses the impact of cross-cultural experiences on the education of a growing student population; those who live mobile lives. These students move across countries for their parents' careers or as immigrants or travel daily across cities or national borders to attend school. A transitory lifestyle means they must adapt to unfamiliar educational environments (Lijadi & van Schalkwyk, 2018), which may cause challenges in their sense of belonging and interruptions in academic progression. Consequently, educators have a responsibility to understand the complexity and interrelatedness of learning, education, and culture (Hofstede, 2001) and adapt accordingly to support student success. The challenges facing this student population, including the needs and strengths emerging from their unique cross-cultural and mobile experiences will also be discussed, as well as methods of adapting teaching schemas. Additionally, potential areas of research are recommended. Teaching and serving students of hidden and apparent diversity is based on research in the fields of CCKs and TCKs, global transitions, cultural competence, cross-cultural and international education.

Keywords: neuroscience, hidden diversity, cross cultural and international education, cross culture and third culture kids.

1. INTRODUCTION

The purpose of this chapter is to help educators better understand, serve, and educate students with hidden and mobile cross-cultural experiences. The challenges, weaknesses, and strengths that emerge out of the unique cross-cultural and mobile growing up experiences of this student population are discussed, as well as methods of adapting teaching schemas. A further goal of this chapter is to elucidate the need for further research and practical applications that support educational adaptations to meet the needs of culturally mobile students.

2. BACKGROUND

If every "experience has a formative effect on the constitution of the human being" (END, 2023), and we are to accept that education is one of those experiences, it is necessary to recognize and address the influence of cultural experiences on student educational outcomes. In the context of increasingly mobile societies, there is a need to consider how education can develop new pedagogies to better serve students living and moving between cultures. Although culturally relevant pedagogy is available (Ladson-Billings, 1995), there is little research on the cultural influence of high mobility.

Individuals referred to as Third Culture Kids (TCKs) have similar challenges to students of other cross-cultural life experiences, such as those from less dominant cultures living in their passport country or children of immigrants, referred to as Cross Culture Kids (CCKs). “A TCK is a person who has spent a significant part of his or her developmental years outside the parents’ culture…” (Pollock, Van Reken, & Pollock, 2017, p. 15). TCKs and CCKs make up a growing population of students. Individuals can experience mobile lives as students for a variety of reasons, including globally because of parents’ transnational careers (Tan, Wang, & Cottrell, 2021), immigration, traveling daily across borders or cities, or as part of international classrooms (De Leersnyder, Gundemir, & Agirdag, 2022). As a result of their experiences, these students may have challenges with a sense of belonging and academic progression. Just as Lijadi and van Schalkwyk (2018, p.50) posit that “…one of the significant adaptations needed by children of high mobility families when moving to a new country is adjustment to the education system”, there is also a need for adaptations by students who transition between cultures for reasons other than moving to a new country.

Consequently, educators have a responsibility to understand the complexity of these particular cross-cultural experiences and their potential impact on educational success. This means that educators must become aware of and acknowledge these diverse life experiences that influence their students’ ability to adapt and learn. Since worldview emerges from one’s own culture and life experiences, Bredella (2003) cautions that we have the tendency to serve that culture first. For educators this can create blinders to understanding and learning how to effectively approach diverse worldviews and schemas that are vital to supporting positive student outcomes. This chapter begins to address the question, how do educators and student service professionals teach and serve these students effectively?

3. OBJECTIVES

Through an analysis of journal articles, the aim is to present an overview of the population of students experiencing cultural transitions, the need for educators to take into consideration the impact of a transitory lifestyle on pedagogy and educational outcomes and discuss potential research. Specifically, this chapter:

a. Defines hidden diversity, third culture kids, and cross culture kids.
b. Identifies the needs and potential strengths of culturally diverse students.
c. Explores constructive approaches to teaching and serving students of hidden diversity.

4. METHOD

This chapter is a qualitative review of relevant cross disciplinary literature. The literature chosen is related to the topics of Third Culture Kids (TCKs), Cross Culture Kids (CCKs), hidden diversity, intercultural relations, culturally relevant pedagogy, and inter/cross cultural and international education. The sources were selected based on their applicability to the subject and purpose of this chapter. Additionally, they were chosen based on:

a. Publication patterns: Years, journals, dissertations, and authors.
b. Research characteristics: Definitions of TCK and CCK samples, and sample characteristics.

c. Content analysis: Research topics and themes.

More specifically, sources were decided upon based on their relevance to culture in education, transitions in relation to the mobility of TCKs and CCKs, neuroscience and culture. Dissertations were included due to the limited number of peer reviewed journal articles on TCKs and the impact of mobility on the education of TCKs and CCKs. Although the majority of the publications originated in English, there were a few that were translated into English. Dates of publication were also considered. More recent articles, within the last five to ten years, were selected. However, there were resources older than ten years that were included because of their relevant information. Articles were also chosen based on sample characteristics. For instance, only those articles with research populations that fit the definitions of a TCK and CCK were selected.

5. DISCUSSION

5.1. Delineating Third Culture Kids and Cross Culture Kids

Third Culture Kids (TCKs) are defined as individuals who live or have lived outside their parents' culture or home country during their formative years, with the expectation of returning to the parents' home country (Pollock & Van Reken, 2009). "They are often described as people who build relationships to all the cultures they have lived in, but not having a full ownership in any" (Tan et al., 2021, p.81). Additionally, their appearances and behaviors do not necessarily match the expectations of others. An example is a Caucasian student returning to a dominant White country and culture after living as an expatriate in an African or Asian country where she looked different from the people of the host country. While growing up in this "foreign culture" she may have absorbed multiple cultural identities and practices, but upon return to her "home" country she is expected to reintegrate as part of the dominant culture. For example, a White student returning to a White dominant home culture may look like she fits in the but does not feel or behave as expected by her peers in the home country. This may result in challenges with identity and belonging, resulting in identity confusion, unresolved grief, and loss (Sichel, 2018). Additionally, she may be overlooked and misunderstood by educators due to assumptions and expectations that she is familiar with the educational system (Yang-Handy, 2019), which may lead to marginalization. A student of color returning to a dominant White culture may not only be marginalized but also become the target of racism. This marginalization and racism that he did not experience as an expatriate can lead to confusion in his worth and identity. The experience of being overlooked with the addition of inequitable and discriminatory treatment from educators, can impact his academic performance.

Cross Culture Kids (CCKs), the umbrella term that encompasses traditional TCKs, consists of individuals from diverse cultural experiences. For example, students who travel across town from culturally diverse neighborhoods to campuses in monoculturally dominant areas of cities, or those who immigrated with parents to new countries, or are refugees. CCKs daily study in new cultures but return home to parents' cultures at the end of each day, meaning these students live between two cultural worlds while trying to fit into both. Other categories of CCKs may be from families of mixed race or color, multiple cultures, or both (Pollock &Van Reken, 2009). These are all examples of multifaceted complex cultural experiences impacting student identity development and schema that in turn may affect student learning and are not necessarily apparent, thus hidden.

Hidden diversity as defined by Van Reken and Bethel is a "diversity of experience that shapes a person's life and worldview but is not readily apparent on the outside, unlike the usual diversity markers such as race, ethnicity, nationality…." (Pollock, et al., 2017, p.78). Hidden diversity is used as a descriptor because such cultural identities often are unrecognized or unacknowledged by the individuals themselves or others. Their identities are 'hidden' because individuals "look" the way others expect them to look like, yet because of their life experiences have cross-cultural influences not readily apparent to others as elucidated in previous examples. These cross-cultural experiences may influence students' ways of thinking about, approaching, and interacting with their environments, which can be different than for students, faculty, and staff from monocultural and culturally dominant backgrounds.

5.2. TCK and CCK Challenges and Strengths

Considering the neuroscience behind culture and education may give insight into why education can be challenging for students with multicultural and cross-cultural backgrounds. There is an increasing body of knowledge indicating a connection between the brain and culture (Hammond, 2015; Han & Humphreys, 2016; Park & Huang, 2010). If culture influences the way one thinks, then it would follow that culture influences how we learn. For example, Western culture typically approaches thinking and learning from a linear approach, whereas an Indigenous culture's approach is cyclical, and an Eastern culture's approach is from a holistic perspective (Briers, 2010). These differences can make it challenging for students to learn in an educational environment different from ones they are accustomed to. In support of this notion are the findings from an analysis of western teaching methodologies in an eastern context that this can result in "…a complex web of cultural conflicts and mismatches." (Nguyen, Elliott, Terlouw, & Pilot, 2009, p.109).

Other influences of culture in education include the power dynamic between student and instructor. For example, power distance, how one perceives authority (Hofstede, 2001), may influence student relationships with authority figures and comfort levels for questioning and challenging their instructors. If instructors with an egalitarian teaching style are informal with students accustomed to hierarchal authority, their teaching style may be perceived as unprofessional. Conversely, if students are comfortable with an egalitarian approach to learning, an instructor with an approach that is not egalitarian may be perceived as too formal and rigid.

Interestingly, the strengths of TCKs can become challenges. One such potential strength of TCKs is their tendency to be cultural chameleons. The skills needed to survive in multiple changing environments such as adaptability and inquisitiveness may give them a sense of confidence and self-reliance (Pollock et al., 2017). However, the desire and ability to adapt to new circumstances developed during transitory experiences and out of the need to fit into new environments, may keep them from seeking help. This characteristic can also make it difficult for faculty and staff to recognize a TCK's need for support.

Acknowledging that transitions between cultures can cause cognitive overload, due to continual adjustments, cultural switching, loss, and cultural shock, will aid faculty and staff in developing the empathy necessary to support TCKs and CCKs learning. Another aspect of transitioning between cultures and cultural switching that requires empathy is language. TCKs and CCKs may speak multiple languages. They may not speak their "mother tongue" as their first language or speak it with an accent leading to bullying by classmates and misidentification by educators as they transition between cultures and countries. Spelling can be a challenge, particularly for TCKs who have learned British and US English. For instance,

remembering when to use "s" versus "z" in words such as criticize can become a problem (Pollock, et. al., 2017).

Adult Third Culture Kids, adults who grew up as TCKs, show a passion for diversity, self-assurance, and diplomacy that contributes to their propensity for global mindset and global leadership (Stokke, 2013). These are strengths that educators can encourage TCKs to develop, and that could one day open career opportunities. Encouraging their potential to become "changers, communicators, creative solvers, and global citizens" (Stokke, 2013, p. 105), which are often developed through multiple transitory growing up experiences, may help TCKs further cultivate their potential for communicating and building bridges across differences.

5.3. Adapting to Teaching and Serving Students of Hidden Diversity

Culture has been compared to the air around us (Hofstede, 2009), we are so familiar with it and we accept it without thinking about it until something affects that air. Educators often are steeped in 'what it means to educate' based on their own culture, without understanding how their cultural references can impact their teaching and interactions with students. Nguyen, Terlouw, and Pilot (2006) called for "…educational approaches that take a society's cultural diversity into account…" (p.1) and to adapt pedagogy to improve cultural compatibility. As such, the first step to becoming a culturally responsive educator is to accept and understand oneself as a cultural being by reflecting on one's own culture and cultural experiences (Chavez & Longerbeam, 2016; Hammond, 2015; Marshall, 2002). Gaining an understanding of the air they live in by identifying their cultural references before facing cultural conflicts, shapes reference points about instructional schemas for faculty and staff (Hammond, 2015, p. 56).

Faculty and staff can explore their cultural self by asking themselves reflective questions such as: Was I the first in my family to attend college? If not, who did? Who were the heroes and anti-heroes in my family? As a child, did I call adults by their first names? Related questions about education and school background will lead to discovery of beliefs and schemas about time, collective or individual studies, viewpoints about cultural groups, countries, or educational systems. Other reflective questions may include: What approach and schema do I teach from? How can I adapt my approach to students from culturally diverse educational backgrounds? Do I make assumptions about their identities? Do I notice and acknowledge my students' cultural backgrounds?

Educators can explore their cultural selves using questions such as those mentioned above in personal reflection journals or discussions about cultural situations with colleagues in professional development workshops or other meetings. Discussion activities in workshops that explore cross-cultural critical incidents can be facilitated in a small group format or in a gamified fashion. One example of this is using a game of cultural competence called incluKit© from diversophy® (Simons, n.d.). The incluKit© game engages educators and staff in a nonthreatening manner and leads them to explore dealing with diverse cultures and critical incidents in educational settings. This type of game can provide a safe avenue for open conversations about culture that is vital to developing cultural awareness and competence.

It has been shown that students who experienced a multicultural approach in international classrooms had fewer cultural misunderstandings and more inclusive learning environments as compared to mono-national classrooms (De Leersnyder et al., 2022). When students perceived faculty as recognizing and valuing cultural diversity, they indicated that they were being taught in a psychologically safe and inclusive classroom. Conversely, students felt less safety and inclusion when they perceived that faculty was overlooking cultural differences.

6. CONCLUSIONS AND RESEARCH RECOMMENDATIONS

If "Our own culture is to us like the air we breathe and another culture is like water – and it takes special skills to be able to survive in both…" (Hofstede, 2009, p.18) and culture is not just in the material world, but also outside of us, within us, in our minds and thoughts (Simons & Amara, 2022) then educators need to acknowledge the strengths of students in cultural transitions and address the challenges of experiencing multiple cultures. It is important that educators first recognize the connection between culture and education, second understand their cultural selves and the impact on their teaching, and lastly adapt their teaching schemas to become culturally responsive educators. This helps enable educators to support the learning and development of the unique capabilities of TCKs and CCKs. To provide that effective support to culturally mobile students, more research is needed to gain a better understanding of the impact of mobility on teaching and learning. This would supplement the existing research on cultural influences on education and address the gap in teaching and learning of students with mobile growing up experiences.

Kwon (2019, p.113) posits that there is a "necessity of supporting the growing community of TCKs in maximizing the potential benefits of cross-cultural experiences while helping them navigate the potential challenges of identity, transition, and relocation." This author concurs and suggests the need to broaden that support to all CCKs, including implementing strategies to encourage direction and confidence by building upon the strengths of TCKs and CCKs. Along with that support, educators must acknowledge and develop TCKs propensity for connecting across differences and leadership capabilities (Stokke, 2013), as well as leverage their cross-cultural experiences to develop intercultural competence and positive diversity beliefs (de Waal, Born, Brinkman & Frasch, 2020).

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AUTHOR INFORMATION

Full name: Patricia Ann Stokke, EdD, MA, PHR
Institutional affiliation: West Valley College
Institutional address: 14000 Fruitvale Avenue, Saratoga, California, United States of America, 95070
Short biographical sketch: Dr. Patricia Stokke is Associate Faculty at West Valley College in Saratoga, California, USA, where she teaches business management courses. She holds an EdD in Educational Leadership and Management with a concentration in Human Resource Development from Drexel University, a MA in Management from John F. Kennedy University, and a BS in Organizational Behavior from the University of San Francisco. Her research, Adult Third Culture Kids: Potential global leaders with global mindset, focuses on the propensity of adults who spent growing up years outside their parents' culture for thinking and leading across cultures, led to her work on the education of Third Culture Kids and Cross Culture Kids, intercultural communication, and intercultural competency. She is certified to administer the icEdge Intercultural Communication assessment tool and Global Mindset Inventory and has her certification as a Professional in Human Resource Management. She also consults as a Talent Development Professional.

Chapter #10

CONTEMPORARY ART METHODS IN TEACHING VISUAL ARTS

Marija Brajčić[1] & Dubravka Kuščević[2]
University of Split, Faculty of Humanities and Social Sciences, Croatia
[1]Ph. D., associate professor, Department of Preschool Education
[2]Ph. D., assistant professor, Department of Teacher Education

ABSTRACT
Recomposition and photomontage are an integral part of contemporary art and should be implemented in the contemporary teaching of visual arts. This paper aimed to determine whether using recomposition and photomontage in visual arts classes stimulates student creativity. The research was carried out from 2019 to 2022 among students at the Department of Teacher Education and the Department of Preschool Education at the Faculty of Humanities and Social Sciences in Split, who applied the methods of recomposition and photomontage in visual arts classes. The research was qualitative and quantitative, observation and descriptive methods were used, and a total of 133 students participated in the research. The resulting artworks were divided into groups according to the degree of creativity that the students expressed in the artworks.
It was concluded that the works created with the use of recomposition and photomontage stimulated creativity among students. A significantly greater degree of freedom was observed in combining, using imagination and creating new ideas.

Keywords: creativity, photomontage, recomposition, student, teaching visual arts.

1. INTRODUCTION

Art presents an exceptional form of human activity that enables the creation of new ideas; through art, humans can creatively express their personal experience of the world and social relations. Art is thereby defined as a cultural universal that exists in all societies and civilizations. Art represents a human's subjective and individual side, but also the objective, rational, and intellectual side. The complex art structure requires an effort to create and understand the artistic, symbolic language used to express one's personal experience. Art gives form to human emotions, and feelings, and enables expression of their values and thoughts.

Artistic activity is realized in the communication between the artist, the audience, and the artwork. An artwork is the creator's authentic experience that contributes to the awareness of some aspects of personal life. Yet, the artwork is there for everyone to enjoy it, or to find meanings in it, thus enriching their own life.

Humans are in a constant process of questioning, studying, and getting to know art. Art has been present in human history since the earliest times, and it is thanks to it we recognize many historical periods and observe different social and cultural concepts occurring during historical events. There are different definitions of art, each trying to interpret this complex phenomenon in its own way. Yet, there is a problem because the definition of art, especially in the context of philosophy, always remains open. Throughout history, art was essentially linked to social transformations and changed with the

transformation of social perceptions. Most often, art is seen as the totality of human spiritual activity that expresses the aesthetic experience, including creation, the created work, and the experience of the work. Art contains the tendency to translate a feeling or idea into an objective existence by giving it a form. The basis of art is the realization of an idea, within which the subject frees themselves of their individuality and disappears into the object of art (Hrvatska enciklopedija, 2022). Speaking artistically about art, Finci points out the following: "It is an image of the world and a worldview, the interpretation and the interpreted, the subject and object of the aesthetic, which reveals itself and hides itself" (Finci, 2006, p. 49).

Today, "art ceases to be a strictly professional activity, but takes on an anthropological dimension that problematizes not only the issue and role of art, but also the sensibility and awareness of modern humans with themselves and the world in which they live and work" (Rukavina, 2009, p. 583). "To stand in front of an artwork means to abandon prejudices and accept the challenge of the new" (Štalekar, 2014, p. 185). Creating something new and creativity are often associated with art; therefore, creativity is necessary to create an artwork.

Visual arts are a part of the endless world of art that exists in all societies, and it is usually the educational process that enables the adoption of artistic values and the development of visual and artistic literacy. Art plays a vital role in the development of research and creative abilities, and in the educational context, this role has a special significance in artistic areas (Tomljenović, 2018).

To understand art and its essence, one needs to have knowledge and insights into a broader context of understanding art and knowledge of its history and present. Consequently, quality art education is needed. As Duh et al. point out: "The goal of visual arts is to achieve a certain level of artistic culture, i.e. to develop creative abilities, the ability of visual observation, visual thinking, evaluation, criticism, as well as the ability to adopt innovations and new ways of creating" (Duh, Herzog, & Lazar, 2016, p. 50).

The new determinants of visual arts education provide a new definition of an artistically literate person, emphasizing that this is a person with developed thinking and analytical skills, able to maintain an art-conscious relationship with the visual environment. This means that in teaching visual arts, attention should be paid to directed analytical observation of the visual language structure, imagination, and development of divergent thinking and intense empathic experience, which will result in developing individual art language during visual arts activities. The artworks created in this way will correspond to the personal experiences, individual skills, and abilities of their creators. This will give the created works an artistic touch because the experienced content will enrich thinking and cognitive processes.

2. CREATIVITY IN THE PEDAGOGICAL CONTEXT - METHODS OF RECOMPOSITION AND PHOTOMONTAGE IN VISUAL ARTS

Creativity drives society and creates civilizations. Innovation, creativity and the ability to create new things are some of the top educational policy priorities of the European Union (Ferrari et al., 2009; European Union [EU], 2010; Coate & Boulos 2012, as cited. in Griffiths, 2014). Therefore, creativity is highly positioned on the scale of social values, and concepts of creative teaching are an important subject of educational discourse. Innovation and creative approach to the problems are basic and essential drivers of progress (Srića, 2003). The term "creation" comes from the Latin word *creare*, which can be translated as "to create", but also as "the art of creativity and participating in something

useful or valuable" (Simel & Gazibara, 2013). Creativity also means creating, inventing, or producing. In the vocabulary of psychology, creativity is described as an activity that gives new and original products, in the material or spiritual sense (Petz et al., 1992). The word creativity implies both artistic creativity and creativity in scientific and technical achievements, and it is commonly used today as we are witnessing the increased emphasis on the importance of creativity in almost every area of human life and activity. The social changes in the 21st century require changes in all areas of life, especially in the field of education while the demands for changing the paradigms of acquiring knowledge imply a quick reaction from educational institutions (Stoll & Fink, 2000). Redesigning and rethinking the existing educational concepts are complex and necessary processes because the strengths of tradition and inertia in theory and practice, with their insensitivity to progressive turmoil, partly suppress the path to the affirmation of more efficient, functional, and rational educational work.

Creativity is an ambiguous phenomenon that cannot be precisely determined, so today we distinguish a multitude of different definitions and understandings of this concept. Stevanović (1986) sees creativity as a way of finding new and original solutions and as a kind of intellectual inventiveness. Plucker, Beghetto and Dow (2004) point out that creativity means the interaction between abilities, processes, and the environment used by an individual or a group to invent something interesting and useful for a social group. Similarly, creativity is explained as a "mental process by which a person creates new ideas or products or combines existing ideas and products in a way that is new to them" (Vlahović-Štetić et al., 2005, p. 133). Amabile (1983) emphasizes that creativity is not just one personality trait but a behavioral characteristic resulting from a particular constellation of characteristics such as personality, cognitive abilities, and social environment (as cited. in Arar & Rački, 2003).

Although no agreement has been reached on a single definition of the concept of creativity, its important features almost always include valuable and inventive ideas or products (Sternberg & Lubart, 1992; Torrance, 1993; Slunjski, 2013; Kunac, 2015). Runco (2014) emphasizes that there are different approaches to the study of creativity which are interdisciplinary and unite behavioral, evolutionary, developmental, cognitive, educational, historical, organizational, economic, psychological, and social approaches. The author also points out that most studies are useful and reliable, but that the creative process has multiple meanings and is extremely hard to define.

Nowadays, creativity has found its place in all areas of human life, including education. Thus, Craft (2010) states that creativity is an essential life skill that should be encouraged through education.

In pedagogical terms, there are two definitions of creativity: it is a synonym for creation, i.e., creating new and original solutions, and a trait or set of traits to be expressed in the act of creation (Kadum, 2011). Creativity is also seen as the creation of ideas that are both new and different, but also appropriate, correct, useful, and valuable (Pušina, 2020).

As can be seen, there are many understandings of the concepts of creativity and creation; however, what they have in common is creating something new and original, giving original ideas, taking other positions, a new way of approaching problems, a successful step into the unknown, openness to experience, perceiving new relationships among phenomena (Kadum, 2011). Stimulating student creativity requires innovation, changing and improving existing ideas, and thinking outside the box (Simel & Gazibara, 2013). Creative work always has the power to release creative energy and encourage class participation (Stevanović, 1986).

In the 1960s and 1970s, Paul E. Torrence showed in many studies that creativity in the classroom could be encouraged in the following ways: by considering unusual questions; imaginative and unusual ideas; by respecting and appreciating ideas; by ensuring the time in which ideas are evaluated; by combining evaluation with causes and consequences (as cited in Bognar, 2012). Encouraging creative activities and creative thinking is one of the important tasks of modern teaching. Creativity in education is seen in turning traditional into creative and open teaching. In such an environment, teaching is based on participants' activities, mutual communication and respect, continuous encouragement, asking questions, assigning tasks to the participants, and evaluating the results achieved. One of the great challenges of contemporary pedagogy is to provide conditions for creative activities from kindergarten to higher education level, making educational institutions places that will prepare students for independent, creative, and active work and help them find their place in society in the future.

"Each human being possesses creative abilities in some activity to a certain extent, and it only takes a certain possibility for them to manifest" (Duraković 1985, p. 25). Although today creativity is associated with many professions, it is still considered that creativity is most often present in art and science (Kyaga et al., 2011). Creativity is very often emphasized as one of the more desirable qualities according to many educational standards, educational policies, and national curricula of most countries of the world. Yet, the importance of artistic areas in teaching is often marginalized. The curricula give priority to STEM activities (mathematics, science, technology). In educational systems, creative potential is encouraged through artistic subjects (Huzjak & Županić-Benić, 2017).

Visual communication knowledge, skills, and abilities are increasingly valued in the world today, and it is crucial to be able to determine the quality of visual messages in a dynamic and media-driven modern environment. Therefore, educational systems should foster the development of visual intelligence, hyper-visual sensibility, visual and artistic competencies, and visual and artistic thinking in children and young people. Contemporary art pedagogy should be able to respond to contemporary challenges; therefore, quality visual art education is a necessity of educational curricula, especially in faculties that educate future preschool and school teachers.

Students develop their visual and artistic abilities spontaneously in interaction with the visual environment in which they live and act, nevertheless, a larger and better part of productive abilities and art appreciation abilities (perception and reception of artworks) should be developed systematically within educational institutions.

Visual Arts university courses need to be modernized, making it necessary to form new strategies within the didactic and methodical framework in terms of the application of modern teaching methods that will allow students to express their creativity. Such activities should be student-centered, and the teacher should intensively encourage students to become active subjects who independently explore and solve the defined art tasks.

In visual arts activities, there are different artistic methods (recomposing, redefining, combining, varying and building) that students use to express themselves creatively (Jakubin, 2000). One of the creative methods of art design is the recomposition. To understand this term, we should first clarify what composition is. Composition in art is the process of putting together and connecting artistic elements into a unique artistic whole according to an individual artistic conception, where the resulting work is also called a composition. According to Jakubin (2000), these factors condition composition in visual arts: concept or idea (the core of the work), art technique (meaning the material used to realize the idea), the size and shape of the surface on which the composition is made, art elements that make up the composition, and art principles (the compositional elements

according to which the art elements are connected). On the other hand, "Recomposition is the process of decomposing a previously created composition in flat or space-plastic design and newly composing the decomposed elements in a completely new way, into a new form, a new visual content" (Jakubin, 2000, p. 136). We can recompose by tearing and cutting the existing artistic forms and decomposing a composition into new artistic compositions (horizontal, vertical, pyramidal, circular, diagonal, or free) and recomposing the existing decomposed surfaces.

Photomontage is a type of art where photographs or their fragments are used to create a collage and achieve recomposition, and to direct the viewer's thoughts towards the newly created composition. Photomontage can be created in two ways. A simpler way involves the creation of an image by gluing, i.e. newspapers or magazine clippings, photographs, and various pieces of paper are glued on a surface thus making a collage. Another, more complex way is combining photos in photographic art, where the images are often digitally processed. The combined surfaces in the new composition create a unique image, and sometimes it is very challenging to tell apart photomontage and real photography. Using the mentioned method of artistic expression, artists explore the world, construct new imaginative and surreal images, and stimulate the mind to think and decipher the visual representations.

Listed and presented art activities realized using the method of recomposition and recomposition with photomontage are useful for students because they help to develop divergent thinking, reasoning, creativity, and creation. Divergent thinking lets students obtain a greater number of different answers to the questions posed, which results in creating new forms. This helps them connect elements that are otherwise considered unrelated. Artistic creativity should be seen as an ability that can be recognized and aroused, developed and understood, and finally realized through quality artistic works.

3. RESEARCH METHODOLOGY

3.1. Objectives

The research *subject* was the Visual Arts activities of students in the Department of Preschool Education and the Department of Teacher Education.

This study aimed to examine whether recomposing as an artistic method would encourage creativity in student artistic expression.

Based on the research aim, we have defined the following research *tasks*:

1. to examine whether there are differences in artistic creativity between student artworks created using recomposition and those created using photomontage
2. to examine whether this kind of artistic expression will stimulate stereotypical and schematic artistic expression in students.

After identifying the research *subject*, *aim,* and *tasks*, we formulated the research *hypothesis*.

H1 It is assumed that students will show a high degree of creativity in works created using photomontage.

H2 It is assumed that recomposition and photomontage will not stimulate stereotypical and schematic artistic expression in students.

3.2. Research Participants

In terms of the influence on the development of students' creativity, research was conducted in the period from 2019 to 2022 among students of Teacher Studies and Early and Preschool Education at the Faculty of Humanities and Social Sciences in Split. 133 female students took part in the research because there were no men among the students of Teacher Studies and Early and Preschool Education. Unfortunately, in the Republic of Croatia, the students in the teacher studies and in the early and preschool education are mostly women, so there were no male students at the study in Split.

3.3. Research procedure and description

The artworks were collected from students during regular classes in visual art education and training courses. During eight academic hours of Visual Arts, students applied recomposition and photomontage while painting. Recomposition was achieved in two ways in student works. In one group, students used two previously created artworks to recompose them in new artworks during four academic hours. In another group, students achieved recomposition using the photomontage technique (during four academic hours).

3.4. Methods

Qualitative and quantitative methodologies were applied in the research. The qualitative methodology was based on the observation and analysis of student artworks. The works were evaluated by the authors of the research (art pedagogues) using the following criteria for assessing the creativity of student artworks:

a) an unusual representation – an original idea,
b) unity in the artistic composition,
c) good technical presentation,
d) successfully combined artistic elements in the new artwork.

According to the above criteria, three groups of student artworks were identified and coded with numbers: 0 – no elements of creativity, 1 – contains elements of creativity, and 2 – creative artwork (Kuščević & Brajčić, 2022).

3.5. Results

Table 1.
Exemplary coded student artworks – recomposition (using old artworks).

0 No elements of creativity	1 Contains elements of creativity	2 Creative artwork
		

Table 2.
Student artistic creativity expressed in recomposing old artworks.

0		1		2		Σ	
f	%	f	%	f	%	f	%
47	65 %	21	29%	4	6%	72	100%

Table 1 and Table 2 show the students' creativity according to the stated assessment criteria in the described methods (coded with 0, 1 and 2). From the presented results, we can determine that almost 65% of the students did not achieve elements of creativity in their works. Elements of creativity were observed in 29% of students, while 6% of artworks represented creative works. When we add up the works that show elements of creativity and those that we evaluated as creative (code 1 and code 2), we conclude that 35% of students made a breakthrough in creative artistic expression, which we consider a high percentage, knowing that divergent opinion is the most difficult to encourage and achieve.

Table 3.
Exemplary coded student artworks – photomontage.

0 No elements of creativity	1 Contains elements of creativity	2 Creative artwork
		

Table 4.
Student artistic creativity expressed in recomposition with photomontage.

0		**1**		**2**		**Σ**	
f	%	f	%	f	%	f	%
30	49%	22	36%	9	15%	61	100%

In Tables 3 and 4, we can notice that female students were more creative during the creation of art works by photomontage and that the recomposition performed by photomontage provided them with better opportunities to create new art compositions. In the results, we can see that 49% of students did not realize elements of creativity in their works, while elements of creativity were observed in 36% of students' art works, and 15% of students made creative works. In this part of the research, we confirmed the first hypothesis that students would show more creativity in artworks created using photomontage.

Table 5.
Exemplary stereotypical and schematic student artworks.

Recomposition	Photomontage
	

Table 6.
Stereotypes and schemes in student artistic expression.

0		**1**		∑	
f	%	f	%	f	%
20	66%	10	34%	30	100

In Tables 5 and 6, Table 6 (Art works without templates and stereotypes are coded 0, while templated and stereotyped works are coded with the number 1). In Table 6, from the results, we can notice that out of 30 works in which there are no elements of creativity, 66% do not show stereotypes and patterns and 34% show them. In the second hypothesis, we assumed that recomposition and photomontage would not lead students to stereotypical and schematic artistic expression.

3.6. Discussion

Recomposition as a way of artwork enables students to organize artwork on new bases, i.e. students in such activities have to think creatively about new ways of connecting and structuring decomposed art and compositional elements. Thus, based on their own knowledge and experience, through creative activity, students come to new artistic knowledge and different artistic results. Creativity is the foundation of the modern concept of upbringing and education, and the development of artistic creativity is a specific art if our goal is to reach creative artistic ideas that will arise because of the affirmation of students' divergent/creative thinking.

It is necessary to develop students' creative thinking because creative thinking improves students' intellectual abilities and abilities to solve problems, which is transferred to external, not only artistic situations, and results in success in various areas of life. During the work, the students were given complete freedom in the artistic creation. Learning, i.e. the acquisition of art knowledge is always an individual experience and an act of each student based on the complex thought processes. Therefore, freedom of expression is essential in art activities, because otherwise motivation is absent, the teaching itself becomes a purpose and takes on formalistic characteristics, which leads to templates in art expression. Creativity in art classes encourages observation and curiosity of students, enables persistence in the formation of personal action ideas and develops initiative in the spirit of research and curiosity. Thus, art education becomes an active learning and the imagination and originality of students are awakened. Learning through problem solving

and inquiring encourages students. In this kind of acquisition of art knowledge, there is a high degree of student responsibility, because with this type of learning students take responsibility for decisions in the process of acquiring knowledge.

In the first research task, we wanted to investigate whether there are differences in artistic creativity between the artistic works of students that were created using recomposition and photomontage. In doing so, we started from the hypothesis that students will show a great deal of creativity in works created using photomontage. The first group of artworks which was formed during 4 teaching hours with 72 participants created the artworks using the method of recomposition. During the art activities, students analyzed shapes, colors, sizes, and surfaces and completely recomposed two old artworks. The creation of new art compositions enabled the dynamic restructuring of existing art content. While observing the artworks of the students and the work process, we noticed that the students approached the creation of new paintings with interest and motivation, mainly using the collage of previous works. The students themselves chose which old works of art they would recompose and create a new composition from. Playing with ideas and materials, the students tried to create a new abstract composition. Almost all students finished their artworks within the stipulated time. By analyzing the artworks, we determined that the artworks were of different artistic qualities.

The second group of artworks was created using the method of recomposition - photomontage. Examples of artworks according to the criteria can be seen in table 3. 61 female students participated in the work, and the artworks were created during 4 teaching hours. In this part of the research the respondents gladly collaborated and created their art compositions with interest. They used photos from different magazines and collage paper. A dose of humor was observed in one part of the artworks. Students showed greater creativity in photomontage recomposition. We determined that our first hypothesis has been confirmed and we can conclude that artistic expression is a human need connected to the fields of innovation and creativity (Bogataj & Rant, 2021).

In the second research task, we wanted to examine whether this way of artistic expression will lead to a stereotypical and schematic artistic expression of students. In the second hypothesis, we assumed that the recomposition and photomontage would not lead students to stereotypical and schematic artistic expression. We can see that the students to a greater extent (66%) did not apply the template and the stereotypical solution in artistic expression, thus confirming our second hypothesis. The departure from templates and stereotypes can be attributed to greater student motivation during work and a certain dose of humor observed in student works. The students made a creative departure from the usual way of thinking and produced artistic quality works according to the described research criteria.

Creativity presupposes human freedom (Piirto, 2004), and the freedom to think and create means a society with freedom of thought and action. Free societies allow personal development. Artistic creation is a possible form of affirmation of personal freedom. That is why expression in visual arts as a form of artistic expression presupposes creative freedom of expression without schemes and stereotypes in artistic representations.

Schemes, clichés, or stereotypes are plastic or wooden aids, that enable different people to make the same artworks. Using schemes and stereotypes in visual arts presupposes a lack of involvement, an impersonal and unimaginative artistic expression that does not require thinking and prevents the creator from trying to perceive and express something new.

Schemes and stereotypes in visual arts expression have an imitative and reproductive character, are considered undesirable, and prevent artistic creativity. They do not allow innovation and improvisation, essential in achieving creativity. Individuals who are afraid of developing personal creativity resort to this way of artistic expression, which leads to the lack of creator's originality and individuality. Since creativity is one of the essential human characteristics, implying freedom from role models, it is important for personal growth and development, but also for the successful development of many social activities.

4. FUTURE RESEARCH DIRECTIONS

Future research could be focused on the inclusion of more creative art methods of expression in the art classes with a greater number of students' art activities, and long-term results and psychological well-being of students could be monitored.

The presented art methods of recomposition and recomposition with photomontage could be used during art activities with children and young people of all ages, and the development of artistic creativity could be monitored through the analysis of artworks. In future research, perhaps a larger number of students from different Pedagogical Faculties in the Republic of Croatia, who are engaged in raising children of preschool and early school age, could be included.

5. CONCLUSION

Creativity, one of the extremely important human qualities, is the ability to create new ideas, inventions or artistic creations (Vukšić, 2020). It is emphasized that creativity is one of the key abilities in the process of training an individual for life in the 21st century (Jukić & Knezović, 2022). Today, creativity is perceived as an important component of life that enables solving various personal and professional problems (Lubart, Zenasni, & Barbot, 2013). Visual art education affects the affective and cognitive development of young people, and also provides an excellent basis for encouraging creativity.

Encouraging awareness of the importance of creativity is particularly important in higher education circles, and especially important are the ways in which creativity can be stimulated in specific teaching courses by devising artistic work methods.

Contemporary didactic-methodical thinking emphasizes the need for the development of modern art teaching and the use of modern teaching methods.

In the visual-art problematic context, in complex and demanding art processes, students were offered a greater degree of freedom in art activities in terms of imagination and combination when creating artworks, using the art method of recomposition during art creation. The offered art materials (old works, collages from magazines) were a good stimulus for awakening a series of ideas and unusual imaginative art combinations. We expected that the student works created using the method of recomposition and recomposition-photomontage would be more creative, given that this method enables the manipulation of ideas and the creation of unusual visual representations.

A certain number of student works with elements of creativity and creative works indicate that student creativity was initiated, but we believe that this method of artwork could better encourage students to express themselves creatively. Templates and stereotypes were observed in 34% of student works, which indicates that a greater number of female students were able to think creatively and create interesting new artistic compositions.

Creativity in teaching should be encouraged whenever possible because creativity plays a significant role in the upbringing and education of creative, innovative, and capable students who will be able to successfully apply their artistic creativity in working with children in the lower grades of primary school and in early preschool education.

The application of the mentioned artwork methods (recomposition and photomontage) resulted in creative works of students, therefore we determined that "in the modern system of upbringing and education, the primary goal and task of art education lies in nurturing productive abilities and their creative expression" (Zečević, 2020, p. 84). The described artistic methods influence artistic creativity and can be applied in a wider scope of artistic activities with students. We hope that the described methods of art design will find their place in the higher education systems.

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AUTHORS' INFORMATION

Full name: Marija Brajčić
Institutional affiliation: Associate professor
Institutional address: Faculty of Humanities and Social Sciences, Poljička cesta 35, 21000 Split, Croatia
E-mail address: mbrajcic@ffst.hr
Short biographical sketch: Marija Brajčić is an associate professor at the Faculty of Humanities and Social Sciences at the University of Split, Croatia. He teaches at the Department of Preschool

Education and Teacher's Studies. She was the Head of the Department of Preschool Education for a number of years. During her scientific work, she published over fifty scientific papers in reputable international journals and three books in the field of Fine Arts and Art Education. Her scientific interest is also Cultural Heritage and the Development of Artistic Expression. She is a member of editorial boards in journals and several conferences editorial boards. She has been cited many times in scientific journals in the country and abroad. In her scientific work in the field of education, he deals with preschool education and primary education. He cooperates with colleagues from his country and the world.

Full name: Dubravka Kuščević
Institutional affiliation: Assistant professor
Institutional address: Faculty of Humanities and Social Sciences, Poljička cesta 35, 21000 Split, Croatia
E-mail address: kuscevic@ffst.hr
Short biographical sketch: Dubravka Kuščević is an assistant professor at the Faculty of Humanities and Social Sciences at the University of Split, Croatia. He teaches at the Department of Preschool Education and Teacher's Studies. Investigates and publishes scientific and professional papers in the field of Cultural Heritage, Fine Arts and Visual Design methodology, and out of these areas individually and co-authors published sixty five papers and one book. She has been cited many times in scientific journals in the country and abroad. In his scientific work in the field of education, he deals with preschool education and primary education. He cooperates with colleagues from his country and the world.

Chapter #11

MENTORS' COMPETENCE DEVELOPMENT TO SUPPORT NOVICE TEACHERS: CROSS ANALYZING TWO MENTORING CONTEXT

Julie Courcy[1], Nathalie Gagnon[1], & Andréanne Gagné[2]
[1]*Université du Québec à Rimouski, Canada*
[2]*Université de Sherbrooke, Canada*

ABSTRACT
Mentorship is known to be one of the most utilized and effective ways to support new teachers. Many researchers have focused on how the mentees are supported and how an experienced mentor can make a difference in their induction process. Knowing the benefits of this affiliation, one of the main keys for a successful mentorship program is the mentor's ability to respond to the mentee's needs. Based on Le Boterf's competent action model this chapter exposes the commonalities between two different studies, both focusing on the development of the mentors' competent action: S1 was conducted in the province of Ontario, with mentor supporting novice teachers in their induction process and S2 was conducted in the province of Quebec with 11 participants, acting as associate teachers (ATs) with interns, in Vocational Training Centres. The cross-analysis shows that both mentors and ATs have similar needs regarding their competency development. The results shed light on the various factors conducive to the development of competency as seen through the lens of Le Boterf's concept of competent action: how to act, desire to act and ability to act. Finally, three keys are recommended to better support the mentors competent action development.

Keywords: mentors, competency, competent action model, professional development, supporting new teachers.

1. INTRODUCTION AND RESEARCH CONTEXT

Throughout countries, contexts, and school systems, mentoring, whether formal or informal, is one of the most utilized ways to support the professional induction process of new teachers. In fact, mentoring relationships have been shown to have positive repercussions on several aspects of the professional development of new teachers.

The stakes are high. The experienced teachers (mentors) embody lifelines (Cameron & Grant, 2017), imperative guides on this abrupt newcomers' hike. Novice teachers face a variety of challenges: the gap between professional ideals and reality (Gingras & Mukamurera, 2008), the intensification of the teacher's responsibilities, the inheritance of a heavier caseload (Mukamurera, Lakhal, & Tardif, 2019), etc. Their need for support is well documented, regarding organizational socialization (Mukamurera, Bouthiette, & Ndoreraho, 2013), class management, learning management, educational differentiation, and of personal and psychological nature (Mukamurera et al., 2019). In order to overcome these challenges and to help fulfill their needs, the support of more experienced teachers (mentoring relationships) has been shown to be effective (Demeyer, 2022; Hobson, Ashby, Malderez, & Tomlinson, 2009; Morettini, Luet, & Vernon-Dotson, 2019; Schwan, Wold, Moon, Neville, & Outka, 2020).

Based on a supporting relationship, mentorship refers to an experienced person (a mentor) offering his or her guidance and expertise to a less experienced person (a mentee) (Cuerrier, 2003; Gagnon, 2017). Cuerrier (2003) summarizes that mentorship depends on three fundamental components: support, dialogue, and learning. Inspired by this definition, Gagnon (2017, p. 89) explains that mentorship refers to a support and an interpersonal, cooperating, sharing, and learning relationship, between a mentor and a mentee, sharing a professional and personal development experience. This affiliation has been noted to have many benefits, amongst those: to improve both parties' communications skills, to improve work satisfaction, to facilitate professional induction, to reduce stress and professional isolation, to support professional identity development, etc. (Gagnon, 2017).

Indeed, mentorship is known for its benefits, but what are the keys to ensure its full potential?

1.1. The Key Factor to Mentorship: The Development of the Mentors' Competency

One of the main keys for a successful mentorship program is the mentor's ability to respond to the mentee's needs (Hobson et al., 2009; Stanulis, Brondik, Little, & Wibbens, 2014). To act efficiently as a competent mentor is not innate and can sometimes be done in a haphazard manner (Sewell, 2017), notably due to the lack of clarity and structure in the mentoring approach (Ambrosetti, 2014). Therefore, to ensure a successful mentor/mentee relationship (Stanulis et al., 2014), it is necessary for experienced teachers to develop specific competencies related to their mentoring actions and to the supportive nature of this relationship.

Even though the literature recognizes the mentor's need for preparation—and the trainings helping them to successfully accomplish this role are developed and evaluated (Bullough, 2005; Crasborn, Hennissen, Brouwer, Korthagen, & Bergen, 2011; Rippon & Martin, 2006)—, a limited number of studies have focused on understanding the way the supporting mentoring relationship is experienced by mentors, from their point of view. We believe it is necessary to focus on the keys and components can make them act in a more competent way towards their mentee.

1.2. The Role of the Experience and the Mentor's Competency

Why is it imperative to focus on the mentor's experience when interested by the mentor's competency to support a mentee? Because it allows a better understanding of the competency development process. As Gagnon (2020) reminds us: "the experience and competency are closely related concepts. Indeed, the competency of an individual could not be studied without paying a particular attention to what characterizes their experience of the situation i.e., the way mentors live on the cognitive, emotional, and motivational levels, and the way they act and react during a situation (Mayen, 2009)." (p. 59) In other words, depending on the nature of the mentor's experience, it can feed or hinder the mentor's competency development.

1.3 The Mentor's Competent Action Experience: Lights on Two Canadian Studies

Preoccupied by the development of the mentors' competency, two Canadian studies dive deeper into understanding of the components of their *agir compétent* (translated here as "competent action"). To do so, both studies (Gagnon, 2017, 2020; Gagnon, Gagné, & Courcy, 2023) focused on the actual experiences related to the mentors' supportive role towards

mentees. The first study (S1) of interest took place in a professional induction program for French elementary and secondary levels new teachers of the Ontario Province (Canada) (Gagnon, 2017, 2020). The second study (S2) of interest focused on the experience of associated teachers (AT) from the vocational training sector, in the francophone province of Quebec (Canada) (Gagnon et al., 2023). Strictly speaking, these ATs (Associated Teachers) are not official mentors. This professional induction context (vocational training) calls for a relationship based on guidance between an experienced teacher (also experienced in a specific field of expertise (hairdresser, plumber, mechanics, etc.) and a new teacher hired at their Centre. Ultimately, the results of S1 and S2 led to identifying some key elements related to development of the mentors' competent action. Also, both studies allowed us to understand the experience of mentor teachers.

This chapter fosters a deeper look onto the keys engaged in the development of the mentors' competent action. For this purpose, the following pages present the commonalities of their results, based on the outcome of a cross analysis focusing on the mentor's development competencies' using Le Boterf's competent action model (*Modèle de l'agir compétent*).

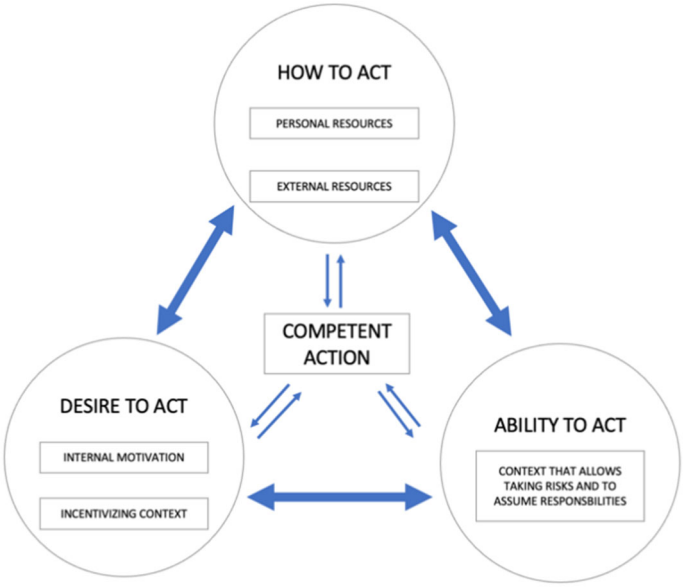
2. CONCEPTUAL FRAMEWORK: LE BOTERF'S COMPETENT ACTION MODEL

Based on Le Boterf's competent action model (2011), competency is understood as organizing the activity to make it possible to adapt to the characteristics of a situation, with an eye to fulfilling a goal (Gagnon et al., 2023). As Le Boterf (2013) explains:

> To face a situation, to carry out an activity or to solve a problem, a professional should not only know how to wisely choose resources from their repertoire, but also know how to organize them. They should build a specific combination of multiple ingredients that would have been sorted—consciously or not—for the right purpose. […] It is possible to break down the basic know hows, but the global competency cannot be reduced to this addition. An interactive dynamic exists between these components. (Free translation, Le Boterf, 2013, p. 2)

The competent action model prescribes that acting in a competent way includes a person putting into action, in a specific context, a variety of resources, focusing on dealing successfully with a situation (Gagnon, 2020). More specifically, for Le Boterf, competent action is understood to be the outcome of three components: how to act, desire to act and ability to act. The following Figure 1 exposes the translated representation of the model rendered by Cachet (2009, p. 139).

Figure 1.
Le Boterf's model of competent action.



How to act refers to the ability to implement a relevant professional practice while mobilizing an appropriate combination of personal resources (knowledge, knowhow, attitudes, experiences, etc.) and external resources (documentary resources, professional networks, databanks, resource people, etc.), and the ability to learn lessons from the practice implemented.

The second concept of this model, *desire to act,* refers to "taking action" and "to the individual's personal motivation that underpins every action in a more or less incentivizing context in which they are operating" (Le Boterf, 2013, p. 99). Desiring to act determines the individual's commitment to an activity, the "direction" they choose, the intensity with which they invest in their commitment and, ultimately, whether the activity is abandoned or pursued. It also plays a crucial role in workers' productivity and performance.

The *ability to act* refers to "the existence of a context, work organization, management choice, social conditions, what makes it possible for the individual to assume responsibilities and take risks, and legitimizes it" (Le Boterf, 2013, p. 99). In other words, even if a person can efficiently combine and mobilize the appropriate resources in a specific situation (how to act), and with the greatest motivation (desire to act), it would still not be possible to express competency to its fullest if that individual does not evolve in a supporting environment which allows and encourages taking responsibilities (ability to act).

To better understand the mentors' competency, it appears relevant, as the competent action model does, to study it with different individual, environmental and contextual factors. It seems consequent to shed light on some of the facets of the growth process of this competency. Do mentors have enough knowledge or the appropriate abilities to be a competent support person (how to act)? Are they engaged in their role towards new teachers (desire to act)? Does their school system allow them to thrive and to discover who they are as mentors? Do they have the liberty to take risks and to innovate in their role as mentor teachers (ability to act)?

3. METHODOLOGIES COMMONALITIES

Following a logic based on knowledge enhancement, similar objectives were pursued by both studies mentioned earlier: the two studies focused on describing the overall experience of the mentors to better understand the development of their mentoring competencies, using Le Boterf model. Therefore, both employing a qualitative approach and using a single case study methodology (Merriam, 1998; Yin, 1984), this methodological approach is particularly suited to expose the hows and whys of a contemporary phenomenon within a specific life context, in which it occurs (Yin, 1984; Yin, 2009). This methodology also allows an in-depth understanding of a situation and the meaning of this situation from the targeted subject's point of view (Merriam, 1998).

3.1. Contexts & Samples

Geographically, S1 took place in French schools of Ontario (an anglophone province) while S2 took place in vocational training centres, in Quebec. For both studies, participants were recruited using purposeful sampling (Creswell, 1998) where an email invitation was sent to the schools or centres targeted by the researchers to share with their teaching staff the possibility of participation to the researchs.

Contextually, S1 is linked to the experience of mentors involved officially in a provincial mentorship professional induction program for new teachers in elementary and secondary schools (NTIP) (Gouvernement de l'Ontario, 2010). The 11 mentors (1 male, 10 females) of this study supported new teachers who achieved a teaching bachelor's degree before being hired. For S2, the results are linked to the experience of 15 associated teachers (AT) (4 males, 11 females) supporting teaching interns. An important distinction is that these interns are in fact experienced professionals from a specific field (hairdressers, plumbers, mechanics, etc.) who have been hired based on their field competency. In this context, new teachers are hired without prior pedagogical training and have up to 10 years to complete a teaching bachelor's degree. During this process, they will have to complete three to four internships, accompanied on site by an AT from the same VTC (Vocational Training Centre). Although this context concerns associated teachers and teaching trainees rather than mentors and mentees, their relationship in both contexts is similar to mentoring; these cooperating teachers support trainees who are already teachers and consequently, colleagues (Gagné & Gagnon, 2022).

3.2. Data Gathering and Analysis

For the data-gathering process, both sets of data were collected through in-person (S1, S2) or on Zoom (S2) interviews, where each testimonial was recorded digitally, then fully transcribed, uploaded and coded using the NVivo12 software. A semi-inductive logic characterized the data analysis where the researcher would question the meaning contained in the collected data while allowing the key research concept to guide the analysis. This flexible procedure allowed the researchers to constantly adjust the data classification during the process of analysis (Savoie-Zajc, 2011). A detailed line-by-line analysis of each interview was then undertaken. This is what Strauss and Corbin (2004) call microanalysis, which involves "examining and interpreting the data very carefully, even meticulously" (p. 84), in order to identify the general ideas emanating from the participant's words and to grasp their meaning. Blind parallel coding procedures were also applied to ensure the rigour of analysis.

The "analyze and interpret" process enlightened by Le Boterf's model allowed us to unravel the dynamics intertwined in the competency development process and to expose some of the keys helping the decision-making process regarding training, management and support intended for mentors.

4. THE RESULTS

Because both sets of results are similar on many levels, this section exposes the main commonalities related to the identification of what can influence the development of mentors' competency. The following section exposes the commonalities of S1 and S2, allowed by the three main components of Le Boterf's (2011) model of competent action.

4.1. How to Act

Let us remind that this component targets the individual need to act, with autonomy. For a mentor, this means to be able to autoregulate, to use internal and external resources and to have the ability to look for new ones, within their environment.

The participants from both sets of data are unanimous, the teachers supporting mentees or interns must "have a clearer idea of what their [mentor] role is." Therefore, the training offered appears important and useful for individuals who want to support new teachers: "Thanks to training, offered by [Quebec universities names] […]. That's where I better understood my [mentor] role." For those who explain not having received specific training on "how to mentor," it is noted that it could help them: "it would be beneficial for me. It is not always easy to know how to approach someone else, how to approach a theme […]."

It also appears that the participants do not have many opportunities to discuss with other mentors about their mentorship experiences. The participants believe that sharing with their peers for example could make them benefit from the group's experiences and expertise, as mentors or teachers in general, and could optimize ultimately their autonomy. This way, meetings between mentors have been noticed to be helpful: "It would be nice, at the beginning of the year, to know who the other mentors are, so we can meet, and help each other."

Referring to what they learnt through their teaching experiences and mentoring (as mentor or as mentee), the mentors and ATs are positive on the importance of being independent. Another mentor also specifies that it is imperative for a mentor: "[to be] very autonomous. You cannot ask someone that is not autonomous and that does not have the leadership to do this [mentoring]."

4.2. Desire to Act

The data analyzed allowed us to better grasp on motivational aspects for mentor teachers as they exercise their support role. This section presents the results on the factors that motivate mentors in their role as well as the benefits they perceived during the experience.

The main reason almost all the participants did volunteer to be mentors is because they like to help others as this quote shows: "I will learn something. This is precisely what interested me, to help myself and to help others." Mentors and ATs notice the satisfaction of being involved in a "carrying" relationship and in addition, they feel good about themselves: "I feel useful," as one mentor explains.

Mentors and ATs explain that for the most part, they are not compelled to support novice teachers but that they rather act freely and willingly: “I made a choice, no one imposed it on me.” As this AT explains, “[the first time] I volunteered […]. Now they [the management team] ask me each year, and I am always interested.” In fact, the sets of data showed that the mentors and ATs are intrinsically motivated to fulfill their mentor role; they act because they deeply believe in the relevancy of such a process. On that note, it is possible to see that their desire to act is strong, supported by the benefits they recognized flowing from the richness of the mentoring experiences. For example, the mentors and ATs explain that one of the reasons they do want to support newly graduated teachers or teaching interns is that it allows them to stay close to the latest pedagogical findings: “to learn and to update my practices with the mentee, to question my professional actions, to share strategies, documents or tasks, to regain motivation for my profession.” The mentoring allows them to become better teachers in their own classroom.

It has been noted that mentors and ATs are motivated by the feeling of making a difference in their school or field: “The feeling of helping the next generation, to better prepared them”, an AT explains. “You are part of a team who collaborated to train the next generation,” as another one says. Many of the participants explain that they were lucky enough to be well accompanied when they were a new teacher and being a mentor or an AT is their way to pay it forward: “I give back what I had the chance to receive in my life. It is an honour for me. I had an excellent model when I was a mentee and I wanted to be just like that, a mentor.” As mentioned by two different ATs: “This feeling of paying it forward, this feeling is truly the best for me!” “Mentoring, it is a way to pay forward. […] it is the satisfaction of being able to give back to someone who’s starting, knowing that you liked when someone did it for you.”

However, for both studies, mentors and ATs express their disappointment regarding too few gestures from their school or centre’s management team for their mentoring involvement. It is possible to see some mentors express how they felt competent and motivated by some encouragement provided by their principal, as this passage shows: “It is motivating, my principal often congratulates me for what I do. Indeed, this motivates me a lot.”

Some mentors and ATs express feeling disappointed by the lack of feedback and encouragement from their management teams: “Sometimes, there are congratulations expressed for different projects, but we never see a mention specifically for ATs. Like: *Good Job Geneviève to have mentored your second intern*.” They specify that more encouragement from their superior could be beneficial to recruit mentors and make them feel valued.

4.3. Ability to Act

As presented earlier, *ability to act* refers to the context that allows taking risks and assuming their role and responsibilities. For mentors and ATs, this means evolving in a context allowing them to express their competency.

What appears interesting relies on the fact that both sets of participants noticed the lack of time to accomplish their mentoring role: “Sometimes, we don’t have a choice to go outside our working hours”. Neither mentors nor ATs have official relief offered by the school or the centre on their weekly regular teaching schedule. Therefore, as many explain: “Of course it overflows from my duties, it takes me longer.”

Amongst repercussions noted, many participants say that they need to let some of their own teaching duty go, if they want to have enough time to support adequately their mentee or intern. This mentor says: “It’s a role overload they inherit, the mentors. It’s a heavy burden.” On the counterpart, some mentor who did not want to let go some of their teaching

duties, had to decline the offer of being a mentor: "It happened to me before, to refuse students because my caseload was too big, I felt overwhelmed."

Consistently, both studies allow us to understand that participants are not efficiently informed regarding the induction process, the mentorship requirements nor the offered resources for mentors and ATs. From written documentation to a university contact person, the mentors and ATs have different resources that are sometimes offered, although those resources vary greatly from one school or centre to another (different formats, target various aspects of mentorship, etc.). They feel the need to be autonomous in the search of information, as this mentor express: "I go get the information I need to have". Some explain that the information does exist but that it does not seem to be travelling to the teachers. As a mentor suggests, depending on the initiative, the resources should be targeting the mentors, easily accessible, and be offered to them directly, to avoid having to "chase" for the information.

To better educate themselves in their role and responsibilities, the mentors and ATs mentioned the importance of the collegiate and collaborative climate, amongst each other and amongst the school or centre's staff. They express how they benefit from each other's experience and expertise. It appears relevant to specify that the participants from both studies stipulate that the administration's leadership (the principal, for instance) appears to be important in setting a collegiate culture around the school. As a summary, the ability to act is promoted when the other teachers and members of the school are supporting each other, informally.

5. DISCUSSION

Sharing similar roles within their respective mentorship contexts, the mentors and ATs seem to have similar needs regarding their competency development. Both studies shed light on some of the various aspects of this experience that could improve or impede the expression of their competent action. For example, the type of support offered by mentors and the ATs is similar. Both are acting as experienced teaching professionals, offering expertise in a relationship based on support, dialogue, and learning (Cuerrier, 2003). The supporting experiences they are willingly going through influence their ability to competently execute their role towards the novices they are guiding.

Table 1.
Summary of the similarities between the mentors and the ATs.

<table>
<tr><th colspan="3">Similarities of their role and duties as mentors & ATs</th></tr>
<tr><td colspan="3">- The type of support they offered is similar.
- They engage willingly going through a supporting experience.
- They act as experienced teaching professionals offering their expertise.
- They guide novice teachers.
- They evolved in a relationship based on support, dialogue, and learning.
- They execute their role towards the novices they are guiding</td></tr>
<tr><th colspan="3">Desire to act</th></tr>
<tr><td>Least support needed.</td><td>They are strongly intrinsically motivated.</td><td>They are engaged in their role, freely and willingly.</td></tr>
<tr><td colspan="3">To think about: For them to have greater recognition and appreciation of their mentor role could be an interesting key to utilize in order to feed their desire to act.</td></tr>
</table>

How to act		
Support needed and offered but could be improved.	They want learning devices allowing mentors to reflect and to analyze their practices.	They would benefit on the development of their personal resources and enrichment their knowledge and skills.
To think about: The necessity to enhance training offers to improve mobilization.		
Ability to act		
Least support offered.	They face the challenge of conciliation of the time allowed to their distinct roles.	They don't have access to time management support mechanism or measures.
To think about: To have the "full" ability to act, mentors need to do better and, to do it with others: to have enough time, to have a manageable workload, to have access to the relevant information, to evolve in a collaborative environment.		

Amongst the three main components of the model of competent action, desire to act seems to be the one element mentors need the least support with. The results demonstrate that mentors and ATs are strongly motivated to fulfill their role, intrinsically, which represents the strongest type of motivation (Le Boterf, 2011). The mentors are engaged in their role, they are volunteers, and their motivation is strong. For several authors, engaging freely and willingly in a mentorship process represents a high efficacy possibility and optimizes the possible positive results (Kane, Jones, Rottmann, & Pema, 2013; Lindgren, 2005). That being said, Le Boterf (2013) stresses that competency is a shared responsibility between the individual and their workplace: "This imperative of responsibility must not lead to a belief that the individual is the only one responsible for building their competencies. […] It is not enough to simply have potential to act competently; one must also have the tools" (p. 99). This is also true of the motivational mechanisms underpinning competent action, which are based, on the one hand, on the individual's personal motivation and, on the other, on their somewhat incentivizing context. Therefore, a greater recognition and appreciation of their mentor role could be an interesting key to utilize in order to feed their desire to act.

Regarding the *how to act*, it is possible to suggest a necessity to enhance training offers to improve mobilization. Based on Le Boterf, training—which helps to develop a person's resources and then enrich their knowledge and skills—is one of the key elements to consider fostering the *how to act.* This echoes the results of many other scientific studies who have been saying for several years that training is essential to ensure the success of mentorship programs (Duchesne & Kane, 2010; Stanulis et al., 2014).

Based on the results previously exposed, we can clearly see how training can be crucial in improving competence. However, it appears that mentors and ATs might not always have access to training. Also, even if the participants strongly support the need for more offers, they also confess not necessarily attending the training offered. On that matter, Gagné and Petit (2021) have already outlined the importance of an in-depth renewal of training for mentors. Action-research field studies await to optimize the support of mentors and measure the gain of the training. Building on the concepts of *médiatisation* and *médiation* (Charlier, Deschryver, & Peraya, 2006), authors suggest characteristics for a hybrid remote training offer that would respond to the mentors' needs in terms of interactions, to increase their sense of belonging, access resources and share experiences related to authentic mentoring experiences.

Le Boterf (2013) also believes that learning devices allowing mentors to reflect and to analyze their practices, like sharing group and professional learning community, can contribute to the development of the *how to act*. Indeed, following the training, the shared experiences lead to the development of the mentors' faculty to mobilize, to combine and to transpose their resources. For the mentors and ATs studied, if the training seems to encourage the development of their how to act when they can do so, the opportunities to share with others are nowhere to be seen even if they do represent a key which the organization should utilize to optimize the development of the mentors how to act.

As for the *ability to act*, it is clearly challenging for the participants to conciliate the time allowed to their distinct roles. They must choose between their own teaching practices and their mentorship role, which causes stress and resentment. Too few mechanisms exist to support time management in between the mentor and the mentee. In the process, to have the "full" ability to act, mentors need to do better and, to do it with others: to have enough time, to have a manageable workload, to have access to the relevant information, to evolve in a collaborative environment. Further research focusing on the perception of the management team regarding their role in the mentoring, would definitely be consistent with our findings.

6. CONCLUSION

While other studies have looked at mentors' competence, the two studies reported here provide new insights into this area. In fact, for the first time, the mentoring experience as lived by mentors was studied, thus providing a more complete picture of mentoring. The study of the mentors' experience in the light of Le Boterf's model of competent action, and the comparison of the results, is also a new element: the results discussed regarding both studies enabled the understanding of the keys allowing the support of the mentor's competency development, in different contexts, from different systems and from different expectations from their organization.

Based on these commonalities, **three main recommendations** emerged from the discussion process:

Informed mentors are better mentors. Schools, school boards, or VTC management teams should facilitate the access to resources and information regarding mentorship and the mentors' role. Mentors could be formally trained, and they could be provided with documentation detailing their role, as well as the institution's expectations towards them. They could be informed on the help they can expect or are entitled to receive daily. They could also share what their expectations are regarding the support they need to develop their competence. This aspect refers to all kinds of information and resources, including formal or informal training, co-working space, mentor meetings or sharing groups, etc.

Acknowledgment to aim for greater mentors. The supportive nature of the context and the environment within which mentors evolve is essential. It is imperative for them to be recognized and to be acknowledged for the extra work they do as mentors, as teachers who are putting the efforts to ensure their profession is well taught and well represented. The key is to combine diverse ways to make mentors feel valued: either by weekly encouragements from their superior, by allowing their schedule to be more flexible or to ensure they easily have access to the resources they need for their mentor's duties. Also, their role could be better promoted, and recruitment can then benefit from measure such as inviting current mentors (acknowledge their expertise!) to express how amazing being a mentor is to positively reflect on the mentor's role.

Becoming a competent mentor takes time. Firstly, it has been understood that mentor-mentee or any mentorship teams need to have the time to meet, to chat, to collaborate. Modalities need to be taken to allow mentors to think, to prepare, as a way of supporting their ability to act and, therefore, to develop their desire and how to act. Secondly, becoming a better mentor, developing competent action does not happen overnight. Mentors need to be supported for the long run, and understand that this is a process, where experience plays a vital role.

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AUTHORS' INFORMATION

Full name: Julie Courcy
Institutional affiliation: Université du Québec à Rimouski
Institutional address: 300, allée des Ursulines, C. P. 3300, succ. A, Rimouski (Québec) G5L 3A1 Canada
Short biographical sketch: Julie Courcy is a research professional and a PhD student at the Université du Québec à Rimouski. Her main scientific interests focus on teaching representations, academic pathways, and professional identity.

Full name: Nathalie Gagnon
Institutional affiliation: Université du Québec à Rimouski
Institutional address: 300, allée des Ursulines, C. P. 3300, succ. A, Rimouski (Québec) G5L 3A1 Canada
Short biographical sketch: Nathalie Gagnon is a professor in practical training in vocational education at Université du Québec à Rimouski. She is mainly interested in professional induction in teaching, support strategies for new teachers as well as teacher's competency and self-efficacy.

Full name: Andréanne Gagné
Institutional affiliation: Université de Sherbrooke
Institutional address: 2500, boul. de l'Université, Sherbrooke (Québec) J1K 2R1 Canada
Short biographical sketch: Andréanne Gagné is a professor in the Department of Pedagogy at the Université de Sherbrooke. She is responsible for practical training and internships in the bachelor's degree program in vocational education. Her current research program focuses on mentoring, construction of professional identity and the professional experience of VET teachers.

Chapter #12

EMERGENT LITERACY STIMULATION IN INITIAL YEARS OF LITERACY

Caroline Fernandes Brasil, Luana Baron Scollo, & Simone Aparecida Capellini
Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marilia, São Paulo, Brazil

ABSTRACT
This study focus on verify the educational efficacy of a stimulation program with emergent literacy practices with students in the initial literacy series. **Materials and Methods:** The study included 20 students from the 1st and 2nd year of Elementary School I of a municipal public school, of both sexes. The students were divided into two groups, with group I (GI) consisting of 10 students, aged 6 years to 6 years and 11 months, five 1st year students and five 2nd year students undergoing the training program. stimulation and group II (GII) consisting of 10 students, aged between 6 years and 6 years and 11 months, five 1st year students and five 2nd year students not subject to the stimulation program. The results revealed that GI students had better performance in skills considered predictive of reading development, such as copying shapes, dictating pictures, segmenting syllables, dictating words, repeating words, alliteration, rhyming, repeating numbers in reverse order and naming digits in order fast and automatic, while GII students also performed better in copying shapes, dictating figures and segmenting syllables.

Keywords: literacy, learning, reading, emergent literacy.

1. INTRODUCTION

Literacy is a social construction, mediated by language, therefore, it is characterized by being inseparable from cultural and linguistic practices, as well as power relations in specific contexts (Gillen & Hall, 2003). In this way, literacy is molded and developed in the individual due to the different experiences that will be established throughout life (Gomes & Lima Santos, 2004).

The promotion of literacy must occur very early, even in the period of Early Childhood Education and in the initial literacy grades, this is because, when addressed in the educational context, literacy takes on a new concept, the concept of emerging literacy, which is characterized by being a process based on experiences, practices and interactions with written language, which when positive, allow the development of speaking, reading and writing skills in the early years of literacy (Dougherty, 1999, Smith & Dickinson, 2002, Roskos, Christie & Richgels, 2003).

Unlike what happens with the development of oral language, which arises spontaneously as the growth and maturation of the central nervous system and interaction with the environment, the development of written language is the product of a deliberate effort, which requires academic instruction. gradual and systematic. It is in this context of difference between the development of oral language, which evolves naturally and implicitly, and the development of written language, which needs to be learned explicitly, that the acquisition and development of reading and writing presents itself. as a non-spontaneous

process and, therefore, susceptible to the occurrence of difficulties during the teaching-learning process (Gomes, 2001).

International studies have highlighted that academic, personal and even professional failure can result from these learning difficulties when there are low levels of literacy and emerging literacy (Darcovich, 2000, OECD, 2003, Gave, 2004, Resende & Figueiredo, 2018).

Literacy intervention should occur in Early Childhood Education, when literacy is treated in the educational context, it assumes a new concept, the concept of emergent literacy, which is characterized by being a process based on experiences, practices and happiness with written language, which when positive, allow the development of speaking, reading and writing skills in the Early Childhood Education period (Dougherty, 1999, Smith & Dickinson, 2002, Roskos, Christie & Richgels, 2003).

2. BACKGROUND

In the literature, there is a description of two theories that support the understanding of emergent literacy. The first theory developed by Whitehurst and Lonigan (1998) concerns the classification of emergent literacy and the second theory Sénéchal, Lefreve, Smith-Chant, and Coton (2001) describes the dimensions of emergent literacy.

According to Whitehurst and Lonigan (1998) emergent literacy can be classified into two domains, exterior-interior and interior-exterior. The outer-inner domain includes behaviors that encompass the child's knowledge about contextual factors in which reading and writing occur, for example, vocabulary, conceptual knowledge, and narrative schemes. The inner-outer domain considers children's knowledge about the rules of correspondence between the writing system and its sounds, for example, this dimension includes knowledge about the names of letters and sounds, spelling ability, syntactic and phonological awareness.

Sénéchal et al. (2001) described a different conception of the concept of emergent literacy proposed by Whitehurst and Lonigan (1998). For Sénéchal et al. (2001) there are two dimensions, the first being conceptual knowledge and the second being procedural knowledge. Conceptual knowledge is the child's knowledge about the functions of writing and perception of themselves as a reader. Procedural knowledge is the child's knowledge of the mechanisms of reading and writing, for example, knowing the name and sound of letters.

Despite these two different conceptions, both authors consider that emergent literacy develops the child's knowledge about the mechanisms of reading and writing, as the name and sound of letters.

Unfortunately, emergent literacy practices are not carried out in the context of classrooms in Brazil and, therefore, it is not possible to know for sure which of the strategies foreseen in emergent literacy stimulation are used by the teacher with students at the beginning of literacy.

With the advent of the COVID-19 pandemic, social isolation was imposed as a measure to prevent and mitigate the virus and, among these measures, the suspension of in-person classes and remote teaching, therefore, the experience of Brazilian schoolchildren in the first two initial years of literacy were carried out remotely and, due to social and educational discrepancies, we know that this teaching was not carried out in an equal or homogeneous way among the students public and private education systems (Camacho, Joaquim, Menezes, & SantÁnna, 2020).

Due to this pandemic situation, we are aware that emerging literacy was not properly experienced by students in the 1st and 2nd year of literacy, therefore, this study aimed to verify the educational effectiveness of the stimulation program with emergent literacy practices in students in the initial literacy phase.

3. OBJECTIVES

This study aimed to verify the educational efficacy of the stimulation program with emergent literacy practices with students in the 1st and 2nd year of Elementary School I.

4. METHODS

4.1. Participants

This study was approved by the Research Ethics Committee of the University (4.862.668). This is a prospective cross-sectional cohort study, consisting of a convenience sample. The study included 20 students aged 6 to 7 years and 11 months from the 1st and 2nd years of Elementary School I of a Brazilian municipal public school with lower-middle socioeconomic status, distributed in:

Group I (GI): 10 students, of both genders, aged between 6 years and 7 years and 11 months, with five students from the 1st year and five students from the 2nd year submitted to the stimulation program.

Group II(GII): 10 students, of both sexes, aged between 6 years and 7 years and 11 months, five of which were in the 1st year and five in the 2nd year not submitted to the stimulation program.

4.2. Materials and Procedures

All students in this study were submitted the Cognitive-Linguistic Skills Assessment Protocol for Students in the Initial Literacy Phase (Silva & Capellini, 2019) in a pre and post-testing situation for the application of the Emerging Literacy Practice Stimulation Program. The stimulation program consisted of 8 books from the Stories Collection for the Development of Rhyme and Alliteration (César, Santos & Capellini, 2019).

The choice of this book collection is because it offers the stimulation of reading skills associated with the ability to rhyme, alliterate and knowledge of writing through facilitating factors for the development of reading and writing, as proposed by Ellis (1995) and Alves (2012):

- Lexicality: words belonging to children's vocabulary that will allow quick understanding of lexical vocabulary, including words that rhyme;
- Frequency: increased frequency of occurrence of written words that favor the development of orthographic lexical memory;
- Regularity: offering written words with a regular syllabic structure to favor the mastery of direct letter-sound knowledge and, successively, offering written words with greater complexity of syllabic structure for the development of orthographic lexical memory of irregular words for the conversion mechanism letter-sound.

Each session was held in a group composed of 5 students, once a week at the end of the school shift, as authorized by the school board to carry out this study. The stimulation time with each group was 40 minutes. In total, each group was exposed to 8 stimulation sessions, once a week.

After completing the eight sessions of the Emergent Literacy Practice Stimulation Program, all students were once again subjected to the application of the Cognitive-Linguistic Skills Assessment Protocol for Students in the Initial Literacy Phase (Silva & Capellini, 2019) to verify the educational effectiveness of the program carried out.

The results were statistically analyzed using Cochran's 'Q' Statistical Test, in order to compare the results of the pre- and post-application of the Emerging Literacy Practices Stimulation Program. The IBM SPSS Statistics (Statistical Package for the Social Sciences) program, version 25.0, was used to obtain and analyze the results and verify the educational effectiveness of the systematized program. Statistically significant data were marked with an asterisk in the tables.

5. RESULTS

Table 1 presents the comparison between the performance of students from GI and GII in the subtests of the Cognitive-Linguistic Skills Assessment Protocol for Students in the Initial Literacy Phase (Silva & Capellini, 2019) in a pre- and post-test situation.

Table 1.
Performance of Students in the Cognitive-Linguistic Skills Assessment Protocol pre and post stimulation program of literacy.

SUBTESTS	Categories	GROUPS I Freq.	I Perc.	I Sig. (p)	II Freq.	II Perc.	II P value
EDNPRE	1	0	0,00%	> 0,999	2	20,00%	0,317
	2	6	60,00%		4	40,00%	
	3	4	40,00%		4	40,00%	
EDNPOS	1	0	0,00%		1	10,00%	
	2	6	60,00%		4	40,00%	
	3	4	40,00%		5	50,00%	
EASPRE	0	1	10,00%	0,102	1	10,00%	0,180
	1	1	10,00%		1	10,00%	
	2	1	10,00%		0	0,00%	
	3	7	70,00%		8	80,00%	
EASPOS	2	1	10,00%		2	20,00%	
	3	9	90,00%		8	80,00%	
CFPRE	1	3	30,00%	0,034*	2	20,00%	0,046*
	2	7	70,00%		7	70,00%	
	3	0	0,00%		1	10,00%	
CFPOS	1	0	0,00%		1	10,00%	
	2	7	70,00%		5	50,00%	
	3	3	30,00%		4	40,00%	
DPPRE	0	4	40,00%	0,034*	2	20,00%	0,180
	1	2	20,00%		3	30,00%	
	2	3	30,00%		4	40,00%	
	3	1	10,00%		1	10,00%	
DPPOS	0	3	30,00%		2	20,00%	
	1	0	0,00%		2	20,00%	
	2	3	30,00%		3	30,00%	
	3	4	40,00%		3	30,00%	
DPPPRE	0	4	40,00%	0,066	2	20,00%	0,034*
	1	2	20,00%		5	50,00%	
	2	3	30,00%		2	20,00%	
	3	1	10,00%		1	10,00%	
DPPPOS	0	3	30,00%		2	20,00%	
	1	0	0,00%		2	20,00%	
	2	3	30,00%		2	20,00%	
	3	4	40,00%		4	40,00%	
DFPRE	0	4	40,00%	0,034*	2	20,00%	0,023*
	1	0	0,00%		3	30,00%	
	2	4	40,00%		4	40,00%	
	3	2	20,00%		1	10,00%	
DFPOS	0	3	30,00%		2	20,00%	
	2	0	0,00%		2	20,00%	
	3	7	70,00%		6	60,00%	
DN PRE	1	1	10,00%	0,317	3	30,00%	> 0,999
	2	5	50,00%		3	30,00%	
	3	4	40,00%		4	40,00%	
DN POS	1	2	20,00%		3	30,00%	
	2	4	40,00%		3	30,00%	
	3	4	40,00%		4	40,00%	
RASPRE	3	10	100,00%	> 0,999	10	100,00%	> 0,999
RASPOS	3	10	100,00%		10	100,00%	
RAOAPRE	2	0	0,00%	> 0,999	1	10,00%	0,317

SUBTESTS	Categories	GROUPS I Freq.	I Perc.	I Sig. (p)	II Freq.	II Perc.	II P value
	3	10	100,00%		9	90,00%	
RAOAPOS	3	10	100,00%		10	100,00%	
LPPRE	0	6	60,00%		6	60,00%	
	1	1	10,00%		0	0,00%	
	3	3	30,00%		4	40,00%	
LPPOS	0	3	30,00%	0,063	3	30,00%	0,083
	1	1	10,00%		3	30,00%	
	2	1	10,00%		0	0,00%	
	3	5	50,00%		4	40,00%	
LPPPRE	0	6	60,00%		6	60,00%	
	1	0	0,00%		1	10,00%	
	2	1	10,00%		0	0,00%	
	3	3	30,00%	0,083	3	30,00%	0,083
LPPPOS	0	3	30,00%		3	30,00%	
	1	0	0,00%		4	40,00%	
	2	1	10,00%		0	0,00%	
	3	6	60,00%		3	30,00%	
RPRE	0	1	10,00%		2	20,00%	
	1	1	10,00%		0	0,00%	
	2	7	70,00%		7	70,00%	
	3	1	10,00%	0,008*	1	10,00%	0,102
RPOS	1	0	0,00%		1	10,00%	
	2	2	20,00%		7	70,00%	
	3	8	80,00%		2	20,00%	
APRE	0	4	40,00%	0,004*	5	50,00%	0,063

SUBTESTS	Categories	GROUPS I Freq.	I Perc.	I Sig. (p)	II Freq.	II Perc.	II P value
	1	1	10,00%		1	10,00%	
	2	5	50,00%		2	20,00%	
	3	0	0,00%		2	20,00%	
APÓS	0	0	0,00%		1	10,00%	
	1	1	10,00%		3	30,00%	
	2	3	30,00%		4	40,00%	
	3	6	60,00%		2	20,00%	
SSPRE	0	2	20,00%		3	30,00%	
	1	0	0,00%		1	10,00%	
	2	4	40,00%		3	30,00%	
	3	4	40,00%	0,024*	3	30,00%	0,038*
SSPOS	1	0	0,00%		1	10,00%	
	2	1	10,00%		3	30,00%	
	3	9	90,00%		6	60,00%	
DSPRE	0	2	20,00%		2	20,00%	
	1	1	10,00%		0	0,00%	
	2	2	20,00%		5	50,00%	
	3	5	50,00%	0,102	3	30,00%	0,083
DSPOS	1	0	0,00%		2	20,00%	
	2	3	30,00%		4	40,00%	
	3	7	70,00%		4	40,00%	
RPPRE	0	0	0,00%		1	10,00%	
	1	2	20,00%	0,025*	0	0,00%	0,157
	2	5	50,00%		5	50,00%	
	3	3	30,00%		4	40,00%	

SUBTESTS	Categories	GROUPS I Freq.	I Perc.	I Sig. (p)	II Freq.	II Perc.	II P value
RPPOS	1	1	10,00%		1	10,00%	
	2	2	20,00%		4	40,00%	
	3	7	70,00%		5	50,00%	
RNPPRE	0	0	0,00%		1	10,00%	
	1	1	10,00%		0	0,00%	
	2	2	20,00%		1	10,00%	
	3	7	70,00%	0,157	8	80,00%	0,317
RNPPOS	1	0	0,00%		1	10,00%	
	2	2	20,00%		1	10,00%	
	3	8	80,00%		8	80,00%	
RNOIPRE	0	1	10,00%		4	40,00%	
	1	5	50,00%		4	40,00%	
	2	2	20,00%		2	20,00%	
	3	2	20,00%	0,025*	0	0,00%	0,034*
RNOIPOS	1	2	20,00%		7	70,00%	
	2	6	60,00%		2	20,00%	
	3	2	20,00%		1	10,00%	
RANFPRE	0	0	0,00%	0,102	1	10,00%	0,059
	1	2	20,00%		3	30,00%	

SUBTESTS	Categories	GROUPS I Freq.	I Perc.	I Sig. (p)	II Freq.	II Perc.	II P value
	2	5	50,00%		3	30,00%	
	3	3	30,00%		3	30,00%	
RANFPOS	1	1	10,00%		3	30,00%	
	2	3	30,00%		1	10,00%	
	3	6	60,00%		6	60,00%	
RANDPRE	1	5	50,00%		6	60,00%	
	2	4	40,00%		4	40,00%	
	3	1	10,00%	0,025*	0	0,00%	0,059
RANDPOS	1	3	30,00%		3	30,00%	
	2	3	30,00%		5	50,00%	
	3	4	40,00%		2	20,00%	
MVFPRE	1	3	30,00%		3	30,00%	
	2	4	40,00%		4	40,00%	
	3	3	30,00%	0,102	3	30,00%	0,157
MVFPOS	1	0	0,00%		2	20,00%	
	2	6	60,00%		4	40,00%	
	3	4	40,00%		4	40,00%	

6. FUTURE RESEARCH DIRECTIONS

The number of subjects in this study was small, which may be a limiting factor for the generalization of its findings, however, this is one of the first Brazilian studies with emergent literacy, which in this way may contribute to the need to discuss these practices in classroom.

The analysis of the results, both from GI and GII, reveals that some emergent literacy skills are developed in the classroom, even if Brazilian teachers do not make a direct relationship with the predictors for literacy or with emergent literacy, revealing that these skills are intuitively stimulated in the classroom context. However, this study revealed that not all emergent literacy skills are systematically stimulated in the classroom, especially those that have an impact on reading development, such as use of the letter-sound conversion mechanism, important mechanism to development of reading highlighting the need for teacher training studies to discuss emerging literacy practices in the classroom.

7. DISCUSSION AND CONCLUSIONS

The data from this study revealed that GI students submitted to the stimulation program with emergent literacy showed better performance in skills considered predictors for the development of reading, such as copying shapes, dictating pictures, segmenting syllables, dictating words, repeating words, alliteration, rhyme, repeating numbers in reverse order, and fast auto naming of digits.

The fact that the students in GI showed improvement in metaphonological skills (rhyme, alliteration, and syllabic segmentation) is coherent because the focus of the stimulation program was precisely to develop skills related to the proper use of the letter-sound conversion mechanism, thus developing the phonological pathway for reading development; this is because the choice of stories used for the program contained facilitating factors for reading and writing development (Ellis, 1995; Alves, 2012).

Metaphonological skills, phonological working memory and speed of access to the mental lexicon, also called phonological processing skills, are considered predictors for the development of the alphabetic principle, since they are considered central phonological mechanisms in the acquisition of reading and writing (De Jong & Van der Leij, 1999; Dougherty, 1999, Smith & Dickinson, 2002, Roskos et al., 2003).

Tasks that involve the stimulation of visual-motor perception, such as copying shapes, rapid fusion in succession of stimuli, such as syllabic segmentation, dictation and word repetition, metaphonological skills, such as rhyme, alliteration and syllabic segmentation, phonological working memory , such as the repetition of digits in reverse order and speed of access to the mental lexicon such as rapid automatic naming of digits, are necessary for learning to read as they involve both the perception of details of the letter's layout, and the auditory perception of ordering temporal of the acoustic stimuli that will be converted into letters and, both perceptions help in the development of the letter-sound conversion mechanism necessary for reading in an alphabetic writing system, such as Brazilian Portuguese (Silva & Capellini, 2019).

However, among the students from the GII, also showed better performance in skills considered predictors for the development of reading, such as copying shapes, dictating pictures, and segmenting syllables, showing that the students' improvement of GI in these skills cannot be attributed to the program, since the school also offered educational strategies in the classroom that enabled students to develop these skills.

The fact that there were no statistically significant levels in the reading subtests or in the other subtests of the protocol used for assessment at both moments of the study does not invalidate the importance of these findings. On the contrary, it reinforces the need to carry out new studies with a greater offer of stimulation with emerging literacy, to verify the occurrence of changes in performance in cognitive-linguistic skills of students in the initial phase of literacy because of more frequent stimulation. and with a longer duration of the proposed activities.

The study also highlights more than an educational problem, since the COVID-19 pandemic resulted in the blocking of access to school and increased a gap in the exposure of the little ones to emergent literacy practices in Early Childhood Education, reconfiguring the education system, society and consequently demonstrating that speech-language pathology professional, both from a clinical and educational perspective, is necessary, mainly to combine the areas of Education and Health. From the results of this study, we concluded that GI students submitted to the emerging literacy stimulation program showed better performance in skills considered predictive of reading development, such as copying shapes, dictating figures, segmenting syllables, dictating words, repeating words, alliteration, rhyme, repetition of numbers in reverse order and rapid automatic naming of digits.

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AUTHORS' INFORMATION

Full name: Caroline Fernandes Brasil
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Institutional address: São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Biographical sketch: Graduate Student in Education, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.

Full name: Luana Baron Scollo
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Institutional address: São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Biographical sketch: Master in Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.

Full name: Simone Aparecida Capellini
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Institutional address: São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Biographical sketch: Full Professor at Speech and Hearing Sciences Department, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.

Section 2
Projects and Trends

Chapter #13

ABELIAN GROUPS AND WHAT STUDENT TEACHERS SHOULD LEARN FOR TEACHING ALGEBRA

Natalia Karlsson & Wiggo Kilborn
Department of Pedagogy and Didactics, Södertörn University, Huddinge, Stockholm, Sweden
Faculty of Education, University of Gothenburg, Gothenburg, Sweden

ABSTRACT
The purpose of this didactic project is to analyze a current research question, namely how student teachers' knowledge of *Abelian groups* contributes to their understanding of an essential aspect of teaching algebraic concepts by extending numbers and arithmetic operations. The theoretical approaches employed are *Subject Matter Knowledge*, and the choice of algebraic content with focus on students' learning of algebra. Discussions about the *Subject Matter Knowledge* model related to teacher students' learning of algebra in the context of knowledge for teaching are crucial domains for the outcome of this chapter and the research questions. In this chapter a central content is a conceptualization of *Common Content Knowledge* (CCK) related to the algebraic content of the Abelian groups, and its conceptual transformation into *Specialized Content Knowledge* (SCK) for teaching of algebra. Conceptual findings illustrate theoretically the conceptual transformation as interplay between CCK and SCK within the SMK model. This study can contribute with new knowledge about professionally specific mathematic knowledge for teaching algebra. The outcome of this theoretical research work is a follow-up of an earlier research project, namely *Mathematics in teacher education:* S*tudent teachers' knowledge of and perceptions of mathematics*.

Keywords: Abelian group, pre-service teacher, subject matter knowledge, teaching algebra, learning for teaching.

1. INTRODUCTION

The purpose of mathematics teaching is to plan and carry out activities that enable the student to construct and generalize mathematical concepts. For students to successfully learn mathematics, certain crucial aspects and properties of a concept must be varied, while others must remain constant (Davydov, 1990). From a teacher's point of view, this requires a good overview of and insight into the current content, as well as opportunities to identify students' multifaced perceptions of an actual concept. If not, it will be difficult for the teacher to present content that enables the student to find the essence of the concept nor to offer a relevant variation. This is not an easy task for teachers since there is a concurrent ambition to reach a certain level of quality in teaching able to produce long-run effects on students' development of mathematics knowledge (Adler & Sfard, 2016).

This complexity also requires the transformation of formal mathematical concepts to a level that enables students to learn. From a teacher's point of view, this requires a good overview of and insight into the actual content, and an ability to break down the content based on students' individual perceptions of the actual concept. This means that teachers' knowledge of mathematics with focus on content and teachers' subject matter knowledge (Ball & Hill, 2008) include qualitative dimensions. Banner and Cannon (1997) describe, "in order to teach, teachers must know what they teach, and how to teach it; and in order to

teach effectively, they must know it deeply and well" (p.7). Other researchers, like Shulman (1986), Ma (2020) and Hill, Rowan, and Ball (2005), have also confirmed the importance of teachers' theoretical and practical competencies for teaching of mathematics. In addition, Ball and Bass (2000) believe that neither the lack of teacher knowledge about mathematical content nor the lack of subject knowledge can be compensated by practical experience. This means that today's teacher education should aim to prepare student teachers in mathematics in such a way that they are able to teach a form of mathematics that favors students' mathematical development.

Mathematics is an abstract and general science for problem solving and method development. The simple addition of $2 + 1 = 3$ is essentially a breathtaking abstraction that applies not only to marbles and apples, but also to hours and days. The abstract nature of mathematics poses a great challenge for teachers to adapt teaching to different students' abilities to think abstractly and absorb the content. To enable this, teacher education should focus on the development of student teachers' own knowledge of mathematics, as well as how this can be transferred into teaching in terms of how different students learn mathematics at different ages (Hill, Ball, & Schilling; 2008).

Mathematics is also part of a cultural heritage and an important tool for perceiving and developing the increasingly complicated world around us. Therefore, a primary aim of teacher education in mathematics is to provide a perspective that is characterized by both mathematics as science and how this can be implemented in school related to students' learning. This means that teacher education should focus both on the development of student teachers' subject-specific knowledge of mathematics and knowledge for teaching in terms of how students learn mathematics at different ages with focus on continuity of learning (Hill et al., 2008). This applies not least to how they can present mathematics in a well-structured way, based on its concrete origins. The goal is for the student teachers to perceive the importance of conceptual sequence in the progression of learning and what students learn during their first years of school, in the long run, gradually will be generalized in the direction of the academic subject of mathematics (Subramaniam, 2019). This implies that the mathematics taught during the first years of schooling must be a preliminary and simplified form of mathematics accessible to all students, but at the same time must be based on sustainable and developable mathematical concepts and methods. Accessibility also deals with student teachers' ability to find continuity in students' learning from pre-school to the 9^{th} grade and onwards. This means that students must successively learn the internal structures of the concepts as essential properties, which in turn, must be generalized with the aim of understanding the significance of the concepts and their connections and relationships to other concepts. To perceive and follow such a learning process in students' learning requires student teachers to be able to process and produce knowledge in their own learning. In other words, they must be able to take a second-order perspective on students' learning, which is intimately related to a first-order perspective on their own learning of mathematics (Leatham, 2006). This is a matter of solid self-awareness of how knowledge is perceived and developed, and the misconceptions that may arise in learning. Students' misconceptions of mathematical concepts and methods can, like incorrect generalizations during earlier school years, cause serious consequences when students reach secondary school. Promoting students' learning of mathematics and perceiving, and correcting their misconceptions requires student teachers not only have solid knowledge of the mathematics they teach, but also of how it could be apprehended by different students in practical teaching.

This complexity also requires a transformation of formal mathematical concepts to a level that enables student teachers to learn. From this point of view, it requires a good overview of and insight into the actual content, and an ability to break down the content, thus, taking student teachers' individual perceptions of the actual concept into account (Askew, 2008). This means that today's teacher education should aim to prepare student teachers in such a way that they are able to teach a form of mathematics that supports the long-term and sustainable development of students' knowledge. Against this background, it is important to know that the student teachers' perceptions and experiences of mathematics often emanate from their own studies of mathematics in primary and secondary school. According to Pajares (1992), such a background often forms a filter through which they apprehend new ideas. This is often crucial for the student teachers' ability to change their understanding of mathematics and assimilate didactics of mathematics in teacher education. The same aspects are problematized by researchers such as Radovic, Black, Williams, and Salas (2018).

2. BACKGROUND

In this chapter, the results of two ongoing theoretical research studies are presented, namely *Teacher students' knowledge of and perceptions of mathematics* (SKUM) and *Mathematics in Teacher Education* (MIL) (Karlsson, 2015). This is followed up with studies on how teachers in different grades teach multiplication, rational numbers, and proportionality, as well as how students in different grades perceive these concepts and how they use them in problem solving (Karlsson & Kilborn, 2018; Klang, Karlsson, Kilborn, Eriksson, & Karlberg, 2021).

These empirical studies identified a need to reconstruct current Teacher Education of mathematics with particular focus on mathematical contexts in order to strengthen student teachers' knowledge about teaching mathematics. Moreover, there is a need to reinforce student teachers' ability to build and analyze mathematical content in their teaching and to carry out sequencing of the content, which can provide development and continuity in students' learning.

The purpose of this theoretical study is to analyze what mathematics in teacher education really means (the SMK model), and how interplay between Common Content Knowledge (CCK) and Specialized Content Knowledge (SCK) within the SMK model can be constructed theoretically. There is a certain focus on student teachers' knowledge of mathematical contents, necessary for the sustainable development of students' mathematical knowledge in elementary school. Consequently, there is a particular focus on basic algebra.

Research questions in this theoretical-analytical study are:

(RQ1) What kind of mathematics, specifically algebra, should student teachers learn in relation to the *Subject Matter Knowledge* model?

(RQ2) How can the subject-specific context of Abelian groups (common mathematical knowledge, CCK) provide conceptual support for student teachers to understand essential points for teaching algebra, *Specialized Content Knowledge*, (SCK)?

3. THEORETICAL FRAMEWORK: A PRACTICE-BASED MODEL OF SUBJECT MATTER KNOWLEDGE FOR TEACHING

Over the years, several researchers have claimed that teachers' knowledge of mathematics and knowledge of teaching are not sufficient to develop students' learning of mathematics. This led to a need for a "practice-based" theory called *Subject Matter Knowledge* (SMK) (Shulman, 1986; Ball, Hill, & Bass, 2005). This theory forms a basis for what mathematics teachers should be able to teach. According to Ball, Thames, and Phelps (2008), and Hill et al, (2008), the SMK model is divided into three areas, namely *Common Content Knowledge* (CCK), *Specialized Content Knowledge* (SCK) and *Horizon Content Knowledge* (HCK).

Ball et al. (2008) emphasizes that teachers' CCK is a necessary factor for teaching, but it requires an interaction with SCK. One interpretation of this is that CCK is about the student's perspective of the content, while SCK is about the teacher's perspective of the same content. SCK is a prerequisite for keeping focus on the "learning object" and offering a suitable variation of the content, from lower to higher levels of difficulty. At the same time, it is important to be aware that mathematics taught in the earlier school years is often based on preliminary concepts that will gradually be developed into more correct mathematical concepts. This means that it is not enough for teachers to solely understand the mathematics they teach. They also need to understand it in such a way that the content can be unpacked and developed during later school years. This place demands on teachers' ability to summarize the progression of students' learning from year 1 and onward in order to ensure progression in teaching, which in turn, leads to a need for knowledge in HCK, including knowledge of the curriculum in mathematics. Consequently, HCK is about seeing mathematics from a wider perspective, not least in how the mathematics taught to younger children is connected to teaching at later stages and vice versa. It is also about how basic mathematical patterns (structures) permeate mathematics at all stages.

In this theoretical review, there is a focus on Common Content Knowledge as a prerequisite for understanding Specialized Content Knowledge for teaching mathematics. The analytical transformation of CCK content to SCK is a crucial in this chapter.

3.1. Algebra and Student Teachers Learning for Teaching: Why Algebra?

An important part of teacher training is that student teachers develop algebraic reasoning based on generalized mathematical ideas linked to algebraic concepts. This applies particularly to concepts that constitute the basis of modern algebra and the conceptual relationships between: (1) algebra and the generalization of arithmetic; (2) algebra and patterns; (3) algebra and mathematical models; and (4) the meaning of mathematical symbols (Kaput, 2008). To help students to make such generalizations of arithmetic and understand algebraic content, it is necessary for the student teacher to be provided with sufficient knowledge of algebra to understand relationships between arithmetic and algebra, and how an extension of arithmetic into algebra works in a conceptual sense, before they start to teach algebra (Kieran, 2004). Student teachers' ability to teach algebra depends on their own theoretical conceptual knowledge of algebra. This means that student teachers need to take a teacher's perspective on students' learning to achieve continuity in, and the planned expansion of, algebra in students' learning. This includes conceptual relationships between different number ranges from natural numbers to real numbers, for example, how the basic laws of arithmetic also apply to negative numbers, rational numbers, and real numbers, even if the operations themselves need to be

modified. In order to understand negative numbers and rational numbers, it is also important to understand subtraction as the inverse operation of addition, and division as the inverse operation of multiplication. To help students to make such generalizations, it is necessary for the student teachers to be provided with sufficient knowledge of algebra for understanding how an extension of arithmetic in a conceptual sense works, before they start to teach such content (Kieran, 2004). This is also a matter of how students can learn algebra by working informally with natural numbers and rules of arithmetic during younger grades, but in such a way that they will later be able to apply these to whole, rational and real numbers. To understand these generalization processes, the student teachers need meta-knowledge of algebra and an ability to apply this knowledge in the teaching of algebra.

This study draws attention to the interplay between the conceptual sense of algebra (definitions of concepts) as common content knowledge (CCK) and its connection to specialized content knowledge (SCK) in the SMK model. In international research, it becomes evident that in SMK very important factor is given to mathematical structures (mathematical concepts) and the interplay between teacher student conceptual knowledge of fundamental mathematics, and how this knowledge can be used in teaching (Carrillo-Yañez et al., 2018). In Swedish teacher education, the conceptual connection between these two types of knowledge often has a weak character. A reason for this is that mathematics and didactics of mathematics are two different academical disciplines, and the interdisciplinary collaboration between them is insufficient (Bergsten & Grevholm, 2004). In the next chapter, we will illustrate how transformations from fundamental mathematical concepts into teaching can help student teachers to understand mathematics for teaching as well as how this can provide continuity in students' learning of mathematics in a conceptual way. This is a very important aspect of students' learning because their ability to generalize arithmetic into algebra is directly connected to teaching. Moreover, students' individual ability to adapt what is taught relies on teachers' use of correct mathematical structures (concepts). If not, inconsistencies will gradually arise in students' conceptual thinking. A reliable way to avoid this in teacher education is to re-insure the teaching content in basic algebra.

4. KNOWLEDGE FOR TEACHING

4.1. The Abelian Group for Addition

Basic arithmetic assumes two Abelian groups (van der Waerden, 1971), one for addition and one for multiplication (CCK). A group consists of a set, for example, whole numbers, and an operation, such as addition.

The following conditions apply to addition as *Abelian group for addition*.

- For all a and b in the group, the sum $a + b$ also belongs to the group. The group is said to be closed under addition.
- For all a and b in the group, $a + b = b + a$. This is the commutative law.
- For all a, b, and c in the group, $(a + b) + c = a + (b + c)$. This is the associative law.
- There is a neutral element 0 such that $a + 0 = a$ for all a in the group.
- For all a in the group there is an element $(-a)$ in the group such that $a + (-a) = (-a) + a = 0$. Here $(-a)$ is called the (additive) inverse of a and vice versa.

4.1.1. The Abelian Group for Addition and Knowledge for Teaching Addition, its Inverse Subtraction, and Negative Numbers

Understanding of the Abelian group for addition gives student teachers' a key to algebraic ideas and logic. It also gives them an understanding of conceptual algebra and the algebraic content students should learn gradually, which is decisive when introducing algebra as a concept and the essential characteristics of algebra (Karlsson & Kilborn, 2014).

Conceptual finding 1. Addition operation

A closer analysis of the Abelian group for addition shows that the first three points give information about which operations can be performed in addition and how an addition algorithm can be built. This provides important knowledge of what content the teaching should include, with a focus on what students should learn about algebra. Concerning the natural numbers, these three points are known to younger students at an early stage, at least informally.

Conceptual finding 2. Subtraction as the inverse of addition

To progress and understand subtraction as well as how to work with negative numbers, the last two points become important. For every natural number, such as 4, there is an inverse (opposite) number (-4). In this way, negative numbers and subtraction of whole numbers are defined. The subtraction $a - b$ can, for example, be defined as $a + (-b)$. In this way, not only can the negative numbers be defined, but also rules for subtraction of whole numbers. For example, the subtraction $a - b$ can be defined as $a + (-b)$. Based on this, it is easy to explain why $a - (-b) = a + b$. (Notice that b is the inverse of (-b)). Simply stating procedurally that "same signs give plus, and different signs give minus" does not lead to any developable knowledge. Moreover, the two minus signs have completely different meanings, they just look similar.

4.2. The Abelian Group for Multiplication

There is another *Abelian group for multiplication* (van der Waerden, 1971), related to CCK.

- For all a and b in the group, the product $a \cdot b$ also belongs to the group. The group is said to be closed under multiplication.
- For all a and b in the group, $a \cdot b = b \cdot a$. This is the commutative law.
- For all a, b, and c in the group, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$. This is the associative law.
- There is a neutral element 1 such that $a \cdot 1 = a$ for all a in the group.
- For all a in the group (provided that $a \neq 0$), there is an element $\frac{1}{a}$ such that $a \cdot \frac{1}{a} = 1$. $\frac{1}{a}$ is called the (multiplicative) inverse of a and vice versa.

4.2.1. The Abelian Group for Multiplication and Knowledge for Teaching Multiplication, its Inverse Division, and Rational Numbers

Conceptual finding 1. Multiplication operation and the basic law of algebra

As with addition, the first three points of the Abelian group for multiplication are already known by younger students, at least informally, concerning natural numbers. However, they need to learn of the structure and properties of multiplication in the conceptual way.

By studying the definition of the group for multiplication, the student teachers can also realize the risks with a one-sided definition of multiplication as repeated addition.

Multiplication is a two-dimensional operation, whereas addition is just one-dimensional. The commutative and associative laws of multiplication are, for example, difficult to derive from repeated addition because of its one-dimensional nature.

To link addition to multiplication, there is a distributive law: $a \cdot (b + c) = a \cdot b + a \cdot c$. An analysis of the definition of multiplication will help the student teachers to understand that multiplication is an arithmetic operation with special properties. The student teachers can also understand the importance of the distributive law, not only to explain how the multiplication algorithm is structured but also its important role in mental arithmetic. For example, $4 \cdot 48 = 4 \cdot (50 - 2) = 200 - 8 = 192$.

Conceptual finding 2. Inverse

The last two points in the definition of Abelian group for multiplication deal with the inverse (reversed) operation of multiplication (Vergnaud, 1983; 1994). With help of the inverse, the student teachers can understand an important property of multiplication, namely by starting from the natural numbers, they can not only define the rule of division of $a \div b$ as $a \cdot \frac{1}{b}$, but also the basic fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$,… At the same time, the meaning of the multiplication operation must be redefined when the set of numbers is extended from natural numbers to whole numbers, and to rational numbers. To understand this, and thereby create continuity in teaching, it is important that student teachers at all stages study basic algebraic concepts.

Conceptual finding 3. Rational numbers

The inverse operation provide understanding of how algorithms for multiplication and division are structured, as well as basic rules for mental arithmetic. The rules apply not only to natural numbers and whole numbers but also to rational numbers. Notice that for every natural number, such as 4, there is an inverse $\frac{1}{4}$ such as $4 \cdot \frac{1}{4}$, = 1. In this way, not only can fractions be defined, but also division as the inverse of multiplication. By using the inverse, the division $6 \div 4$ can be defined as $6 \cdot \frac{1}{4}$, and the division $\frac{2}{3} \div \frac{4}{5}$ as $\frac{2}{3} \cdot \frac{5}{4}$.

5. FUTURE RESEARCH DIRECTIONS

The findings of the research study draw attention connection between fundamental mathematics and mathematics didactics in the teacher education This is necessary to develop research and implement with focus on student teachers learning for teaching of algebra. This research has opened opportunities for further studies about teaching practice related to learning of subject-specific content, where connections to fundamental mathematics can be used for designing of courses in mathematics didactics for future mathematics teachers. This, in turn, can be the start of a life-long development of teachers' mathematical competences.

This analytical research indicates that student teachers' own knowledge of mathematics and algebra (CCK) is key to their understanding of the content in teaching and what is meant by continuity in and sequencing of the content in mathematics teaching. This means that without an understanding of the conceptual sense of mathematical concepts within algebra (fundamental mathematics), it is impossible to adequately teach algebraic concepts and help students to expand arithmetic into algebra as a path from operations in different number ranges into operations in symbolic form.

6. CONCLUSION/DISCUSSION

An important part of teacher education is a clear definition within the SMK model of what is meant by common content knowledge (CCK) and knowledge for teaching (SCK). It is a key for teacher students to understand the crucial role of their knowledge of mathematics, what is meant by conceptual knowledge, as well as the interplay of conceptual relationships between the concept and different parts of mathematics. This should rely on correct and sustainable algebra like the Abelian groups and how to introduce arithmetic operations within a conceptual algebraic context. This study presents Abelian groups as an important part of modern algebra regarding student teachers' conceptual knowledge of mathematics and how this knowledge can be applied in teaching. There is also an analysis of what mathematics in teacher training can mean in relation to mathematics didactic research, such as the SMK model, and how an interaction between formal mathematics and school mathematics with a focus on algebra can be achieved. Against this background, the student teachers can be offered mathematical content that can be transformed into teaching practice and, in the long run, benefit their future students.

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AUTHORS' INFORMATION

Full name: Natalia Karlsson
Institutional affiliation: Södertörn University
Institutional address: School of Teacher Education, Department of Pedagogy and Didactics, Alfred Nobels allé 7, 141 89 Huddinge, Stockholm, Sweden.
Email address: natalia.karlsson@sh.se
Background in brief: Natalia Karlsson is an Associate Professor of Mathematics at Södertörn University, Sweden. Her qualifications include a Master's degree in Mathematics, a Master's degree in Education, and a PhD in Mathematics and Physics. Her research areas are mathematics education and applied mathematics. Her areas of expertise in the field of mathematics education are mathematical content in teaching and students' learning of mathematics. Her research has a focus on developing theoretical and methodological approaches to teaching, crucial mathematical content, and the variation of and the relationships between the teaching and learning of mathematics.

Full name: Wiggo Kilborn
Institutional affiliation: Faculty of Education, University of Gothenburg
Institutional address: Läroverksgatan 15, 41120 Gothenburg, Sweden
Email address: wkutbildning@gmail.com
Background in brief: Wiggo Kilborn is a researcher whose PUMP project initiated a new methodology and a new technique for studying the teaching process. He has also contributed to the development of the didactics of mathematics in Sweden. He has applied his experience to developing courses for teacher training and in supporting the development of research and education in several countries, such as Portugal, South Africa, Mozambique, Zimbabwe, Tanzania, and Guinea-Bissau.

Chapter #14

WHAT ARE THE MODELS OF COURSES IN ACADEMIC TEACHING IN SLOVAKIA?
Document analysis and the survey of lecturers' opinions

Tímea Šeben Zaťková
Department of Education, University of Ss. Cyril and Methodius in Trnava, Slovakia

ABSTRACT
The aim of the study is to identify, describe and compare models of courses in academic teaching (AT) conducted at Slovak universities and to describe how the pedagogical content knowledge (PCK) of university lecturers is acquired at particular higher education institutions (HEI). There are also briefly described the organisational aspects of pedagogical education of university lecturers in Slovakia, which is mainly conducted as part of their further education. The document analysis was employed to identify existing models of courses in AT in Slovakia. The text of the study also illustrates the experience with the implementation of courses in AT at Slovak universities and summarises results from a questionnaire survey on the importance of the pedagogical preparation and educational needs of the course participants - university lecturers. A variety of good practices, surveys and opinions of participants and graduates from various models of education are good sources of inspiration for higher education quality improvement. The study also intends to emphasise the requirement that teachers´ work at any level of education (even in higher education) cannot be the result of high erudition in the scientific field and only intuition-based knowledge of education and its principles.

Keywords: higher education, courses in academic teaching, university lecturers, opinions on pedagogical education, models of courses in academic teaching, pedagogical content knowledge.

1. INTRODUCTION

Since the first universities originated, higher education has changed significantly with many new forms, methods and tools of teaching. University lecturers are confronted daily with innovations and social changes and their teaching methods need to reflect this. But are lecturers sufficiently prepared for their pedagogical activities in contemporary education? What is typical for university lecturers is the fact that they don't specifically prepare for their profession before they start practising (Petríková & Ondriová, 2015; Benedetti, Plumb, & Beck, 2022). Lecturers are constantly assessed in their scientific-expert activities, but the assessment of their teaching activities is usually limited to mere evaluation of the number of students. Faculties in Slovakia focus on requirements expressing the lecturers' qualifications, but the competencies related to teaching methods, for example, the ability to organise and communicate are not assessed (Kravčáková & Jelenová, 2010). There is not always a correlation between the quality of a lecturer's subject knowledge, scientific activities and the quality of their teaching. For example, analysis of the evaluations of 600 academic workers at the Prague University of Economics and Business in the Czech Republic revealed a very weak link between teachers' research activity and student satisfaction with teaching (Stiburek & Kafka 2023). There is a lack of evidence that the higher expertise of the lecturers in the scientific field also increases their teaching skills.

Only a few Slovak universities provide their lecturers with opportunities to improve their teaching skills. Pedagogical content knowledge (PCK) as specialised knowledge that lecturers need to effectively teach a particular subject or course is essential. PCK combines content knowledge with pedagogical knowledge, or knowledge of how to teach that subject matter (Shulman, 1986; Rollnick & Mavhunga, 2017).

Nowadays in Slovakia, university lecturers must comply with qualification requirements in line with Act No. 131/2002 on Higher Education Institutions (Zákon 131/2002) and Act No. 269/2018 Coll. on Quality Assurance of Higher Education (Zákon 269/2018), but there is no requirement for pedagogical education. On the other hand, in the former Czechoslovakia existed a compulsory system of pedagogical education for lecturers. In Czechoslovakia, the emergence of higher education pedagogy and theory of AT began in the 1950s and it was developed in the 1970s and 1980s when higher education pedagogy developed as a scientific discipline at some faculties in the Czech Republic and Slovakia. In the 1980s the obligatory model of pedagogical education was designed and introduced as the "*System of Enhancing Pedagogical Qualification of Higher Education Teachers*". The Ministry of Education of the SR in accordance with Act No. 39/80 Coll. on universities with a special amendment from June 1983 established the framework for the system for further improving the qualifications of university teachers (Zákon 39/1980, § 78).

This system copied the systems of the Soviet countries and was obligatory for all lecturers. It included two stages: (1) Basics of AT for young lecturers with up to 5 years of experience; (2) a specialised course in AT for all lecturers with up to 10 years experience at HEI. After 1989 (the end of the Communist Era), the system of pedagogical education of lecturers collapsed. Since 1990, when Act No. 39/80 Co ll. was repealed and replaced by a new law, there has been no legislative groundwork implemented to improve the pedagogical education of lecturers in Slovakia, but their research-scientific and publication activities are subject to regular quality assessment under the accreditation process. In the 1990s, pedagogical seminars occurred only sporadically at universities as an interest-based and voluntary activity. Later, at the beginning of the 21st century, efforts began again to introduce courses in AT at some HEIs (Vašutová, 2010; Novák, 2019).

Today, some universities in Slovakia organise their pedagogical training for teachers (as a pedagogical minimum) according to their needs and on a voluntary basis. Courses in academic teaching are based on the internal guidelines of particular universities (e.g. University of Economics in Bratislava; or as part of habilitation and inauguration criteria - e.g. Slovak University of Agriculture in the period 2008 - 2014; at other universities as occasional courses organised as part of grant projects) (Novák, 2019; Minimálne kritériá, 2008; Benková, 2018).

In education, it is important to draw on the tradition and good practice proven by years of experience. Of course, it is not possible to unilaterally strengthen conservatism in approaches to education but mainly to develop a tradition with regard to societal needs and developmental tendencies in education science. It is important to focus on prospects for development and modernization to increase the quality and efficiency of the higher education process.

2. BACKGROUND

Faculties in Slovakia focus on the requirements expressing the lecturer's qualifications (requirement of an academic degree; requirement of knowledge of a foreign language; requirement of previous experience; publication activity and reviews; participation in scientific grants). Faculties probably perceive other competencies related to the performance

of the role of a university lecturer (organisational, communication, ...) as an automatic disposition of the lecturer. Content analyses of advertisements for teaching positions of professor, associate professor and assistant professor at public universities published on the website of the Ministry of Education of the Slovak Republic show that universities only sporadically cover in these advertisements the requirements for skills that are necessary for the high-quality pedagogical work of a lecturer (Kravčáková & Jelenová, 2010). It is not possible to clearly state that there is a correlation between the quality of a teacher's scientific erudition and the quality of his educational work.

Many HEIs in different countries offer explicit pedagogical training to support the certain, varied, but implicit, experiential training that lecturers receive in the classroom. However, the success of such training receives mixed reviews, and the perception remains that lecturers are often insufficiently prepared (Addy & Blanchard, 2010; DeChenne et al., 2012; Benedetti et al., 2022).

Pedagogical education of lecturers is a necessity, but it is questionable whether and how it is provided by universities in Slovakia.

Nowadays, there are three main core roles in higher education. Namely teaching, research and service (Br Sitepu, Eliyana, Raza, & Rosalina, 2020). University lecturers are usually carefully trained in how to conduct research but often lack training in academic teaching (Gosling, 2009). In many countries, this situation is solved by the requirement to complete pedagogical courses (Gibbs, 2013; Hanbury, Prosser, & Rickinson, 2008; Havnes & Stensaker, 2006; Trowler & Bamber, 2005). These courses have become an international phenomenon (Amundsen & Wilson, 2012) and higher education pedagogy (or academic teaching) is now a legitimate field of study (Silander & Stigmar, 2023).

Currently, there is increased attention to the pedagogical education of lecturers and the development of their pedagogical competence and PCK. In the contemporary higher education systems in the world, various models of such pedagogical education exist.

Chalmers, Stoney, Goody, Goerke, and Gardiner (2012) divided teacher education programs into formal and informal types. Formal programs are accredited or required by relevant authorities and are offered in intensive or extended form. Informal programs include shorter workshops or seminars, online courses and special events.

Požarnik (1998, according to Askerc Veniger, 2016) lists seven models of pedagogical training for university teachers: (1) initial education programs for assistants with at least one year of teaching experience; (2) mentoring of a newcomer by an experienced university teacher, not only in research, but also in teaching; (3) (mono)thematic seminars and courses from various fields; (4) pedagogical workshops; (5) action research projects; (6) network of experts; and (7) peer training.

In addition to investigating various models of pedagogical training for lecturers, it is important to adapt the form and content of such courses. The identification of the lecturers´ educational needs brings many benefits for the HEI that can help to design training programs and help trainers to design programs and courses that satisfy the needs of lecturers, improving training effectiveness and identifying staff performance problems and difficulties and finally raising the efficiency of higher education. According to Abouelenein (2016), the training needs are the changes required in the skills, knowledge and behaviours of the university faculty to achieve purposes and overcome difficulties.

University academic staff in most countries are appointed to their functions based on research experience and not on teaching experience. Their task is to conduct research and teaching, but research increases their status and the university often gives them higher priority. The need for further education of these workers is widely recognized, but in all the status remains at the decision of the universities.

According to Eurydice study (2000), in the Netherlands, some universities have introduced compulsory teacher training for lecturers. In Swedish universities, pedagogical skills have become more important in recruiting teachers, while the research activity as a condition of academic staff is decreasing. To improve teaching skills, institutions offer courses for teachers and they organize pedagogical conferences. Since 1995, Norwegian academic staff are required to have pedagogical education or teaching experience. Further training is the task of employer institutions, many of which offer pedagogical training for workers, mainly in communication and dissemination of knowledge.

3. OBJECTIVES, DESIGN, METHODS

The aim of the study is to identify, describe and compare models of courses in AT conducted at Slovak universities and to describe how the PCK of lecturers is acquired at particular HEIs.

Research question (1): What models of courses in AT exist in HEI in Slovakia?

Reserach question (2): What are the educational needs of university lecturers in higher education?

The research design for this study was a mixed-methods design. In accordance with this design, this study is composed of two phases; the first phase, qualitative data collection and analysis, was conducted to identify and describe the models of courses in AT. The second phase was quantitative data collection and analysis. The data is based on a survey with open and closed questions and document analysis.

The primary sources of the content analysis were 20 web pages of the public universities and Higher education institutions from all HEIs in Slovakia. The content analysis approach aimed at freely accessible web pages of the selected institutions. According to the Ministry of Education, Science, Research and Sport of the Slovak Republic, there are public universities (number 20), state (3), private (10) and foreign universities (6) operating in Slovakia (Minedu, 2023). From the overall universities, we analysed the available information about the pedagogical education and professional development of university lecturers at all public universities in Slovakia, since uniform legislative requirements apply to this group of universities.

A questionnaire survey for obtaining feedback from the respondents (the participants of the courses and workshops in AT) was used as a secondary research method. Surveys were obtained in 2021-2023. The data was analysed by statistical calculation or phenomenological analysis by the author. The study was based on a written survey containing a total of 22 open and closed questions and was emailed to 46 participants of the course at the Slovak University of Agriculture (SUA) of whom 29 completed it. The same questionnaire was sent to participants of the workshops in AT at the University of Ss. Cyril and Methodius (UCM) (27 answered). Informed consent, both in writing and orally, was obtained from all participants involved in the study, and anonymisation was ensured to safeguard privacy. Ethical approval of the primary data study was obtained from the Ethical committee at the investigated institutions.

4. RESULTS AND DISCUSSION

HEIs in Slovakia organise their own pedagogical education in various forms and models (as a pedagogical minimum) according to their needs and on a voluntary basis. From the overall 20 official web pages of the public universities, no information was found about further education provided for the lecturers at 10 of the analysed HEI (namely: Constantine

the Philosopher University in Nitra; Slovak University of Technology in Bratislava; Academy of Performing Arts in Bratislava; Academy of Fine Arts and Design in Bratislava; Academy of Arts in Banská Bystrica; University of Prešov; Alexander Dubček University of Trenčín; University of veterinary medicine and pharmacy Košice; Catholic University in Ružomberok; J. Selye University). Identified models of courses in AT are summarised in Table 1.

Table 1.
Analysis of models of courses in AT at Slovak public universities.

University	**Content of the course**	**Accreditation and organisational form**	**Source**
University of Žilina	Two level model: 1. Course for PhD. students (23 lessons); 2. Course for the lecturers of engineering or economic orientation (116 lessons/2 years: 1st year: Engineering pedagogy, ICT, Publication support; 2nd year: Language education).	Internal Directive No. 200/2021: "Principles of the selection procedure for filling the posts of university teachers, researchers, professors and associate professors", and Directive 228/2022: "Professional Development of University Lecturers of UNIZA"	https://ucv.uniza.sk/vzdelavanie-zamestnancov-uniza/adaptacne-vzdelavanie/
Technical University of Košice	Two level model: 1. Pedagogical Minimum for PhD. students; 2. Course in AT for lecturers (204 lessons/2 years).	The course is optional. Accredited by IGIP[i] (title obtained - ING-PAED IGIP)	https://osv-ip.tuke.sk/
Technical University in Zvolen	One level model: 2 years course (204 lessons/5 blocks) - the curriculum corresponds to the IGIP criteria.	Actual information not found - the last information from 2016 refers to a 2 year course from September 2016 to January 2018.	https://cdv.tuzvo.sk/sk/kurz-vysokoskolskej-pedagogiky

Slovak University of Agriculture in Nitra	Optional seminars: - optional topics for lecturers (1 hour duration), who can choose from a list of 15 topics, the exact time and place is specified according to the interest.	Occasional seminars (webinars)/ workshops – optional - model is introduced since the year 2021; Previously – One level model: 3 semesters/2 years, accredited by IGIP 2016-2020; re-accredited 2021-2025.	https://www.spu.sk/sk/uppc-o-nas
University of Economics in Bratislava	Three-level model: 1. course for PhD. students (2 days/introduction to the AT); 2. course for novice assistant professors (2 semesters/76 lessons); 3. workshops for experienced teachers interested in selected issues ("Edubreak").	- Education is carried out in accordance with internal directive of the rector of UE (No. 3/2014) "Pedagogical Education for Teachers of the University of Economics in Bratislava) - accredited by a British organisation SEDA[ii]	https://nhf.euba.sk/katedry/katedra-pedagogiky/profesionalny-rozvoj
University of Ss. Cyril and Methodius in Trnava	Two level model: 1. Course for PhD. students - part of the study plans as an independent course - "Academic Teaching - Theory and Practice" (1 semester/26 lessons); 2. Occasional workshops under grants support (in 2012, 2014/2015 and 2022/2023).	- organisation, scope and content depends on success of the grants (e.g. grants: ESF ITMS 26110230104 Support for the development of human resources in research and development; NFP312010BF Q3 Support of the internal quality assurance system of higher education at UCM)	http://kped.ff.ucm.sk/sk/vysokoskolska-pedagogika/

Trnava University	Optional seminars: -further education of teaching staff with a focus on ICT,	- pedagogical education is absent	https://www.truni.sk/centrum-dalsieho-vzdelavania
Matej Bel University	Optional courses: -Language courses; Effective methods of communication; Work-life balance; Creation and management of projects; MS EXCEL I.; MS EXCEL II.; Burnout syndrome and its prevention; Resilience; Problematic human communication and manipulation; Social protocol	- pedagogical education is absent	https://www.umb.sk/univerzita/zamestnanec-umb/kurzy-pre-zamestnancov-umb/
Comenius University Bratislava	Pedagogical support center provides three level model: 1. Courses in Academic teaching; 2. Workshops that present innovative educational methods; 3. Individual consultations for teachers;	-more information not found	https://fphil.uniba.sk/cpp/
Pavol Jozef Šafárik University in Košice	Optional seminars: Selected topics focused on working with ICT and various digital tools;	- pedagogical education is absent	https://portal.ccvapp.upjs.sk/activity/zamestnanci

-Academy of Performing Arts in Bratislava	Information not found		https://www.vsmu.sk/
-Academy of Fine Arts and Design in Bratislava			https://www.vsvu.sk/
-Academy of Arts in Banská Bystrica			https://www.aku.sk/sk/
-University of Prešov			https://www.unipo.sk
-Alexander Dubček University of Trenčín			https://tnuni.sk
-University of veterinary medicine and pharmacy Košice			https://www.uvlf.sk/
- Slovak University of Technology in Bratislava			https://www.stuba.sk/
-Catholic University in Ružomberok			https://www.ku.sk/
-J. Selye University			https://www.ujs.sk/
-Constantine the Philosopher University in Nitra			https://www.ukf.sk/

Results of the web pages' analysis prove that courses in AT have different organisation or content because some are based on internal directives of the particular institution, or they are organised as occasional courses organised and financed within grant projects and some of them are accredited by international organisations.

The analysis of the web pages was supplemented by a questionnaire survey on the opinions of participants who took part in academic teaching courses at UCM and SUA.

Results from the questionnaires revealed motivational factors of lecturers to further their education in AT: *a requirement of the head of my department; a condition for professional growth; my own interest; partly self-interest and uncertainty whether this will be a condition for the staff selection procedure*. Courses in AT are seen as very beneficial or partially beneficial, no response indicated that they were useless.

The participants from both universities identified lack of time as the first obstacle in their pedagogical development, this was followed by lack of offers for education and financial costs.

The participants would prefer in the future to take part in further education mainly in the field of psychology, followed by pedagogy and foreign languages. Fewer responses indicated an interest in ICT and the professional field of participant's specialisation.

Participants prefer courses to be in the form of *active learning, model situations, and presentations of practical tips for teaching*.

Particular areas which participants feel as weaknesses in their educational work are sorted by frequency of responses as follows: *applying a variety of teaching methods; creating didactic tests; nothing; communication with students; working with ICT; developing study materials for students; student results evaluation; ways of motivating students; time management*.

Selected suggestions expressed by the participants of the pedagogical education are:

PSUA2: "The course in AT should be compulsory for all. I recommend it to lecturers as well as doctoral students". PUCM2: "*Continue this activity, especially with PhD students who are often lost and often feel incompetent to teach..."* PUCM13: "*I would like to be advised how to be creative when lecturing, how to captivate students with my lecture, how to motivate students and teach them to think about the topic and to have their own opinion on the issue".* PUCM23: "*It would be better to define in advance for whom the course in AT is intended".*

There have been identified 3 models out of the seven categories described by Požarnik (In Askerc Veniger, 2016), namely: monothematic seminars and courses from various fields; pedagogical workshops; initial education programs for beginning assistants or doctoral students.

Despite the prevailing positive opinions about the courses, we can weigh how true this picture is, or whether there could be sources of possible distortion of the results and the limits of the empirical research presented. Only successful graduates of the course (or workshops) completed the final questionnaire and a sense of euphoria in the spirit of "all's well that ends well" and a tendency to defend or overestimate the value of what we have achieved can also be a source of distortion. The results of the questionnaires could be influenced by the tendency to give socially desirable answers, which researchers count on in survey methods (Zeľová, 2015; Krumpal, 2013). Although the questionnaires are anonymous and after the completion of the course the answers may be influenced by the opinion that further education and professional development is something they should care about.

Brief suggestions and recommendations that emerged from our results are:

- to ensure opportunities for pedagogical education for lecturers at all universities in the Slovak Republic (e.g. there is not a necessity to provide courses in AT at each university if there would be a possibility of participating in education outside their own workplace);
- continuously innovate and optimise the content of courses in AT according to the needs and opinions of the participants, which are based on the real needs of a specific group and the latest scientific knowledge;
- to increase interactivity in further education of university lecturers;
- to create a national system of financing further education of university lecturers;
- to organise permanent multi-level module systems of pedagogical education for the university staff aimed at specific groups of participants (doctoral students, young assistants, experienced university teachers, scientific workers, administrative workers, etc.);
- to support the motivation of university staff for further self-development by introducing various motivational tools in their further education;

- to emphasise the internationalisation of universities even through the research in higher education pedagogy and comparison of existing models of courses in AT in Slovakia with the international experience and good practice abroad.

The analysed models of courses in AT are situated mainly at traditionally non-teaching HEIs, engaged in engineering and economic education. These universities have a tradition and higher interest in the development of pedagogical skills in comparison to universities focusing on humanities, social sciences and teacher training study programs. Existing courses vary from occasional workshops and one-level models up to multilevel models. Organization of the courses in AT opens up many questions related not only to the scope and content but also to their financing, accreditation, etc. As stated Benedetti et al. (2022) conventionally training sessions, consisting usually of workshops, remain general and overemphasise policies, not providing sufficient preparation for in-service teaching. The authors propose to overcome these shortcomings by introducing a new methodology that is based on the use of peer teaching and self-reflection and that is both continuous and discipline-specific.

Investigated courses in AT at different Slovak HEIs have similar objectives, and they are to develop lecturers´ PCK. Lecturers´ motivational factors to attend the courses differ, but the majority are motivated by their intrinsic motivation, which is a positive result. The major suggestion that arose from the text is to establish a national system for funding the further education of lecturers with multilevel modular systems of their pedagogical education.

4. FUTURE RESEARCH DIRECTIONS

For future research, it would be beneficial to investigate the opinions among different groups of lecturers and PhD. students. The answers could be influenced by different types of participants and their different expectations, previous experiences and professional backgrounds, as they included PhD. students, novice lecturers, but also experienced university teachers in different functional and academic positions. Also, participants' previous education and professional focus could be diverse (from participants with previous teacher training to participants without any pedagogical training).

We are also aware of the fact that the sample of respondents from 2 universities does not provide a comprehensive view of the importance of pedagogical education and educational needs in the environment of all public universities. This was only a small probe into the given issue and needs to be further investigated.

As it emerged from the analysis of the results of our investigation, universities currently organise their pedagogical education according to their financial and personnel capacities, according to their specific needs and possibilities and on a voluntary basis. In the past passing an AT course was obligatory for the habilitation and inauguration processes at one of the Slovak universities - Slovak University of Agriculture (Minimálne kritéria, 2008) such as it still is in some other countries, for example in Slovenia (Askerc Veniger, 2016). Courses in AT at some of the universities are also held in the form of the occasional courses organised and financed as part of successful grant projects. Therefore, the question "What is the most effective organisational form and model of the pedagogical education of university lecturers?" should be investigated in the future.

According to our results, we agree with the opinion of the authors Petríková and Váradyová (2019) that the educational standards of higher education pedagogy and courses in AT in the conditions of Slovakia are currently not set. It is necessary to search for the optimal requirements that should be set by the institutions and the national decisive bodies.

Future research direction is to investigate not only the opinions and attitudes of the course graduates and their personal needs in further education but the real efficiency of the courses among the stakeholders.

The search for a variety of good practices surveys and opinions of participants and graduates from various models of pedagogical education can be good sources of inspiration for higher education quality improvement. Organising courses in AT and the further education of university lecturers at several Slovak universities opens up many questions regarding not only the scope and content but also their financing, accreditation, etc.

5. CONCLUSION

Currently, the lecturer's PCK is a necessity, and the requirements for its acquisition and development in various forms of further education, such as adaptative, innovative, or updating education, are also defined for teachers at lower levels of education by Act No. 138/2019 on teaching staff and professional staff (Zákon 138/2019), but they are not defined for university lecturers (requirements are absent in the Act No. 131/2002 on Higher Education Institutions (Zákon č. 131/2002) and Act No. 269/2018 Coll. on Quality Assurance of Higher Education (Zákon 269/2018). However, based on our results, not even half of the Slovak public universities are aware of the need to acquire and develop the pedagogical competence of university lecturers.

From a total of twenty analysed publicly available websites, no information was found about the pedagogical education for lecturers and the staff of the HEIs at half (10) of the universities. We assume that if this information has not been published, the respective university does not ensure the further education and development of its lecturers. The remaining 10 universities according to the publicly available information provide various types of further education, but 3 of them lack any kind of specific pedagogical education. The educational activities for lecturers at these 3 HEIs were focused only on the field of ICT, work with various digital tools, project management and publication activities. Further, 7 HEIs were identified as providing their staff with education in the field of academic teaching, respectively in selected topics related to higher education, but these educational models provided at particular institutions differ in content, scope and frequency, commitment, financing and also in forms and methods of education. The existing courses are implemented as occasional workshops, optional one-off seminars, single-level models of courses in AT with no differentiation in the content up to multi-level models of pedagogical education with differentiated content according to the specific group of participants.

Regarding the experience of the participants, the majority of respondents confirm their positive feedback on the completed course formally (during final colloquiums and through questionnaires) as well as informally through personal statements, even though they also state some of their suggestions for improving the quality of the courses (differentiation of content according to the target category of university teachers in the case of 1-level models of education; re-evaluation of the form of education; increasing the ratio of activating teaching methods, etc.). Similar results are reported by Zeľová (2015), according to which the majority of graduates of courses in AT do not see completing the course as a means to facilitate obtaining a job or a bonus during habilitation, and only 4% of graduates state that they would not enrol in the course again. Most would speak positively about the course to potential applicants, and their colleagues. Similarly, as they heard it themselves, they would also argue mainly about the usefulness of the course for pedagogical practice and the broadening of the horizon. Only a tenth of the graduates considers obtaining a certificate from the course to be a decisive benefit. Most of those who sign up for the course have a positive image of it based

on information from colleagues - graduates. This is confirmed by almost everyone who completes the course, and they then tend to recommend the course to others.

As for the educational needs of the surveyed participants, the majority would prefer education and training in psychology, followed by pedagogy with a focus on issues connected to teaching methods, tools for the assessment and evaluation of students, pedagogical communication and the ways of motivating students. The other issues that should be included in their further education are: work with ICT; developing study materials for students and effective time management. To support the teaching activities of higher education lecturers and their PCK development is a need for a quality education. Efforts for the support of the lecturers´ pedagogical education have been growing over the years and we are sure that it should be a well-established practice in the future of higher education.

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AUTHOR INFORMATION

Full name: Tímea Šeben Zaťková
Institutional affiliation: Department of Education, University of Ss. Cyril and Methodius in Trnava (Slovakia)
Institutional address: Námestie J. Herdu 2, Trnava, 917 0, Slovakia
Short biographical sketch:
The author is an associate professor at the Department of Education, Faculty of Arts, University of Ss. Cyril and Methodius in Trnva. She completed her master and doctoral studies in Pedagogy at the Faculty of Education of Constantine the Philosopher University in Nitra. Her research and pedagogical profile focuses on Theory of Education, General Didactics and Higher Education Pedagogy. Her teaching experience is connected to teacher preparation and training at UCM in Trnava and at the Slovak University of Agriculture in Nitra where she worked as assistant professor and the Head of Department of Education in the years 2011 – 2021.

[i] Internationale Gesellschaft fűr Ingenieurpädagogik (eng. The International Society for Engineering Education) https://igip.org/
[ii] SEDA is the professional association for staff and educational developers in the UK, promoting innovation and good practice in higher education. https://www.seda.ac.uk/

Chapter #15

STUDENT TEACHERS BEHAVING BADLY: TEACHERS' PERCEPTIONS OF STUDENT TEACHERS' MISBEHAVIOUR DURING TEACHING PRACTICE

Jaysveree M. Louw
Department of Educational and Professional Studies, Central University of Technology, Bloemfontein, South Africa

ABSTRACT
Teaching Practice (TP) is a crucial component in initial teacher training programmes. All B. Ed and PGCE (Post Graduate Certificate in Education) students at South African universities must undertake TP and behave professionally and ethically during their TP period. However, universities often receive negative feedback from the *teaching community* about the behaviour of some students. This negative feedback was one of the motivating factors that prompted this study. The second motivation was the findings of the portfolio content that student teachers have to submit after TP. Some students' actions were dishonest, for example, they forged *mentor teachers'* signatures. The purpose of this study was to obtain teachers' perceptions of how pre-service teachers conduct themselves during TP. Interviews were conducted with thirty participants to collect data. The findings revealed that even though many students are generally well-behaved and ethical, some of them are entitled, unprofessional and disrespectful. From these findings one can conclude that some student teachers behave in an undesirable fashion which can negatively impact their future placements at schools. One of the recommendations is for student teachers to be adequately prepared by teacher education programmes to meet the professional requirements of teaching in the real school and classroom environment.

Keywords: teaching practice, student teachers, unprofessional, immoral, behaviour, values.

1. INTRODUCTION

Teaching practice is a critical aspect of initial teacher education training that prepares student teachers (also referred to as pre-service teachers) to become professional, skilled, ethical and competent teachers after completing their studies (Merc, 2004; Roy, Wieser, Dhlamini, & Thomas, 2016). During TP student teachers are afforded the opportunity to gain practical experience in the actual teaching and learning environment, namely the school. In addition, student teachers are afforded the opportunity to explore the different educational contexts in which teaching and learning take place.

Marais and Meier (2004: p. 221) assert that "the term TP represents the range of experiences to which student teachers are exposed when they work in classrooms and schools". It is a form of work-integrated learning that is described as a period of time when students work in the relevant industries to receive specific in-service training in order to apply theory to practice. Ehrich, Kimber, Millwater, and Cranston (2011) assert that teaching is profoundly a moral activity and that teachers, whether they are in-service or pre-service, are expected to conduct themselves in moral ways. Values thus play a crucial role in pre-service teachers' path to becoming teachers. The Department of Higher Education and Training (DHET) is the body that determines the duration of TP. Policy documents related to TP

stipulate that B. Ed students must spend twenty weeks at the schools. Students who are registered for the PGCE must spend ten weeks at the schools. This duration is spread over four years and during these times student teachers are at all times supposed to adhere to the policies and codes of conduct of schools (Republic of South Africa, n.d; Republic of South Africa, 2011).

2. PROBLEM STATEMENT

The process of becoming a teacher is for many students a complex and challenging phenomenon. It is also the subject of multiple interests and ways of exploring its different dimensions, role-players and dynamics (Caires, Almeida, & Vieira, 2012). One of the dynamics of becoming a teacher is that all prospective teachers have to undergo TP as part of their training. After completing their TP the student teachers are required to submit portfolios, which contain evidence of what they did at the schools (Taole & Van Wyk, 2015). The content of the portfolios is among others, attendance registers, mentor teacher feedback forms and lesson presentation forms. Most of these forms are signed (or should be signed) by mentor teachers. However, as was witnessed in the portfolios, some students forge signatures, while some fill in information themselves that was supposed to be completed by mentor teachers. In addition to these dishonest portfolio completion practices, often principals and mentor teachers, and even teachers who are not mentors (non-mentor teachers), contact universities to complain about how some student teachers conduct themselves. These are some of the complaints universities received: student teachers arriving late at schools, they do not adhere to the dress codes of the schools, absenteeism without informing the mentor teachers, they are disrespectful towards teachers (e.g. by back chatting) and lastly, student teachers show up unprepared for their lesson presentations. These complaints from the teaching community and falsified documents and signatures in the portfolios were what prompted the research. Although student teachers are orientated for TP in some of the courses, some of them disregard what they are taught. Mentor teachers also discuss (or should discuss) what is expected from student teachers at schools but many student teachers still opt to uphold negative values during their TP period.

3. AIM OF THE RESEARCH

Much research reports and focuses on classroom practices and on student teachers' experiences during TP, but limited research focuses on the moral conduct of student teachers during TP. The aim of the study was to obtain teachers' (mentor teachers, non-mentor teachers and school principals) perceptions of the immoral and unprofessional conduct of some student teachers during TP. This behaviour was evident in TP portfolios that student teachers have to submit, and through the complaints some universities receive from the teaching community. The students in question were Education students from different universities who were placed in different primary and secondary schools.

3.1. Research Question

The main or central research question is a broad question that asks for an exploration of the central phenomenon or concept of the study. It can be followed by associated sub-questions. Research questions typically begin with the words *why* or *what* to convey an open and emerging design (Creswell, 2014). The main research question that guided this research is: What are teachers' perceptions of the moral conduct of some students during teaching practice?

4. SIGNIFICANCE OF THE STUDY

Exploring the teaching community's views of student teachers' behaviour has the potential for improving the quality and effectiveness of TP and for improving student teachers' behaviour and conduct during TP. It is important for student teachers to put their best foot forward because the manner in which they behave has a direct impact on their interaction with role players such as learners, parents and the school community (Van Nuland, 2009). The manner in which student teachers behave during TP can also be a deciding factor on whether or not they could be employed at the schools where they undertake their TP. If student teachers misbehave, they will hamper the reputation of their tertiary institutions. Dreyer (2015) asserts that student teachers represent their institutions during TP and their good behaviour might open or close doors for other students. The study can assist stakeholders as far as the moral bahaviour of student teachers is concerned.

5. LITERATURE REVIEW

5.1. Teacher Professionalism

Student teachers are placed at schools mainly to observe lessons, co-teach and teach independently. During this period, they should conduct themselves professionally and ethically. Teacher professionalism is defined as "a combination of training, knowledge, experience, attitudes and moral behaviour that defines the role of a teacher" (Roy et al., 2016, p. 16). It also refers to one's attitude towards one's work and how you approach your work. Becoming a professional teacher begins with initial teacher training. It is thus the responsibility of universities to prepare and educate future teachers about professionalism. Unprofessional behaviour is any type of behaviour that creates difficulties in the workplace with the people you work with (Malan, 2015). Although pre-service teachers are not employed in their respective schools and are not professional teachers yet, they are expected to model behaviour that is professional and ethical. Promoting professionalism of all teachers in South Africa is the vision of SACE (South African Council for Educators). SACE is a statutory council which promotes and monitors professional conduct of teachers and manages continuous professional teacher development in South Africa. In addition, it must uphold ethical practices by teachers (Republic of South Africa, 2002; Drake, Jackson, & Sotuku, 2016). However, it is often difficult to decide whether actions and behaviours can be deemed as professional or unprofessional, and ethical or unethical. In this regard SACE's 'Code of Professional Ethics' is a guide that stipulates how teachers should conduct themselves. Policy documents such as the Employment of Educators Act 76 of 1998 (C-9) stipulate that misconduct refers, amongst others, to a breakdown in the employment relationship and an educator commits misconduct if he or she

- falsifies documents or any other records
- displays disrespect towards others in the workplace (schools decide which actions and behaviour are deemed disrespectful)
- commits an act of dishonesty (schools stipulate in the teachers' code of conduct which actions are deemed dishonest) (Republic of South Africa, 1998).

The SACE code outlines principles of action and standards of behaviour. But professional conduct is not only about how people act - it is also about appearance. When student teachers dress smartly and appropriately, they convey a message that they take their TP seriously.

5.2. Values and their Role in Teaching

Values (or morals) can be perceived as ideals or beliefs that guide our interaction with others in terms of what is good, beneficial, important, useful etc. (De Witt, 2021; Malan, 2015; Nargiza, 2022). Malan (2015) states that values or ethics are a set of rules that regulate our lives and the decisions we make. They are passed down from parents to their children. They are a person's opinion of what is good or bad, acceptable or unacceptable - an enduring belief that a specific mode of conduct is preferable. Teachers are supposed to act morally and professionally while they are at work, and unprofessional behaviour is usually unacceptable at schools. Professional behaviour and actions rely on moral principles and these moral principles are helpful in guiding student teachers on how to behave morally during TP. The challenge is that moral principles are often relative to cultures or communities. Different cultures (and therefore different people) have a particular system of norms and values which influences their behaviour towards others (De Witt, 2021). Values influence many activities at school as well as interaction among teachers and interaction among learners and teachers. The question is thus: if values are relative and play such an important role in school activities, which values should guide student teachers' conduct at schools, and even outside of the schools?

5.3. Lack of Positive Values Amongst Students

Moral degeneration or moral decline is the failure to uphold sound morality in our societies and societal institutions such as schools and Higher Education Institutions (Njoku, 2016; Lawal & Ali, 2017). Forms of moral decadence among students are, for example drug abuse, rape, examination malpractice, plagiarism, indecent dressing, bribery, gender-based violence, disobedience and academic fraud, to mention a few (Singh, 2018). This alarming moral decadence is to a large extent the result of immoral behaviour exhibited by students. Globally there exists a general decline of morals in schools and outside schools (Samson & Allida 2018; Fayokun, Adedeji, & Oyebade, 2009). The literature study shows that the youth of today is morally corrupt and bankrupt (Njoku, 2016). Students seem to be belligerent, lazy, unruly, ill-disciplined, disrespectful, materialistic, rude, dishonest and disobedient. They do not adhere to positive values and would much rather display these negative values. There seems to be a general absence of consideration for others amongst students, they are dishonest and display this dishonest behaviour by lying and cheating during assessments, they lack good manners, disrupt lectures, are insincere, refuse to take accountability for their actions, wear suggestive and seductive clothes, use bad language and disregard rules and authority (Joseph, Berry, & Deshpande, 2010; De Klerk & Rens, 2003; Fayokun et al., 2009). Some of this behaviour is not only portrayed while students are at their tertiary institutions, but also at schools during TP. Many students fail to display moral and ethical principles in their behaviour and actions.

6. METHODOLOGY

6.1. The Participants

The convenience and purposeful sample consisted of thirty participants: twenty-seven of these were teachers at the schools where student teachers were placed for TP. Three of the participants were principals of schools where student teachers conducted their TP. Convenience sampling was employed because the teachers and principals were available and willing to participate in the research. From the twenty-seven teachers that were interviewed, twenty-four were mentor teachers, while the other three were non-mentor teachers. The participants were from six schools where student teachers conducted their TP.

6.2. Data Collection Method

Face-to-face individual interviews were conducted with the participants and recorded with a cellular phone. The interviews were conducted over a period of six months. Each interview lasted between fifteen to twenty-five minutes. A combination of semi-structured and open-ended questions was asked. This method of interviewing was selected because it is more flexible and allows the interviewees to also ask questions (Nieuwenhuis, 2007; Dakwa, 2015). Some key questions were formulated in advance.

6.3. Findings and Analysis

6.3.1. Thematic Analysis

The aim of qualitative data is to describe and make meaning of phenomena and thus do not require quantification of texts and statistical analysis (Henning, 2004; Creswell, 2014). There are several methods of data analysis that can be used in narrative research design. The data could be in the form of a text, transcript of recorded interviews or documents (Taole & Van Wyk, 2015). The type of data analysis used should be guided by the nature of the research question or questions, the type of data available and the goals of the research. Thematic analysis is particularly beneficial and useful when the research question aims to explore experiences, perceptions, views, opinions and understanding of individuals or groups. Thematic analysis thus seemed the best suitable method for analysis for this study. It is a powerful tool for shedding light on the lived experiences and realities of the participants. Thematic analysis lends itself well to a large volume of rich, detailed data such as in-depth or focus group interviews where participants provide comprehensive accounts of their experiences. There are two approaches to thematic analysis: inductive (the data determines your themes) and deductive (coming to the data with some preconceived themes which you expect to find there, based on theory or existing knowledge) (Dawadi, 2020; Nowell, Norris, White, & Moules, 2017). For this study the researcher adopted the inductive approach.

6.3.2. The Process of Analysing the Data

Thematic analysis is subjective and relies on the researcher's judgement, so the researcher has to reflect carefully on his/her interpretations. The process of coding in thematic analysis is largely inductive, with codes and themes developed from the data itself (bottom-up approach) (Dawadi, 2020; Castleberry & Nolen, 2018). Analysing structured data differs from analysing unstructured data. Structured data typically come coded, whereas unstructured data are not. Also, qualitative data use words, not numbers - in other interviews gestures and facial expressions are used to express feelings. Because of these reasons it is more difficult to analyse qualitative data. There is no single correct way, no set of rules or a simple recipe that one can follow to analyse qualitative data which will always be appropriate and guarantee good results (Boulton & Hammersley, 2006). Researchers have to be creative, disciplined and follow a systematic approach when analysing data. But the flexibility of qualitative analysis allows researchers to turn raw data into results (Feza, 2015). Despite the complexities of analysing qualitative data, there are six general steps that are typically followed in the analysis of qualitative data (Nowell et al. 2017; Castleberry & Nolen, 2018).

Table 1.
Steps in thematic analysis.

1.	Familiarisation	The first step is to read and examine the data carefully (to look for patterns in the meaning of the data to find broad themes). The researcher has to make sense of the data and then transcribe audio data to text. Decide what to code, what to employ and which codes best represent your content - this is referred to as the coding process.
2.	Look for themes in the codes	Search for coding patterns or themes. Choose topics for your themes. Codes are the building blocks for themes.
3.	Generate themes	Ensure that everything you have classified as a theme matches the data and whether it exists in the data. Make sure you have coded all your themes properly and thoroughly. Sometimes codes may become themes.
4.	Review themes	Read through the themes again and answer these questions: Do the themes make sense? Do the themes overlap? Are there sub-themes? Do the data support the themes? In this stage the researcher compares the themes.
5.	Define, name and finalise themes	Analysis will take shape after reviewing, refining and labelling your themes. Ensure your themes match the research question.
6.	Report writing	The final step is to write the report. The report can include quotes from the interviews, an interpretative analysis and arguments for your claims.

7. DISCUSSION

Below are extracts from some of the questions and the responses from the participants. Some of the responses can be categorised into both themes. The data were analysed manually through the six-step process that is explained in Table 1.

Table 2.
Extracts from interviews and subsequent themes.

Questions	Responses	Themes
Q1: We received complaints from some teachers about the worrisome behaviour of students during teaching practice. Can you give examples of how some students behaved?	P1: Many of these students' behaviour is really problematic. P2: *We had students from two universities at my school last semester.* *Generally, they behave well and are respectful. But some of them! A few rotten apples rot the whole box.*	Question 2 was a follow-up question to question 1. The responses fit the theme of unprofessional behaviour (inappropriate dress-code, late coming, refusal to participate in extra-mural activities). The teachers find this behaviour problematic and disturbing.
Q2: Problematic how? (This was a follow-up question to P1's response)	*P1: Let me start with the way some of them dress. The other one was wearing jeans so tight she could not even climb the stairs. I mean really.* *And some come late and want to leave early. For no good reason. They don't want to do extra-murals. And this other one gave me an incomplete lesson plan. I did not mark nor sign it. (The interviewee was shaking her head).*	Inappropriate dress-code, late-coming, not wanting to participate in extra-curricula activities. This behaviour indicates the unprofessional conduct on the part of some students.
Q3: What about their ethical behaviour? Because some teachers say the students can be disrespectful at times.	P3: *One came to school drunk one day. We could smell the alcohol from the gate. That's disrespectful and unprofessional. No respect for other teachers, their work and for the rules. And we brief them about the rules and the code of conduct for teachers. The other one lied about the lesson plan. But some are cute and work hard. And have good manners. Why can't they all be like this?* P4: *And they speak to teachers as if we are their*	The responses from Question 3 speak to the theme of immoral behaviour (e.g. forgery, lying) and unprofessional behaviour (coming to school intoxicated, speaking to teachers in a disrespectful manner, disregard for rules).

	friends. They're not even teachers yet! And some of them – the forms I had to fill in and sign…so untidy! They have no respect for me or their work. No pride! And some are so scared to work. P5 *(who is a principal): I don't want students from University x at my school anymore. They're so rude some of them. They must go to other schools. I will phone University x and tell them to place their students at other schools.* P6: *Sometimes they somme fill in forms themselves. I've seen it. Why don't they give the forms to the teacher or teachers that are supposed to complete them? Huh? Is that not forgery?*	
Q4: What do you think universities can do to change this behaviour?	P6: *Don't the lecturers prepare the students? You must coach them. Give them a contract to sign. A contract that says they must abide by the teacher code of conduct.* P7: *There are certain things that are not allowed at the schools. Life has rules. Schools have rules. The values in the code of conduct need to be respected.* *P8: The way some of them behave……if I were the principal I will never employ them. Some are just plain lazy. They do not know the value of hard work. And they don't know the meaning of please. No manners.*	Unwillingness of students to adhere to the code of conduct for teachers. They do not obey rules. They do not respect hard work etc. These actions can be categorised in the broader theme of unprofessionalism.

Thematic analysis is typical in qualitative research and was employed through the identification of themes that emerged during the interviews. It emphasises identifying, analysing and interpreting qualitative data patterns. It is a method for describing data, but it also involves interpretation in the process of selecting codes and constructing themes. In thematic analysis the researcher has many options on how to convert 'raw' data to final patterns of meaning, or to results (Dawadi, 2020; Nowell et al, 2017). The researcher opted for qualitative coding and categorising of themes. Meanings were thus conveyed in terms of themes. From the responses of the participants the researcher extrapolated two main themes: unprofessional behaviour and unethical conduct of students. From the responses it is evident that the participants are of the opinion that some student teachers are entitled, have no respect and have no pride in their work ethic. The participants were not impressed with the moral and professional conduct displayed by some of the student teachers.

8. CONCLUSION

Teaching practice is a period when student teachers are placed at schools to gain teaching experience, knowledge and skills. While at the schools they have to fulfill certain roles such as teaching, completing assignments and activities and avail themselves for the opportunity to learn as much as possible. During this period student teachers are expected to adhere to the principles of professionalism and ethical behaviour as stipulated in SACE's 'Code of Professional Ethics'. They also have to adhere to the rules of the schools. Although many students do behave professionally and ethically, the findings indicate that there are those that behave in unacceptable ways during TP. The focus of this chapter was on the students whose conduct is questionable during TP. Some examples that were cited by participants include late coming, laziness, disrespect for teachers and dishonesty. Some of the portfolios were also suspicious - for example, different handwritings were used where one and the same teacher was supposed to complete a form (or forms). This creates the impression of cheating and dishonesty by students. The participants alluded to the fact that this behaviour is unacceptable and should be addressed. As Oduran and Mokoena (2015, p. 28) state, "good teaching requires that teachers have knowledge of the theories and insights that guide what they do as teachers, and knowledge of their own behaviours as teachers".

9. RECOMMENDATIONS

There are various ways of improving student teachers' behaviour during practice. Student teachers should be adequately prepared and orientated by tertiary institutions for TP. They should be trained about their responsibilities and conduct during TP. The SACE code should form part of teacher training programmes (and the teaching practice curriculum) from the 1st year of study. A partnership between schools and universities can be mutually enriching and beneficial for student teachers, universities and teaching communities. This partnership must be based on a common understanding of how student teachers should conduct themselves. Schools need to make clear what student teachers' expectations are - this should ideally be communicated to universities before the students are placed at the schools. Student teachers should be informed of conduct that is rude, disrespectful, dishonest etc. Examples of unacceptable and punishable behaviour (e.g. forgery, stealing, arriving at school intoxicated etc.) should be communicated. Student teachers should be informed about the consequences of any misconduct during TP. They should sign a contract in which they pledge to honour the school's policies and code of conduct. Lastly, Dreyer (2015: p. 6) gives this important recommendation: "student teachers must realise that they are guests in schools during their TP period and must abide by all rules and regulations of the school".

10. FUTURE RESEARCH DIRECTIONS

The topic has not yet been fully explored or studied in the existing research literature. This research opens the door for larger discussions. There is much research that can be conducted on the challenging issues of immoral and unprofessional behaviour of pre-service teachers during TP. In order to build a useful body of scholarship around these problems researchers are encouraged to document and share their experiences, pedagogies and findings.

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KEY TERMS & DEFINITIONS

Teaching community: In this study the teaching community refers to mentor teachers, non-mentor teachers, principals and Head of Departments (HODs) at the schools. These are the participants that were interviewed and that sometimes contact the universities with their complaints.

Mentor teachers: These are experienced teachers - often HODs - who are appointed by senior school management to mentor and guide student teachers during their teaching practice. They serve as role models for student teachers. They usually teach the same subjects that student teachers observe or teach during teaching practice.

Non-mentor teachers: Teachers who work at schools but are not appointed to mentor student teachers. They do occasionally work with student teachers, for example during subject meetings that have to be attended by student teachers.

LIST OF ABBREVIATIONS

DHET - Department of Higher Education and Training
HOD - Head of Department
PGCE - Post Graduate Certificate in Education
SACE - South African Council for Educators

AUTHOR INFORMATION

Full name: Jaysveree M. Louw
Institutional affiliation: Central University of Technology (CUT)
Institutional address: 1 Park Road, Willows, Bloemfontein, South Africa
Short biographical sketch: Dr Jaysveree M. Louw is currently a lecturer at the Central University of Technology, Bloemfontein, South Africa. She was the coordinator for the Foundation Phase programme for two years at this institution. Before joining CUT she worked at two other universities namely the University of the Free State and the University of Fort Hare. She was also an English teacher in primary and various secondary schools. She holds the following qualifications: Higher Education Diploma, B.Ed (Hons), M.Ed and a D.Ed. Her areas of interest include Moral Education, Foundation Phase Education and Language Education.

Chapter #16

ONLINE QUIZZES FOR CONTENT CONSOLIDATION IN HIGHER EDUCATION: A COMPARATIVE STUDY IN TOURISM DEGREES

Sónia Pais[1], Laura Chagas[2], & Ana Pires[2]
[1]CIDMA - Center for Research and Development in Mathematics and Applications; CiTUR – Centre for Tourism Research, Development and Innovation, Polytechnic Institute of Leiria, Portugal
[2]CiTUR – Centre for Tourism Research, Development and Innovation, Polytechnic Institute of Leiria, Portugal; CI&DEI, Portugal

ABSTRACT
New strategies regarding student-centered approaches have emerged in higher education contexts, to promote student motivation and engagement towards the learning process. Online quiz platforms such as Kahoot! seem to contribute to the consolidation of learning, particularly through content review.
Our research is based on data from a quantitative survey conducted among students from a Portuguese higher education institution offering undergraduate degrees in the area of Tourism, specifically within the subjects of English and Statistical Analysis. Following a consistent application of Kahoot! quizzes in class for reviewing purposes, the survey was implemented to allow for an examination of how the students perceived the usage of this game-based learning tool.
Results show that most students are very receptive to this tool and highly recommend it, as it promotes motivation. Students also consider the use of Kahoot! in classes to make learning more challenging and dynamic, while positively contributing to content consolidation.
To better understand students' responses to the platform, in this study we aim at analyzing the results according to area of study and investigating different correlations between variables.
However, the results obtained evidence that further studies are needed to confirm the effect on the use of Kahoot! in student performance.

Keywords: higher education, web tools, content consolidation, motivation, gender, technology receptiveness.

1. INTRODUCTION

In the last few decades, higher education has been confronted with a number of substantial changes, which have impacted both students and faculty. On the one hand, the number of students accessing higher education has grown exponentially and, as a consequence, the student-teacher ratio has changed and the student body has become more and more heterogeneous (Olssen & Peters, 2015). This democratization of higher education brought with it many social and economic benefits but aggravated already existing challenges across all education levels regarding student commitment, compromise and motivation (Kember, Leung, & Prosser, 2021). Another recent major transformation in higher education came as a result of the widespread use of information and communication technologies (ICTs), supported by the advent of the Internet. Technology was adopted in higher education not only at the institutional level, through the offer of blended learning or online learning, but also as a means to innovate teaching methods in face-to-face classes (Dečman, 2015). The use of technology in face-to-face classes led to a process of reform

and innovation, as it allows the development of student-centered activities that involve cooperation and active participation, thus altering the traditional role of faculty and students (Wang, Wu, & Wang, 2009; Guardia, Del Olmo, Roa, & Berlanga, 2019). Considering that higher education students are mostly digital natives, known for their dependency on information technology and lower attention span, the adoption of game-based learning platforms can help improve students' learning experiences in higher education (McCoy, 2010; Lister, 2015).

2. THEORETICAL BACKGROUND

This article includes a reflection on how the use of a specific game-based learning platform, Kahoot!, can improve the learning experiences of students in higher education, especially students in the field of Tourism. Within the subjects of Statistical Analysis and English, the researchers resorted to Kahoot!, accessed by students through their mobile devices, in order to revise contents throughout the semester and to encourage and increase their participation and motivation during classes.

Online quizzes can foster engagement, challenge learners, and support content review, making them effective educational tools. Paturusi, Chisaki and Uzagawa (2014) discuss how online tests are created and assessed as helpful resources to improve student performance. According to the authors, "the students' results revealed that these online quizzes can be utilized as an assessment tool to enhance students' performance in learning. By [using] this particular tool, students can make self-assessment about their achievement in learning because the quizzes are automatically corrected and provide as grade for students." (p. 215).

In another perspective, Nuci, Tahir, Wang, and Imran (2021) found that in-lecture quizzes increased students' engagement and interaction levels. Results pointed to four major conclusions, namely: (i) systematic online quizzes can impact students' engagement and motivation; (ii) the interactivity among professors and students increases when using systematic in-lecture quizzes in online classes; (iii) systematic online quizzes impact class dynamics; (iv) including the strategy of having systematic in-lecture quizzes in the teaching plans will impact students' exam performance.

Furthermore, another study reveals that online quizzes can foster engagement, challenge learners, and support content review (Grinias, 2017). The author states that "the use of competitive quiz-based games utilizing web-based student-response systems for comprehensive exam review was reported by students to be both helpful and fun in a quantitative analysis course" (p. 1365).

We are now going to explore the use of these tools in two different fields of study, specifically Mathematics and English Language Learning.

In the case of Mathematics, technology has become essential because the teaching and learning processes are enriched with the use of technologies improving the students' motivation and the students' learning process (Bullon, Encinas, Sanchez, & Martinez, 2018; Zabala-Vargas, García-Mora, Ardila-Segovia, & de Benito-Crosetti, 2019). ICTs are tools that innovate the way mathematics is taught and they may facilitate students' learning (Scanlon, Buckingham, & Burn, 2005).

As far as English language learning is concerned, game-based learning can help to cultivate positive attitudes and increase motivation level of participants, while allowing for language practice, namely easiness of grammar or lexical revision and better acquisition of new structures (Veljković Michos, 2017).

Several authors have studied students' acceptance to the integration of technology in education (Thongkoo, Daungcharone, & Thanyaphongphat, 2020; Raes & Depaepe, 2019). However, few studies investigate the relationship between gender / area of study and game-based learning acceptance, specifically, hence the relevance of our research.

3. OBJECTIVES

The aim of this study is to determine how Tourism students perceive the use of Kahoot! in higher education, more specifically within the context of Mathematics and English classes, with three groups of students. Although the specific name of the subject is Statistical Analysis, the contents refer to the general area of Mathematics, so henceforth we mention this particular field in a theoretical perspective and the subject name in the context of the study.

Following the general results in a previous article (Pais, Pires, & Chagas, 2018), a new perspective of data is presented in the current study, in light of the distinction between these two different subjects, so as to identify the main dissimilarities between them. Additionally, new correlations between variables are investigated, such as (i) gender vs receptiveness to Kahoot!, (ii) gender vs recommendation of use and (iii) technology readiness vs receptiveness to Kahoot!.

Therefore, the first objective of the study is to investigate and understand how online quizzes, specifically using the Kahoot! platform, are useful for reviewing academic content.

The second objective is to evaluate the impact of online quizzes, particularly Kahoot!, on student motivation within the higher education context, especially assessing how the gamified structure of activities influences students' interest for learning.

The third objective is to explore correlations between specific variables, as previously mentioned. This involves a thorough examination of survey data to identify any trends or distinctions between the opinions and recommendations of male and female students on Kahoot! Additionally, the study aims to investigate the influence of students' technology readiness on their receptiveness to this game-based learning tool.

This way, we believe we can contribute to a more comprehensive understanding of the factors that influence student attitudes to educational technologies.

4. METHODS

In this case study, the authors used a game-based learning platform in class, namely Kahoot!, which students could access through their mobile devices, with the intention of encouraging them and promoting their participation and motivation. The platform was used in three lecture classes that corresponded to the conclusion of a syllabus topic. Kahoot! quizzes were therefore mainly used for reviewing class content.

A satisfaction survey was used to gather information about Tourism students' perceptions and quantitative data were collected. A few general questions were adapted from Esteves, Pereira, Veiga, N, Vasco, and Veiga, A (2018) but other questions were added with the intention of analyzing the effect of the use of Kahoot! in the context of Mathematics and English. For those questions a five-point Likert scale was used. For some questions, 1 corresponded to "not at all" and 5 to "very much", while in other questions 1 corresponded to "not important" and 5 to "very important".

A statistical analysis of the data was performed using Excel and IBM Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics (mean, median and standard deviation) were computed to examine the results that were obtained in the

different areas of study. A multivariate analysis was also performed in order to understand the relationship between different variables, firstly analysed through descriptive statistics. At the multivariate level, contingency tables were used in order to analyse pairs of variables and verify independency tests, through Pearson's Chi-Square, with α=5% (significance level):

Figure 1.
Chi-Square Statistics.

$$\chi^2 = \sum_{j=1}^{m}\sum_{k=1}^{n} \frac{\left(n_{jk} - \frac{n_{j.}n_{.k}}{N}\right)^2}{\frac{n_{j.}n_{.k}}{N}}$$

4.1. Respondents

The respondents of this case study were 86 undergraduate students from a Portuguese higher education institution, in the academic year of 2017-2018. The curricular units, henceforth referred to as CU (English for Events II, English for Recreation IV and Statistical Analysis) were set within Tourism-related degree courses. In particular, 32 were English students, whereas 54 were Statistical Analysis students.

Table 1.
Distribution of participants.

	Participants	Respondents
English	48	32
Statistical Analysis	60	54
Total	108	86

From the 86 respondents, 66 (77%) are female and 20 male (23%), as shown in the table below (Table 2).

Table 2.
Gender of respondents.

	Respondents
Male	20
Female	66
Total	86

5. RESULTS AND DISCUSSION

The highest mean score in both subjects is related to item 3 "It was fun using Kahoot!" (English: m = 4.78, sd = 0.491; Statistical Analysis: m=4.65, sd=0.555). Therefore, high scores in both items show that all students, regardless of the CU attended find it fun to use Kahoot!.

As far as the lowest mean scores are concerned, results converge in both subjects with item 2 “Using Kahoot! will contribute to having a better grade in the CU”. The results were m = 3.75, sd = 1.016 in English I and m = 3.43, sd = 0.983 for Statistical Analysis, as shown in the table below (Table 2). High standard deviation values seem to imply, however, that the students’ opinion is not consensual. (English: sd=1.016; Statistical Analysis: sd=0.983). Also, despite being the lowest score, the mean is relatively high, as we can see in table 3.

The survey results corroborate that using Kahoot! provides a less rigid method of learning, makes it more interactive and interesting (Q9), makes classes more active, lively and dynamic (Q10) and that students recommend using Kahoot! (Q6). The results also indicate that the students consider it important for the teachers to resort to different teaching-learning methodologies such as Kahoot! in the classroom. However, this result does not appear to be highly consensual to the English students (sd=0.950).

The results on the platform’s contribution to a more positive view of the CU show that, even though the mean is considerably high (superior to 4 in the 3 CUs), students' opinions are not consensual because they present a high value for the standard deviation (English: sd=0.907; Statistical Analysis: sd=1.060). The question “The response time in Kahoot! is adequate” also does not appear to be consensual among the English (sd=0.096) and Statistical Analysis students (sd=0.951), and the question “It facilitates the interaction between lecturer and student” does not appear consensual among the English students (sd=1.045). The average scores for both CU show that results are slightly higher in English (4.40) than in Statistical Analysis (4.21).

The survey results are presented in Table 3.

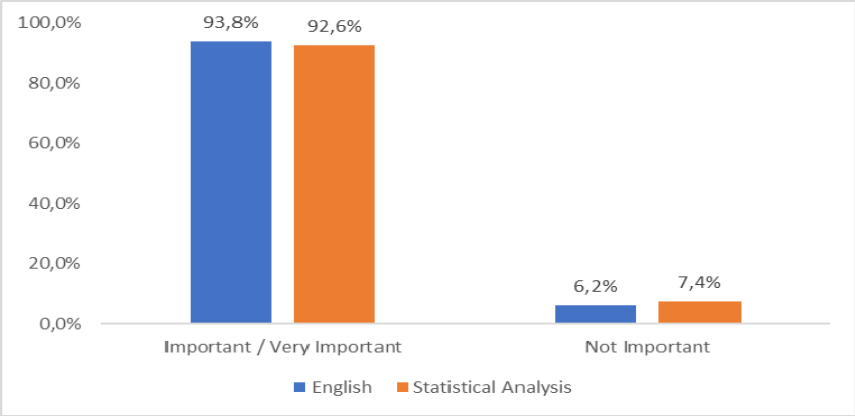
Table 3.
Results of individual survey according to curricular unit (CU).

	English			Statistical Analysis		
	Mean (1 to 5)	Std Dev	Median	Mean (1 to 5)	Std Dev	Median
1 - I believe that Kahoot! contributed to consolidate the contents of the CU.	4.06	1.014	4	4.09	0.875	4
2 - Using Kahoot! will contribute to having a better grade in the CU.	3.75	1.016	4	3.43	0.983	3
3 - It was fun using Kahoot!.	4.78	0.491	5	4.65	0.555	5
4 - The response time in Kahoot! was adequate.	4.31	0.896	4.5	4.04	0.951	4

5 - I find it important to be able to see the scoreboard.	4.25	0.803	4	3.81	1.150	4
6 - I recommend using Kahoot! in the classroom.	4.44	0.759	5	4.41	0.659	4.5
7 - It contributes to a more positive attitude towards English/ Mathematics.	4.38	0.907	5	4.17	1.060	4
8 - It makes learning more challenging, interesting and stimulating.	4.38	0.793	4	4.22	0.793	4
9 - It provides a less rigid learning method making it more interactive and interesting.	4.53	0.621	5	4.37	0.623	4
10 - It contributes towards more active, lively and dynamic classes.	4.56	0.564	5	4.50	0.575	5
11 - It facilitates the interaction between lecturer and student.	4.44	1.045	5	3.98	0.879	4
12 - I find it important for lecturers to use different strategies such as Kahoot! in the classroom.	4.47	0.950	5	4.48	0.720	5
Average score	4.40			4.21		

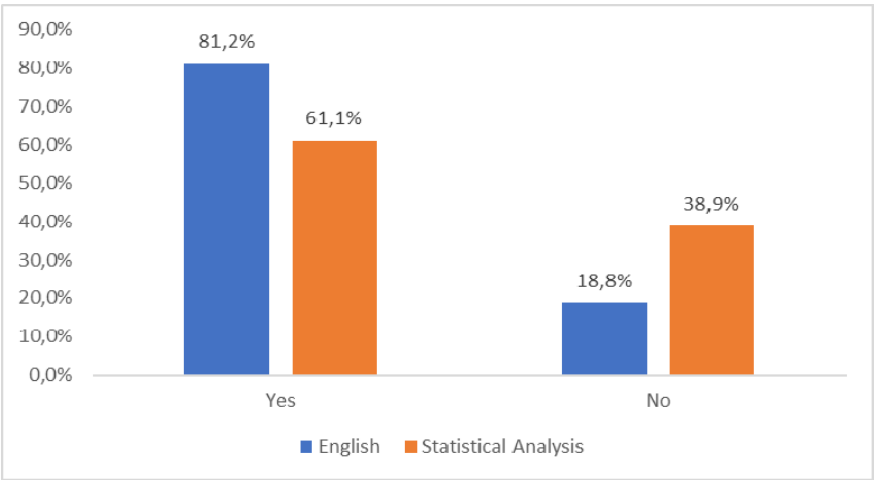
Regarding the question "Do you consider the use of Kahoot! in classes to be important?", results are very high in both subjects (93,8% for English and 92,6% for Statistical Analysis), with a slightly higher percentage for English. The results are shown in figure 2.

Figure 2.
Do you consider the use of Kahoot! in classes to be important?



As for the question "Did Kahoot! help you like the CU better?", results are also high (81,2% for English and 61,1% for Statistical Analysis), but not as much as in the previous question. Moreover, in this question we can find a more pronounced difference between the two subjects (nearly 20%). The results are shown in figure 3.

Figure 3.
Did Kahoot! help you like CU better?



Regarding the general results, other studies show similar conclusions, not only about the fact that higher education students finding the use of Kahoot! as fun and entertaining, particularly in Maths (Bullon, Encinas, Sanchez, & Martinez, 2018).

More specifically, literature shows that Kahoot! can foster and reinforce English learning in undergraduate students, by inducing motivation as well as engagement (Bernal, Ares, Bernal, Nozal, & Sánchez, 2018), providing a meaningful language learning experience (Kaur & Naderajan, 2019). In parallel, Maths students find this platform to be

beneficial, as it allows them to "self-evaluate their learning process" (Curto Prieto, Orcos Palma, Blázquez Tobías, & León, 2019, p. 10).

Furthermore, we can find evidence on how this platform can set up a positive atmosphere in more lively and dynamic classes in these specific subjects: "It was found that Kahoot! had a positive effect on learning both for K-12 and higher education, as well as for language learning, technical and engineering fields, science, math, business, and nursing" (Wang & Tahir, 2020, p. 12).

In order to observe the non/existence of independency among variables, multivariate analysis was also performed using the Pearson Chi-Squared Test. Contingency tables analyses have been used, through the independency test of Pearson Chi-Squared, in order to understand if:

- there are relationships between different variables and the curricular units that should be considered;
- there are relationships between different variables and the gender that should be considered;
- there are relationships between variable 2 ("I consider the use of Kahoot! in classes to be important") and variable 3 ("I feel comfortable using electronic gadgets") that should be considered (p-value=0.618).

The results show that for a significance level (α) of 5%, all the crossings obtained a p value higher than 0.05, which means that there is no relationship between the variables when crossed with the curricular units and with the gender (Table 4).

Table 4.
Variables crossed with curricular units and gender.

Variables	**Curricular Units**	**Gender**
	Pearson Chi-Squared Test	Pearson Chi-Squared Test
1- I recommend using Kahoot! In the classroom	(=0.293)	(=0.551)
2- I consider the use of Kahoot! in classes to be important	(=0.158)	(=0.105)
3- I feel comfortable using electronic gadgets	(=0.550)	(=0.701)

6. CONCLUSION

One of the main conclusions of this study is that students tend to show a very positive attitude towards the use of technology in general and specifically towards Kahoot!.

With regard to the differences between students' perceptions in two disparate subjects, namely English and Statistical Analysis, the survey results indicate that mean scores are generally similar, although they are slightly higher in English.

Lower scores concerning students' perspective on the use of Kahoot! to improve their grades are not in line with the conclusions of other studies (Aljaloud, Gromik, Billingsley, & Kwan, 2015; Esteves, Pereira, Veiga, Vasco, and Veiga (2018)), so a deeper analysis on

this perspective would be relevant, as there are only few studies pertaining to this topic (Wang & Tahir, 2020).

Another important result refers to the non-existence of significant differences in terms of gender and area of study (English and Mathematics) regarding the variables examined. Other studies (Izquierdo-Álvarez, Lahuerta-Otero, & Cordero-Gutiérrez, 2018) had similar results regarding gender.

Future studies should focus on the impact of online quizzes in academic performance. In this respect, Zainuddin, Shujahat, Haruna, and Chu (2020) found positive results when comparing them to traditional methods, as they concluded "that the employment of innovative gamified e-quiz applications and paper-based quizzes were effective in evaluating students' learning performance, particularly as formative assessment used after the completion of each topic" (p. 103729). Besides, Bognár, Fauszt, and Váraljai (2021) found that self-monitoring practice and instant feedback can contribute to the effectiveness of learning.

A few recommendations in the context of the use of online quizzes in class might involve their incorporation into different subjects. Moreover, the development of training programs or workshops in designing and implementing effective online quizzes could be important. This could involve not only technical aspects but also strategies for fostering student engagement and motivation through gamified learning experiences. Finally, it should be important to assess how the implementation of gamified learning tools can work on knowledge retention and academic achievement.

In sum, bearing in mind that Kahoot! provides "opportunities to engage with the lecturer, peers and lecture content" (Licorish, Owen, Daniel, & George, 2018, p. 21), it is the authors' belief that this study can positively contribute to disseminate new strategies that can impact students' motivation for learning and ultimately their academic performance.

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AUTHORS' INFORMATION

Full name: Sónia Isabel Vieira Mortágua Pais
Institutional affiliation: Center for Research and Development in Mathematics and Applications, University of Aveiro; Centre for Tourism Research, Development and Innovation, Polytechnic Institute of Leiria (Portugal)
Institutional address: Escola Superior de Turismo e Tecnologia do Mar | School of Tourism and Maritime Technology. Politécnico de Leiria | Polytechnic Institute of Leiria
Campus 4 , Rua do Conhecimento, n.º4, 2520-614 Peniche – Portugal
Short biographical sketch: Sónia Pais, PhD in Education, is Associate Professor at the Polytechnic of Leiria. She is a researcher at CiTUR- Centre for Tourism Research, Development and Innovation. Her research interests are in educational sphere, including how best to teach math subjects. She has a keen interest in Mathematical Education, Educational Technology, Pedagogical Innovation, Game Based Learning, Information and Communication Technologies, Mathematical Tourism, Math Trails, Popularization of Mathematics and Mathematics and Arts. She is particularly interested in the different aspects of digital learning and how digital technologies can be used to achieve educational goals, particularly through the use of game-based learning. She is actively involved on the pedagogical potential of escape rooms, games and technology in the context of design education.

Full name: Laura Vala Chagas
Institutional affiliation: CiTUR – Centre for Tourism Research, Development and Innovation, Polytechnic Institute of Leiria (Portugal); CI&DEI (Portugal)
Institutional address: Escola Superior de Turismo e Tecnologia do Mar | School of Tourism and Maritime Technology. Politécnico de Leiria | Polytechnic Institute of Leiria
Campus 4, Rua do Conhecimento, n.º4, 2520-614 Peniche – Portugal
Short biographical sketch: Laura Chagas is Associate Professor of English at the Polytechnic of Leiria (School of Tourism and Maritime Technology). She holds a PhD degree in ICT in Education from the University of Lisbon, within a grant from a Doctoral Program called 'Technology-Enhanced Learning and Societal Challenges'. She has been teaching in higher education since 2009. Pedagogically, she has been mainly involved in teaching English for Specific Purposes, namely English for Tourism and other curricular units in this field, such as English for Events or English for Marketing. Regarding her research interests, they mainly focus on online teaching and learning, emerging technologies in English language learning, AI in Education and Tourism studies.

Full name: Ana Luísa de Oliveira Gonçalves Pires
Institutional affiliation: Centre for Tourism Research, Development and Innovation, Polytechnic Institute of Leiria (Portugal)
Institutional address: Escola Superior de Turismo e Tecnologia do Mar | School of Tourism and Maritime Technology. Politécnico De Leiria | Polytechnic Institute Of Leiria
Campus 4, Rua do Conhecimento, n.º4, 2520-614 Peniche – Portugal
Short biographical sketch: Ana Luísa Pires is an Associate Professor of English at the Polytechnic of Leiria (School of Tourism and Maritime Technology). She holds a PhD in Literature from the University of Aveiro. She has been teaching in higher education since 2000. Pedagogically, she has been mainly involved in teaching English for Specific Purposes, namely English for Tourism and English for Hotel Management. Her research interests include online teaching and learning, cultural tourism and language education for tourism.

Chapter #17

POSITIVE DIGITAL LEARNING: CHALLENGES AND PATH FORWARD FOR EDUCATORS

Dimitra Pappa[1], Jan Pawlowski[2], Kati Clements[3], & Sofoklis Sotiriou[4]
[1]*National Centre for Scientific Research "Demokritos", Greece*
[2]*Ruhr West University of Applied Sciences, Germany*
[3]*University of Jyväskylä, Finland*
[4]*Ellinogermaniki Agogi, Greece*

ABSTRACT
Digital technologies are rapidly changing teaching and learning in the 21st century as both teaching methods and priorities are evolving. Likewise, the skills required of 21st century educators are constantly evolving, and while it is widely recognised that digital literacy is critical, there is no general consensus on what it means for an educator to be digitally literate and what competencies should be included in literacy frameworks for educators. The debate over teachers' digital competencies continues as the rapid pace of technological change makes it difficult to keep up with the latest trends. At the same time, other critical dimensions emerge that also need to be taken into account. In the present research, we examine the impact of two significant challenges that have emerged in recent years on educators' competencies: Emergency Remote Education (ERE) and generative artificial intelligence (generative AI). We examine their practical implications and the resulting emotional challenges of using digital technologies in education. We critically discuss existing competency frameworks that outline the knowledge, skills and attitudes that educators should possess to effectively support student learning and development. Based on the lessons learned, we discuss future directions for their improvement, namely the integration of digital skills with emotional e-competencies, towards the development of a holistic framework for positive digital learning.

Keywords: digital competence framework, technostress, educators, Emergency Remote Education, generative artificial intelligence.

1. INTRODUCTION

Digital technologies are rapidly changing teaching and learning. Teaching in the 21st century is not the same as **both teaching methods and priorities have changed.** In addition to teaching core subjects, teachers must also teach and develop students with skills for the 21st century (P21, 2019). To ensure that students can develop, practice, and apply 21st Century Skills, teachers must have the expertise and competence to teach and train students in 21st Century Skills. Education is increasingly enabled, supported and guided by technology, including artificial intelligence, data management and ubiquitous access technologies, etc. However, just as the mere existence of digital technology does not guarantee its usefulness for quality learning, the mere familiarisation of teachers with digital technology does not suffice either. Against this backdrop, there is a growing consensus that **digital literacy** is essential for teachers in the 21st century. There is a growing movement to support teachers in developing their digital skills. This includes providing professional

development opportunities, creating digital resources for teachers and developing digital literacy standards.

The problem of better preparing teachers to use digital technologies effectively and productively in schools is a complex challenge (Falloon, 2020). Janssen et al. (2013) stressed that digital competency goes beyond knowing how to use devices and applications. They described **digital competence** as a "conglomerate of knowledge, skills, and attitudes connected to various purposes (communication, creative expression, information management, personal development, etc.), domains (daily life, work, privacy & security, legal aspects), and levels" (Janssen et al., 2013, p.479). Equally, the digital competency for teachers should move beyond the often dominant technical and literary conceptualisations and adopt a more holistic understanding that takes into account the increasingly complex knowledge and skills needed to be ethical, safe and productive in diverse, digitally mediated environments (Falloon, 2020). Educators need to learn how digital environments and resources can enhance and impact their teaching practice and learning experience. They must be able to integrate new technologies and use devices appropriately and effectively. This requires distinctly different skills and competencies to function effectively in the classroom and respond to the demands of the 21st century. The technological skills of teachers are therefore increasingly emphasised. There are several **competency frameworks that describe the required digital skills of educators,** i.e. the knowledge, skills and attitudes educators need to effectively integrate technology into their classrooms and support student learning in a digital environment. Each of these frameworks offers a unique perspective on what educators should know and be able to do to effectively support student learning and development in a digital environment.

While it is widely recognised that digital literacy is critical for educators in the 21st century, there is a lack of shared agreement on what it means for an educator to be digitally literate and what should be included in digital literacy frameworks for educators. **The debate over teachers' digital skills continues as the rapid pace of technological change makes it difficult to keep up with the latest trends. At the same time, other critical dimensions emerge that also need to be taken into account.** In the present work, we examine the impact of two significant challenges that have emerged in recent years on educators' competencies: **Emergency Remote Education (ERE) or Emergency Remote Teaching (ERT) and generative artificial intelligence (generative AI).**

From the beginning of 2020, the COVID-19 pandemic impacted education provision worldwide as educational institutions had to abruptly switch to **Emergency Remote Education** (Ahmed, 2021; Bond, 2021; Chiu & Lapeyrouse, 2021; Dennis, 2021; Donham et al., 2022). The term Emergency Remote Education describes the sudden transition from traditional in-person instruction to online learning due to unforeseen circumstances. ERE during the COVID-19 pandemic has significantly changed the professional roles of teachers, underscoring a deficit in essential digital skills (Sánchez-Cruzado, Santiago Campión, & Sánchez-Compaña, 2021; Li & Yu, 2022) while highlighting the need to strengthen the resilience of education systems (UNESCO & IIEP, 2020). It has proven to be a challenging experience for both teachers and students (Meinck, Fraillon & Strietholt, 2022; OECD, 2021). Although digital education technologies were crucial in the early stages of the pandemic, their forced adoption posed significant challenges and had both benefits and negative consequences (Dhawan, 2020; König, Jäger-Biela, & Glutsch, 2020; Toquero, 2020).

Last year also saw the **rapid rise of generative AI.** In November 2022, OpenAI announced the release of ChatGPT, a generative, pre-trained transformer model capable of generating texts, translating languages, writing various types of creative content, and answering questions in an informative manner. As generative AI chatbots continue to

develop, they are likely to become more sophisticated and useful. This has the potential to revolutionise the way we interact with computers. In education, generative AI is quickly becoming a transformative innovation with far-reaching impacts on pedagogy and teaching practice. It also raises ethical concerns regarding issues such as bias and privacy, originality and plagiarism, etc., highlighting their importance of critical thinking (Lim, Gunasekara, Pallant, Pallant, & Pechenkina , 2023). Teachers need explicit training to understand and use this technology. Educators need to "model responsible use of ChatGPT, prioritise critical thinking, and be clear about expectations" (Cooper, 2003, p. 444). This requires appropriate professional development opportunities to equip educators with the necessary skills and knowledge about the capabilities and uses of Generative AI in education, as well as best practices for incorporating this technology into their teaching practice (Kasneci et al., 2023; Mogavi et al., 2023).

In Section 2 we examine current trends in the use of digital technologies in education and discuss the rising challenges of Emergency Remote Education (ERE) and generative artificial intelligence (generative AI) use in the field. In Section 3 we investigate the emotional challenges of using technology in education, with particular reference to technostress in online education. Subsequently, in Section 4 we critically examine the principal competency frameworks for educators, and we discuss future directions for their improvement.

2. BACKGROUND: CURRENT TRENDS IN THE USE OF DIGITAL TECHNOLOGIES IN EDUCATION

2.1. Shift to Digital: Emergency Remote Education

During the Covid-19 pandemic, emergency distance learning was used to provide a temporary solution for learning. Facing this unprecedented situation, teachers and schools looked for ways to continue teaching during the pandemic to ensure their students could continue learning at home. The aim of ERE was to provide fast, practical and reliable access in times of crisis so that learning can continue, i.e. to create the most flexible, efficient and effective teaching environment for teachers and students in an emergency situation (Dhawan, 2020; Toquero, 2020). Teachers had to switch to online teaching, using various digital tools and resources and implementing new teaching and learning approaches (König et al., 2020). To this end various solutions have been implemented including online learning management systems, educational apps and websites, etc. This sudden transition from traditional face-to-face instruction to online learning has proven to be a challenging experience for both teachers and students (Kim & Asbury, 2020; Reimers, 2021). There are many factors associated with the challenges of emergency distance learning, such as: technological skills, choice of platforms, internet connections, content knowledge, innovative strategies, pedagogical skills, digital equity etc (Dhawan, 2020; König et al., 2020; Toquero, 2020).

Both teachers and students may experience difficulties with digital educational technologies. Many teachers have not received any training for online teaching (Winter, Costello, O'Brien, & Hickey, 2021). This can make it difficult for them to create and deliver effective lessons. Students may also find it difficult to use technology to learn. This can lead to frustration and reduced engagement. Teachers and students may not have access to the resources they need for online classes, such as laptops, software, or internet access. Students with disabilities may face additional challenges due to the lack of specialised equipment. During distance learning, technical difficulties such as internet disruptions or software

problems may occur, which can disrupt the learning process. As a result, distance learning can lead to increased stress and anxiety among teachers and students.

König et al. (2020) concluded that information and communication technologies (ICT) tools, particularly digital teacher competence and teacher education opportunities to learn digital competence, are instrumental in adapting to online teaching during COVID-19 school closures. Winter et al (2021) stressed that for the successful use of technology by teachers' internal barriers need to be addressed as well, namely attitudes and beliefs, confidence and skills. Overall, the COVID-19 pandemic highlighted the need to **rethink digital skills,** i.e. to develop digital competency frameworks for educators that are more comprehensive, relevant and aligned to the challenges and realities of teaching and learning in a virtual environment. It became clear that the effective integration of digital technologies and innovative pedagogy into education requires a rethinking of the digital competence portfolio of educators. Competences are required for a seamless transition to digital learning scenarios as well as competences and skills to react to psychological effects such as technostress, depression or isolation. In this landscape, **resilience and adaptability** have become pivotal for effective planning and adjustment. A distance learning educator should be equipped to support student learning and growth in a virtual or remote setting. This calls for not only a comprehensive understanding of the technologies and tools required for distance learning but also the pedagogical skills tailored for online and remote learning spaces. These skills include the ability to communicate effectively with students online, manage student behaviour constructively, maintain an organised and effective virtual classroom, and foster a positive and safe learning environment. Above all, educators should possess the ability to create and facilitate engaging, interactive online learning experiences for students.

While scholars like Hodges, Moore, Lockee, Trust, and Bond (2020) draw attention on the differences between ERE during the COVID-19 pandemic and regular online learning, stating that ERE cannot be equated with online learning, since "well-planned online learning experiences are meaningfully different from courses offered online in response to a crisis or disaster", there are valuable lessons to be drawn.

2.2. The Fast Pace of Change: The Advent of Generative AI

As information and communication technologies change rapidly, they disrupt traditional practices, change the scope, methods and tools of teaching and learning in formal education and require people to adapt, considering the potential advantages and disadvantages. The fourth industrial revolution (IR4.0) is characterised by disruptive technologies, processes and practices. The resulting educational paradigm (**Education 4.0**) questions the basic assumptions of traditional education. Education 4.0 is increasingly enabled, supported and guided by technologies such as **artificial intelligence (AI), machine learning (ML), data analytics, mobile technologies, robotics, internet of things, cloud computing, big data analytics,** etc (González-Pérez & Ramírez-Montoya, 2022; Huk, 2021). The fourth industrial revolution is an ongoing process that continues to shape and evolve our world today. Possible future educational paradigms beyond education 4.0 are constantly discussed. Although significant strides have been made in integrating technology into education, there remains a need for comprehensive frameworks that provide guidance and support for educators to adapt their teaching practices to the changing demands of the digital age. Educators are striving to keep up with the rapid pace of change. Therefore, the development and implementation of frameworks to support teachers and schools in preparing for Education 4.0 and Industry 4.0 is an ongoing challenge. New technologies and trends are constantly emerging, making it difficult to create comprehensive and static information.

The recently accelerated pace of technological advances makes it difficult to develop frameworks that can keep up with the evolving landscape. The rise of **generative AI (like ChatGPT)** is fast becoming a transformative innovation with far-reaching implications for pedagogy and classroom practice, also raising ethical concerns around issues such as bias and privacy, originality, and plagiarism, etc and underscoring the importance of critical thinking (Lim et al., 2023). The discussion about how generative AI tools can fit into current research and teaching pedagogy has already started but has not yet found clear answers. As a result, reactions are mixed. Some educators consider it a progressive move that can help increase students' self-efficacy and motivation to learn, while others sound the alarm stressing that it has the potential to encourage superficial learning, limit analytical skills, and encourage misbehaviour (Grassini, 2023; Kasneci et al., 2023; Mogavi et al., 2023). From this perspective, Rahman and Watanobe (2023) note that it is important to keep the limitations of generative AI in mind when using it and not to rely on it blindly. Cooper (2023, p. 444) stresses that educators need to "model responsible use of ChatGPT, prioritise critical thinking, and be clear about expectations". Teachers need explicit training to understand and use this technology. This requires appropriate professional development opportunities to equip educators with the necessary skills and knowledge about the capabilities and uses of Generative AI in education, as well as best practices for incorporating this technology into their teaching practice (Kasneci et al., 2023; Mogavi et al., 2023).

As technologies advance, it is expected that they will continue to transform the learning tools that teachers have used in the past decades. Teachers will need explicit training on how to understand and use these new emerging technologies in their future classrooms. A **continuous rethinking of digital competency frameworks** is needed to help educators effectively adapt their practices to the evolving landscape and its needs. However, it is not enough to simply revise competences from a technical/operational perspective. Rapid technological advances can also be a source of anxiety **and stress** for teachers who feel overwhelmed by the pace of change. Generative technologies in particular are constantly evolving, and it can be difficult for teachers to keep up with the latest trends. This can leave them feeling insecure and less confident in their ability to use these technologies effectively.

The following section explores the emotional challenges of using technology in education, with particular reference to technostress in online education.

3. THE EMOTIONAL CHALLENGES OF USING DIGITAL TECHNOLOGIES IN EDUCATION

The use of digital technologies in education presents teachers with significant emotional challenges. Digital learning technologies can be a double-edged sword for teachers. On the one hand, they can be a powerful tool to improve learning and make it more engaging and personalised. On the other hand, they can also be a source of stress and anxiety.

3.1. Technostress

Originally, Brod defined technostress as 'a modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner'' (Brod, 1984, p. 16). Since then, the term has been widely used and studied in various fields, including school education and, more recently, distance learning.

Today, technostress is often understood more broadly as "stress "caused by individuals' attempts and struggles to deal with constantly evolving ICTs and the changing physical, social, and cognitive requirements related to their use" (Tarafdar, Tu, Ragu-Nathan,

& Ragu-Nathan, 2007, p.304). The effects of technostress can be very diverse, depending on the situation and the individual. Mäkikangas et al (2017) noted that stress can be physical or mental for an individual. Technostress can have different causes, strains, inhibitors, and impacts (Nisafani, Kiely, & Mahony, 2020). Salo, Pirkkalainen, and Koskelainen (2019) analysed it in terms of stressors (technostress sources) and strains (technostress results or consequences). Stressors can include factors such as information overload, constant interruptions, difficulty using new technology, and fear of technology obsolescence. Strains can include physical symptoms (such as headaches or eye strain), emotional symptoms (such as anxiety or frustration), and behavioural symptoms (such as decreased job performance or increased absenteeism). Technostress can arise from various sources, such as difficulty adapting to new digital platforms and tools, information overload, technical problems, and feelings of isolation. It can lead to decreased motivation, burnout, and negative impacts on mental and emotional well-being, and can have a negative impact on learning outcomes and performance.

In their study of the "dark side of technologies", Salanova, Llorens, and Cifre (2013) investigated two psychological experiences of technostress associated with the use of information and communication technologies (ICT), i.e., techno-strain (Users report feelings of anxiety, fatigue, scepticism, and beliefs about ineffectiveness associated with technology use) and techno-addiction (users feel bad due to excessive and compulsive use of these technologies).

Technology has become an increasingly important part of teaching at all levels of education. Joo, Lim, and Kim (2016) found that lack of training, inadequate infrastructure, and lack of support from technology specialists can cause anxiety and tension among teachers, which can lead to psychological and physical stress related to technology use. Technostress can influence their intentions to use technology and have a negative impact on the active adoption of new technologies. Over the past few decades, much effort has been devoted to combating the various adverse effects of technology. Positive computing has emerged for building digital environments that can make us happier and healthier, not just more productive. It "comprises concepts, processes and systems which contribute towards the quality of life and well-being of users" (Pawlowski et al, 2015, p. 406). Opposite to problem-focused psychology, positive psychology has been promoted as a scientific approach to studying "what makes life most worth living" focusing on strengths instead of weaknesses, and on building the good in life instead of repairing the worst (Peterson, 2008). Similarly, positive education is pursued as 'education for both traditional skills and happiness'. (Seligman, Ernst, Gillham, Reivich, & Linkins, 2009, p.293). Efforts also include the design and development of technologies to "support well-being and human potential" (Calvo & Peters, 2014).

3.2. Technostress in Online Education

Technostress in online education refers to the negative impact of technology use on a teacher's or student's well-being, including physical and mental health, work-life balance, and overall quality of life. This can lead to decreased motivation, burnout, and negative impacts on mental and emotional well-being, and negatively impact learning outcomes and performance. Increased dependence and exposure to the use of technology for distance education can jeopardise the **well-being of individuals** as the boundaries of school and personal life are harder to maintain and negatively associated outcomes and side-effects of technology use may arise, such as **stress from technology use** (Tarafdar et al. 2007). Students often experience difficulty adapting to new digital platforms and tools that can hamper student learning and increase stress levels (Fuchs, 2021; Chiu & Lapeyrouse, 2021; Mu, Florek-Paszkowska, & Pereyra-Rojas, 2022; Yang, Liu, Li, & Li, 2022). The balance between online classes and other tasks and distractions can lead to time management issues

and stress. Students can experience information overload and stress from managing and processing large amounts of digital information. Online education can limit face-to-face interaction and lead to feelings of isolation and stress. Technostress can lead to decreased motivation, burnout, and a negative impact on mental and emotional well-being. Technical problems and disruptions can disrupt learning and cause stress. Similarly, **technostress can affect teachers** in several ways (Mokh et al., 2021; Nang, Maat, & Mahmud, 2022; Siddiqui, Arif., & Hinduja, 2023). Integrating technology into the classroom and using up-to-date digital tools can increase their workload and stress levels. Technical problems can lead to frustration and stress. Additionally, teachers can feel overwhelmed when transitioning to new digital tools and platforms. The balance between technology-enhanced teaching and traditional teaching methods and administrative tasks can lead to time constraints and stress. Technostress can lead to burnout, reduced job satisfaction and reduced motivation (Aktan & Toraman, 2022). Technostress can negatively impact teachers' mental and emotional well-being, leading to anxiety and depression (Estrada-Muñoz, Castillo, Vega-Muñoz, & Boada-Grau, 2020). Technostress influences the intention to use technologies. Gabbiadini, Paganin, and Simbula (2023) examined the role of technostress in the intention to use digital technologies for distance learning and concluded that technostress is a crucial variable in determining the use of distance learning technologies. They also found that organisational support can act as a protective factor against stress caused by the use of technology in organisational environments. Khlaif et al. (2023) model of techno-stressors among academics was found to include: schedule overload, complexity, uncertainty, uselessness, invasion, and compulsion.

Overall, Technostress **can arise from a variety of sources,** such as difficulty adapting to new digital platforms and tools, information overload, technical problems and feelings of isolation. As new digital tools and platforms are introduced, teachers may need to learn new skills and ways of working. This can create stress, especially when the technology is complex or not user-friendly. Furthermore, with so much digital information available, identifying what is important can be difficult. This can leave teachers and students feeling overwhelmed and stressed. Technical issues such as system crashes, slow internet connections or device malfunctions can be frustrating and stressful as well. In addition, the extended use of technology in communication can lead to feelings of isolation and disconnection from others, especially when face-to-face interactions are reduced. The main **technology stressors** (Donham et al., 2022; Aktan & Toraman, 2022) associated with the use of technology in online education include: technical difficulties (e.g. poor internet connection, hardware failure), time management and workload, difficulty in adapting to new digital platforms, lack of human interaction and social support, distractions and lack of concentration, information overload, difficulty in staying organised and motivated, feeling isolated and disconnected from classmates and trainers etc. Overall, technology stressors can be roughly divided into four main categories:

- **Technical challenges**: Difficulties with hardware, software, or internet connectivity.
- **Learning Challenges**: Adapting to new digital platforms, information overload and difficulty staying organised and motivated.
- **Social Challenges:** Lack of human interaction, social support and feelings of isolation.
- **Time Management Challenges**: Heavy workloads, difficulty balancing multiple responsibilities, and distractions.

The POSITIVE LEARN (POSITIVE LEARN, 2023) investigation into technostress situations in distance learning classes identified three core themes and relevant mitigation strategies, namely technostress related to:

- **Technology use and network connections,** such as power cuts, empty batteries, scarcity of devices, hybrid learning situations etc.
- **Access to learning materials/educational content**, such as digital content being either too basic and unmotivating, or very disruptive, teachers' perceived lack of control over the digital content that students watch in classroom etc.
- **Professional development of teachers' mechanisms,** including their lack of technical skills, lack of motivation to use technology, the poor pedagogical support for teaching with technology during teacher education etc.

This implies that **the support teachers need** to better deal with technostress spans several areas, ranging from professional development opportunities to technical, peer and administrative support, and access to mental health resources (Whalen, 2020; Dennis, 2021; Daneshmand, Harris, & Viviani, 2022). Access to training and professional development programs can help teachers develop the competencies they need to effectively integrate technology into their classroom. Availability of technical support staff can help resolve technical issues and provide assistance with digital tools and platforms. Opportunities to collaborate with colleagues will allow teachers to exchange ideas, experiences and strategies for coping with technostress (learn from others' experiences and knowledge, solve problems related to technology use, receive social support). Support from school administration is needed in terms of providing adequate resources, reducing workload and recognizing the importance of managing technostress. To this end, the availability of mental health resources, training and support for teachers struggling with technostress is critical. In addition, teachers need a combination of **technical, pedagogical, and social and emotional competences** to better deal with technostress.

3.3. Generative AI Technology in Education and Technostress

According to Kasneci et al. (2023), the use of large language models such as ChatGPT in education has been identified as a potential area of interest as they offer a diverse range of applications that have the potential to revolutionise teaching and support teaching processes. However, the adoption of Generative AI technology in education can introduce various challenges for users, which can hinder the integration of AI tools into teaching practices. The introduction of generative AI technology in education can pose various challenges for users that can hinder the integration of AI tools into teaching practice. The technology stressors associated with the use of generative AI technology in education for teachers can be divided into four main categories.:

- **Technical challenges**, including issues such as software reliability, compatibility issues, and availability of technical support.
- **Pedagogical and classroom challenges,** relating to concerns about the quality and relevance of AI-generated content, the potential loss of teacher control over materials, student engagement, and the need for teachers to adapt their teaching methods.
- **Privacy and ethical challenges,** including concerns about data protection, ethical content creation, and intellectual property rights as teachers use AI for classroom materials.
- **Professional development challenges,** including access to training and support, limitations, and time management issues, all of which impact teachers' ability to effectively use generative AI technology in education.

4. DIGITAL COMPETENCES FOR EDUCATORS

Table 1.
Digital competence frameworks for educators.

Name	Author	Focus Areas	Scope
Digital Competence Framework for Citizens (DigComp)	Vuorikari Rina, Kluzer & Punie (2022)	The DigComp framework identifies the key components of digital competence in 5 areas: Information and data literacy, Communication and collaboration, Digital content creation, Safety, Problem solving.	DigComp aims to be an enabling, descriptive, and non-prescriptive reference framework for digital competence.
European Framework for the Digital Competence of Educators (DigCompEdu)	Punie (editor), Redecker (2017)	The "DigCompEdu" framework provides a reference framework for the digital competence of educators, focusing on twenty-two competences organised into six areas: Professional engagement, Digital resources, Teaching and learning, Assessment, Empowering learners, and Facilitating learners' digital competence.	DigCompEdu is aimed at educators at all levels of education, from early childhood to higher and adult education, including education and training, special education, and non-formal learning contexts.
UNESCO ICT Competency Framework for Teachers (ICT-CFT)	UNESCO (2018)	The UNESCO ICT-CFT addresses all aspects of a teacher's work: Understanding ICT in education, Curriculum and assessment, Pedagogy, ICT, Organisation and administration, and Teacher professional learning. The Framework identifies three successive stages of a teacher's development: Technology Literacy, Knowledge Deepening, and Knowledge Creation.	The aim of the UNESCO ICT-CFT is to inform education policy makers, teacher trainers, professional learning providers and working teachers about the role of ICT in education reform.
Technological Pedagogical Content Knowledge (TPACK)	Schmidt et al. (2009)	The TPACK framework identifies three primary forms of knowledge that need to be integrated to effectively teach specific content using technology: Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK).	TRACK describes the knowledge and skills required for effective technology integration in teaching. Other important relationships between knowledge forms include: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK).
The Norvegian Professional Digital Competence Framework for Teachers	Kelentrić et al. (2017)	The Norwegian Professional Digital Competence Framework for teachers describes seven key competence areas of: subjects and basic skills, school in society, ethics, pedagogy and subject didactics, leadership of learning processes, interaction and communication as well as change and development.	Each of the seven competence areas describes the knowledge, skills and competence to meet the requirements of each competence area and/or to action plan how to reach the described requirements.
The International Society for Technology in Education (ISTE) Standards for educators	Crompton (2017)	The ISTE framework for educators includes seven competencies – profiles of the teacher as Learner, as Leader, as Citizen, as Collaborator, as Designer, as Facilitator and as Analyst.	The educator section of the ISTE Standards provides a road map to helping students become empowered learners. Digital skills are implicit in every profile/role.
Educators' digital competence framework (EDC)	Siina, C. (2022)	The EDC framework identifies twenty competencies organised into four sections: Knowledge development, Knowledge application, Knowledge sharing, Knowledge communication.	The EDC framework focuses on 'mobilising digital technology for improving inclusive and quality education for all children, with an explicit focus on the most vulnerable'.

The European Parliament and Council (2018) identified digital competence as one of the key competences that every person needs for "**personal fulfilment and development, employability, social inclusion, sustainable lifestyle, successful life in peaceful societies, health-conscious life management and active citizenship**". Digital competence involves "the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society". It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking".

In recent decades numerous **competence frameworks** have been proposed, outlining teachers' required digital competences. The underlying common goal of all digital competency frameworks is to improve the quality of teaching of teachers in the digital age, i.e. to meet the demands of the digital age. Table 1 provides an overview of the most pronounced frameworks.

These frameworks provide an understanding of what it means to be **digitally competent** as an educator from different perspectives. It is widely recognised that digital literacy requires more than just technical knowledge and encompasses a wide range of interrelated skills and attitudes. Digital competence frameworks consider **multiple dimensions of digital competences**, including technical skills, pedagogical knowledge, critical thinking, information literacy, digital citizenship and collaboration. In addition, they typically organise competencies into different areas, such as e.g. digital literacy, digital communication, digital content creation, digital collaboration, digital assessment, etc. The variety of facets examined illustrates the complexity of the task. As technology plays an increasingly important role in education, educators must not only be able to leverage technology, but also effectively integrate new tools and applications into the classroom to teach 21st century skills. The **pedagogical autonomy of educators in the use of technology** is essential. Teachers must understand and master the pedagogical use of digital technologies as well as their potential and limitations.

To support the effective adoption of ever-changing digital technologies and innovative pedagogies in education, a rethinking of educators' digital skills portfolio is required. The COVID-19 pandemic demonstrated that ensuring learning continuity goes beyond the mere adoption of distance learning modalities. Teachers should be able to use new technologies effectively, adapt to changing conditions and address potential learning challenges. The lack of awareness, capacity and professional skills in teachers for the design and implementation of positive distance learning interventions represents a significant barrier, yet a comprehensive approach to training for **eLearning positivity** is lacking. To increase the preparedness and capabilities to avert such negative aspects of learning, new capabilities must be created. Against this background, the aspects of positive psychology/positive computing as a means for teachers to create positive views, emotions and atmospheres in times of crisis prove to be a necessary skill to address psychological/emotional aspects of distance learning. Nevertheless, the "positification" of distance learning in school education is often overlooked (POSITIVE LEARN, 2023). Educators' lack of awareness, capacity and professional skills to design and implement positive e-learning interventions represents a significant barrier, but a comprehensive approach to teaching e-learning positivity is lacking.

Against this background, **social and emotional competencies,** which have already been studied in other contexts, are increasingly seen as crucial in helping teachers and students cope with technostress in digital learning environments. Socioemotional competencies encompass a range of skills and abilities related to understanding, managing, and effectively interacting with one's own emotions and the emotions of others in social contexts.

Mindfulness-based approaches have long since found their way into the medical and psychotherapeutic fields. Introducing **mindfulness** into education aims to improve well-being, mental health, social and emotional skills, resilience, prosocial behaviour, and academic performance (Sheinman & Russo-Netzer, 2021).

Emotional intelligence (EI) has been shown to be crucial in organisational contexts and beyond (Capgemini, 2019). Emotional intelligence is described as "the subset of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions" (Salovey & Mayer, 1990). There are five key elements to EI: self-awareness, self-regulation, motivation, empathy, and social skills.

In the area of digital wellbeing, **emotional e-competencies** refer to an individual's ability to effectively manage and control their emotions in the digital or online environment (Salinas, De Escoriaza, & Hernández, 2022). Emotional e-competencies encompass a set of skills and qualities that enable individuals to navigate digital spaces in an emotionally intelligent and healthy manner. Salinas et al. (2022) developed a renewed model of socioemotional competencies comprising five main components: emotional e-awareness, emotional e-regulation, e-self-control of impulsiveness, emotional e-independence and social e-competency.

Audrin & Audrin (2023) studied the integration of digital competence and emotional intelligence in a digital environment. They developed a conceptual model for **digital emotional intelligence** (dEI), which builds on both trait emotional intelligence (TEI) and ability emotional intelligence (AEI) and associates them with the knowledge, skills, and attitudes of digital competence.

Against this background, emotional e-competences can be seen as essential for digital learning as they form the basis for effective engagement, collaboration and well-being in the virtual classroom. These competencies enable learners to meet the challenges of online education with resilience, adaptability and positive social interactions. Emotional e-competencies are just as important for teachers in digital learning. As educators navigate the challenges and opportunities of online teaching, these skills will enable them to create a supportive and engaging virtual classroom environment. Teachers with strong emotional e-competencies can better understand and connect with their students, respond to their emotional needs, and build trust and relationships, which is especially critical in remote environments. Additionally, these competencies empower educators to effectively manage their own emotions, reduce burnout, and improve their ability to adapt to the evolving digital landscape. They can also enable productive communication with students, resolve conflicts and provide constructive feedback, ultimately leading to a more enriching and successful digital learning experience for everyone involved.

5. CONCLUSION

Digital competence frameworks should help educators develop the necessary skills, knowledge, and confidence in effectively utilising technologies in their teaching practices. Overall, teachers need a combination of **technical, pedagogical and social and emotional competencies** to harness the capabilities and better deal with the challenges of educational technologies. The way forward is to **integrate digital competences with emotional e-competencies, towards the development of a holistic framework for positive digital learning**. Existing digital competence frameworks for educators should be expanded to include critical emotional e-competences required to enable teachers to manage digital

learning spaces in emotionally intelligent and healthy ways, while also responding to the emotional needs of their students.

Furthermore, teacher competency frameworks need to be viewed as dynamic to ensure that educators are well prepared to meet the changing needs of students, adapt to evolving educational practices, and remain consistent with the broader goals and priorities of education systems. Therefore, regular review and revision of these frameworks is essential. In line with the constant revision of competency frameworks, a culture of continuous learning for teachers needs to be created. This means giving them regular opportunities to find out about new technologies and their use in lessons.

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AUTHORS' INFORMATION

Full name: Dimitra Pappa
Institutional affiliation: National Centre for Scientific Research "Demokritos"
Institutional address: Patr. Grigoriou E'& 27 Neapoleos St. Patr. Grigoriou E' & 27 Neapoleos ST., 153 41, Agia Paraskevi, Greece
Short biographical sketch: Dr Dimitra Pappa holds a degree in Electrical Engineering from the National Technical University of Athens (NTUA) with a specialisation in Telecommunications, an MBA from the Hellenic Open University and a PhD from the University of Surrey (UK). She has participated in numerous European and national research and development projects in Information Systems for Technology Enhanced Learning (TEL), eLearning and Knowledge Management as project coordinator, research supervisor, project leader and/or work team member. Projects include POSITIVE LEARN, HEALTH CASCADE, SCIBIOEU, PHAETONS, ADVANCE, CRe-AM, OEI2, OpenScout, PROLIX, PROLEARN, COCAL, etc. She has published several articles in peer-reviewed international scientific journals and conferences.

Full name: Jan Pawlowski
Institutional affiliation: Ruhr West University of Applied Sciences, Germany
Institutional address: Duisburger Str. 100, 45479 Mülheim an der Ruhr, Gemany
Short biographical sketch: Prof. Dr. Jan M. Pawlowski is Professor for Business Information Systems at the Institute of Computer Science at the Ruhr West University of Applied Sciences, Germany, since 2014. Previously, he has been Professor on Globlal Information Systems at the University of Jyväskylä, Finland. He is doing research and teaching in Business Information Systems (Wirtschaftsinformatik). He has been running numerous research proejcts In different fields, in particular Global Information Systems for knowledge intensive processes. He specializes in Digital Transformation, Innovation, Process Management, Competence & Knowledge Management and E-Learning in the global context.

Full name: Kati Clements
Institutional affiliation: University of Jyväskylä
Institutional address: Mattilanniemi 2, 40014 Jyväskylä, Finland
Short biographical sketch: Dr. Kati Clements (PhD in Information Systems Science) is research project coordinator at the Faculty of Information Technology at the University of Jyväskylä and visiting professor of Xi'an Jiaotong University, China. She has worked in and coordinated various European and global projects in the field of Learning Technologies, eBusiness and Open Education since 2005. Currently she is coordinating technology enhanced learning projects in topics like competence development of AI and emerging technologies for teachers and mitigation of technostress in classrooms. Clements's PhD dissertation topic was Quality assurance of Open Educational Resources Repositories. Currently, her main research fields are AI in education and Sustainable Value Co-Creation of digital services. Clements has also managed and coordinated several projects in Finnish-Chinese collaboration on e-Education and e-Business (Next Generation e-Textbooks, eBEREA, SINOFINN Capstone and Artificial Intelligence in eBusiness (AIineBiz)).

Full name: Sofoklis A. Sotiriou
Institutional affiliation: Ellinogermnaiki Agogi
Institutional address: D. Panagea, Pallini 15351, Attiki, Greece
Short biographical sketch: Dr. Sofoklis Sotiriou has worked at CERN, at the National Center for Scientific Research "DEMOKRITOS" in Athens and in the Physics Laboratory of Athens University. He holds a PhD in High Energy Neutrino Astrophysics and a PhD in Science Education. He is the Head of R&D Department of Ellinogermaniki Agogi, one of the biggest educational institutions in Greece, where has been active in the co-ordination and development of research projects on implementation of advanced technologies (e.g. mobile applications, wearable computers, VR and AR applications, robotics) in science education and training. Since 2001 he is the Director of the Ellinogermaniki Agogi Center for Teachers Training.

Chapter #18

INNOVATING TEACHER EDUCATION THROUGH RURAL EDUCATIONAL CONTEXTS: NEW POSSIBILITIES IN TEACHING AND LEARNING

J. Spencer Clark, Eileen M. Wertzberger, & Nooshin Darvishinia
Kansas State University, Manhattan, Kansas, USA

Abstract
In the United States (US), rural schools are often unable to provide the same academic opportunities as suburban and urban schools. Rural student populations are becoming increasingly diverse and require rural schools to provide new services to their community. This chapter examines how we have collaborated with rural schools to address their need for resources, teachers, and support. We use ecological agency to frame the ways contextual affordances and challenges of rural schools provide distinct opportunities for teacher education programs to innovate teaching and learning. Many factors that have prevented sustained and authentic engagement with rural schools have been minimized in recent years through technology and increased broadband connectivity. Technology offers a range of opportunities for teacher education programs to engage more authentically with rural schools and provide sustained support through telepresence-based field and student teaching experiences, distance and online-based supervision, and shared virtual and online pedagogies of the rural. To make these innovations more sustainable, the use of technology in rural schools will need to be evolved and supported in new manners to have an impact on the agency of rural teachers. In this way, rural can be a lens for technological innovation in teacher education and rural schools.

Keywords: rural, teacher education programs, teaching and learning, innovation, ecological agency.

1. INTRODUCTION

Despite recent prioritization in national politics and economics, rural communities and schools across the United States (US) are still facing an array of challenges (Showalter, Hartman, Johnson, & Klein, 2019). In the US, rural schools are funded less proportionately and often do not have the resources of suburban and urban schools, while also struggling to recruit and retain teachers in nearly all subject areas, especially STEM (Science, Technology, Engineering, and Math education). Rural schools are often unable to provide the same academic opportunities as suburban and urban schools, which has compounding effects on all students, whether they want to take advanced placement courses or other specific courses for their chosen career pathways (Showalter, et al., 2019). Furthermore, rural student populations are becoming increasingly diverse and require rural schools to provide new services (e.g., English language learner [ELL] resources, mental health support, internet access) to their community. These challenges can be seen in states like Kansas, as well as across the Midwest (Nguyen, 2020).

Teacher shortages continue to be an issue across the United States, especially in rural communities. Teacher education needs to find more effective ways to engage with rural schools and contexts to address these shortages. The need to engage with rural schooling serves several goals. The most obvious, of course, is to recruit rural students into teacher education and to prepare teachers to return to rural schools. Beyond that, teacher education

as an academic discipline needs a much more robust research agenda with regard to rural education. We need increased engagement to both better understand how to serve rural schools, as well to better prepare preservice teachers for the pedagogy of the rural (Walker-Gibbs, Ludecke, & Kline, 2015). Recruiting and retaining highly qualified teachers in rural settings has been an ongoing challenge (Azano & Stewart, 2015), and only amplified by the COVID-19 Pandemic (Wang, Tigelaar, & Admiraal, 2021). Teacher education should play a role in addressing teacher shortages in rural, and all, contexts.

Factors that have attributed to teacher education programs lack of engagement with rural schools in general have much to do with two factors: proximity of rural schools to teacher education programs and the complexities of teaching in rural schools. Primarily, rural schools are often long distances from university teacher education programs. The distance and proximity of rural schools to teacher education programs has a dually limiting effect. First, rural schools are not conveniently accessible to teacher education programs for field experiences and student teaching experiences, and subsequently their university supervisors. With limited access to rural schools, preservice teachers' experiences with rural schools (if they have any) are often fleeting, contrived, and lacking in critical engagement with rural pedagogical issues (Azano & Stewart, 2015). Second, teacher education programs are not conveniently accessible to rural students that are aspiring to be teachers. Often times for rural students the idea of leaving their rural community as either a young or mature adult has cultural and financial implications that can cripple aspirations of attending the university. While college or university communities are often relatively small in comparison to cities, these communities can be significantly larger than rural communities. Furthermore, college and university towns often have a significantly higher cost of living.

Secondarily, the complexities of teaching rural schools provide a range of factors that limit teacher education programs' abilities to prepare preservice teachers who want to teach in rural settings. The complexities range from the need for place-based pedagogy and specific career and technical education pathways, to multiple-subject certified teachers (e.g., math, science, and agriculture) to cover all courses of study and meet the financial needs of the rural schools and community (Azano & Stewart, 2015). Complexities of any school context are hard to capture fully through teacher education programs, but especially if preservice teachers have limited or no access to that context. Finally, as teacher education struggled to address the need for diversity—to increase the numbers of diverse candidates and faculty and to provide field experiences in diverse settings—rural schools were, rightly or wrongly, viewed as not contributing to that exigence. This can be attributed in part to faculty and student bias about rural communities, lack of experience in rural schools, and stereotypes of rural students. Many rural communities in Kansas are diverse with 50%-80% of the student population identifying as ELL.

Many of the factors that have prevented sustained and authentic engagement with rural schools have been minimized in recent years through technology and increased broadband connectivity in rural contexts (USDA, 2021). Furthermore, one benefit of the COVID-19 Pandemic has been that rural stakeholders that were once reluctant to engage with technology have become more comfortable with a technological presence in their schools. Technology offers a range of opportunities for teacher education programs to engage more authentically with rural schools and provide sustained support through telepresence-based field and student teaching experiences (Wertzberger, 2019), distance and online-based supervision (Clark, Larson, Wertzberger, & Vontz, 2021), and shared virtual and online pedagogies of the rural (Wang et al., 2021). While these innovative uses of technology have begun to engage rural schools more fully, to make the engagement

sustainable the use of technology in rural schools will need to be evolved and supported in new manners to have an impact on rural teacher recruitment. In this way, rural can be a lens for technological innovation in teacher education. The next three-five years will be pivotal for teacher education programs to establish technologically-based relationships with rural schools to fully realize opportunities for innovation.

2. THEORETICAL FRAMING

We approached our rural school and teacher education partnerships "ecologically," wanting to better understand the interrelations and connectedness of the socio-cultural context in which each unique rural school operates (Wideen, Mayer-Smith, & Moon, 1998). In regard to interrelations, we mean the relationships among those present in the rural school context – students, teachers, administrators—as well as the contextual conditions of the school, community, public and personal spaces. The connectedness and disconnectedness of these relationships create possibilities and opportunities for agency within each rural school's ecological context. Thus, this work was informed by an ecological theory of agency (Biesta, Priestley, & Robinson, 2015). There has been a lot of recent research on the topic of agency, especially for teachers in constraining contexts (e.g., underfunded schools, ELL classrooms without resources or support, classrooms during COVID-19) (Biesta et al., 2015; Buchanan, 2015; Kayi-Aydar, 2015), including the use of ecological agency (Oolbekkink-Marchand, Hadar, Smith, Helleve, & Ulvik, 2017). Ecological agency theorists define agency as action in the context of structures, or an actor's capability to "critically shape their own responsiveness to problematic situations" (Biesta et al., 2015; Buchanan, 2015; Kayi-Aydar, 2015; Priestley, Edwards, Priestley, & Miller, 2012). In an ecological view: "actors always act by means of their environment rather than simply in their environment [because] the achievement of agency will always result from the interplay of individual efforts, available resources and contextual and structural factors as they come together in particular and, in a sense, always unique situations" (Biesta et al., 2015, p. 626). Similarly, our view of agency situates agency as something an individual achieves under distinct ecological conditions, and the resources available to them.

We use "ecological" as a lens to view the rural school context holistically, and the wide range of factors, both inside and outside the school, that enable and constrain not only the school administration's actions, but also our partnerships. Agency, in the ecological sense, maintains actors constantly achieve agency in response to the ecological conditions of the context, even for those who seemingly have the more constraints, or even more affordances. Therefore, in an ecological sense, as a land grant institution, we view our partnerships with rural schools as a mutual way to achieve agency given the distinct context and constraints in which each rural school finds itself. An ecological theory of agency is relevant to our work with rural schools because it prioritizes individuals' reflexive and creative counters to cultural, economic, political, and societal constraints that open inquiry into possibilities (Pantić, 2015). Through partnerships with rural schools, the REC hopes to provide new possibilities for both the reproductive and transformative goals of our rural school partners. We use an ecological sense of agency to better understand the dimensions that our dynamic rural educational contexts utilize in achieving agency. The dimensions of rural educational contexts are dynamic because they represent a constant negotiation between historical precedent, future intentions, and current priorities. Scholars have described three primary dimensions in agency: iterational, projective, and practical-evaluative (Emirbayer & Mischa, 1998). Most recently, and simply, Pantić (2015,

p. 768) illustrated the three temporal dimensions associated with ecological agency, as "influences from the past (e.g., adopted routines), orientations towards the future purposes (e.g., intentions, hopes, fears) and engagement with the present (e.g., judgments about opportunities)." We use these dimensional elements of agency to provide framings for the goals of our partnerships in a structurally constrained ecological context.

We exercise the iterational dimension when we reflexively select and utilize values and beliefs related to past experiences and life histories, past instances of achieving agency, and realizations and actions that were important. (e.g., rural community values, beliefs, and identities and past experiences working with post-secondary institutions). We draw upon the projective dimension when employing intentions to transform and bring about a future that is different from the past and the present, and our partnership with rural schools often prioritizes the projective (e.g., teacher recruitment, grants focused on career education). The practical-evaluative dimension situates our partnerships in the present, where all stakeholders' agency is interacting with the ecological context and being influenced by both past reflexive iterative knowledge and future projective intentions. While the iterative and project dimensions provide priorities for ecological agency, it is in the practical-evaluative dimension where those priorities are negotiated within the context.

3. VISION

Rural schools offer an opportunity for teacher education programs to develop innovative ways of using technology to recruit teachers equipped for the complex needs of rural communities and students. Our primary question for our development and research work is: How can we utilize university, community, and school resources to increase the quality and quantity of teacher recruitment and retention? At our institution we are addressing recruitment and retention by using rural schools to innovate our teacher education programs and support rural schools in three ways: (1) telepresence-based field experiences, (2) distance and online-based supervision, and (3) shared virtual and online pedagogies of the rural. In developing innovative practice for our teacher education program, we have relied on rural schools to be the sites to pilot new approaches to ongoing issues in teacher education. We have found rural districts and schools to be ideal sites for innovation because they offer a highly flexible educational setting whereby their teachers and administrators are receptive to implementing new approaches to teacher preparation and serve as valuable partners in the co-construction of those approaches. In turn, our preservice teachers benefit from their involvement in unique field experiences, while school districts are able to increase their recruitment opportunities through our partnership. We have several practices that have been effective thus far that can affect teacher recruitment.

First, we have found telepresence-based field experiences to be effective throughout our teacher education programs. Our telepresence-based experiences are facilitated through autonomous telepresence robots that can move throughout the classroom. Telepresence-based field experiences increase the richness of teacher education programs by providing opportunities to experience schools that our preservice teachers would not have seen otherwise. By richness, we refer to the depth of a pedagogical approach, it's layers and meanings, and possibilities for multiple interpretations (Doll, 1993). When preservice teachers engage with rural schools through telepresence, they encounter another layer of cultural and contextual experiences, as well as new modalities for them to use in interpretating school contexts. Most of our preservice teachers are from suburban schools and their perspective of what constitutes an elementary, middle, or high school can be

narrow in scope. Telepresence-based field experiences also add richness to our program in terms of pedagogical outcomes. For example, at our institution, preservice teachers in their initial field experiences use telepresence robots to observe and interreact in rural classrooms. It allows us to better scaffold their experiences in the classroom, and they are able to see things like project-based learning and place-based learning in action. They also see a range of diversity with our rural classrooms comprising increasingly culturally and linguistically diverse classrooms, including representation of growing Latinx communities in rural settings (Chang, 2015). Most rural classrooms offer smaller class sizes that allow our preservice teachers to interact more freely with both the students and cooperating teachers. The telepresence experiences deepen preservice teachers' understanding of classrooms and pedagogy, preparing them for subsequent coursework, and providing another conceptual example of schooling.

Equally important, telepresence-based field experiences initiate recruitment efforts and expose our students to a possible career in a rural school. We are working to evolve the use of telepresence experiences to add even more depth by cultivating professional relationships between rural school district administrators and preservice administrators. Rural school districts are leveraging this technology to promote their communities' strengths, share authentic opportunities for potential candidates to experience their schools and communities via telepresence and in-person, and recruit for in-service teaching. Ultimately, school districts are increasingly utilizing telepresence technology to build relationships with preservice teachers through the various field experiences built throughout the sequence of their teacher preparation, from early observational placements to and even including the final semester-long internships (Wertzberger, 2019).

Second, distance and online-related supervision technology also allows us to address teacher recruitment in rural school settings through our online teacher licensure programs. Our online licensure programs allow students who live in rural contexts, and who are unable to attend our university on campus, to attain a teaching degree completely from their rural context. A majority of our students in online licensure programs are currently working in schools, including rural schools. The primary goal of online licensure programs is to help rural schools recruit and train potential teachers in their community – some of which may be in a high school pathway program. The pedagogical innovations of our online licensure programs stem from video assessment software, such as GoReact, which allow for distance supervision and feedback. Secure virtual supervision platforms such as GoReact, allow preservice teachers to livestream or upload video, which university faculty can provide feedback that is timestamped within the video. Preservice teachers can respond and reflect on their videos, and related feedback. Technology, such as GoReact, that enables distance supervision allows teacher education programs to develop their preservice teachers practice and self-efficacy through regular and frequent feedback on their experiences as part of their semester or yearlong field experiences. We are working to evolve the use of distance supervision with even more pedagogical outcomes that add to the recursive and relational (Doll, 1993) outcomes of field experiences through more longitudinal and sustained experiences within schools. As we evolve the field experiences the role of the university supervisor needs to evolve along with it. In our rural school field experiences, technology has allowed our supervisors to take on a role that is better characterized as a coach, due to a more frequent, sustainable, and assets-based interaction model (Clark et al., 2021). Using GoReact is just the beginning of evolving the evaluative supervisor role, to a more supportive coaching role.

Lastly, we think the field needs to prepare preservice teachers for interdisciplinary approaches to subject matter. While these approaches are arising in all school contexts (e.g., STEM, STEAM, CTE), it is much more common in rural schools. By simply being more present in rural schools through telepresence and online programs we address rural teacher retention by supporting their pedagogies and providing additional resources. We call this shared virtual and online pedagogies of the rural. The increased presence in rural schools allows for a two-way street of sharing, developing sets of new relations. The concept of relations (Doll, 1993) as an approach to learning has both pedagogical and cultural implications. Pedagogical relations are best demonstrated through place-based learning. Often times the instructional practices are nothing new (e.g., expository writing, monitoring and measuring environmental aspects, or historical cause and effect) but applied to something in the rural community. From our experience, no one implements place-based learning better than rural schools, often because their sense of community and cultural identity comes through in their teachers' pedagogical relations. In many rural classrooms you see the talents of multi-subject teachers weaving together content, all while connecting it to their students' context. Our institution has worked to provide resources to these teachers to further connect their place-based learning to careers and technology in their community or region. This includes technology such as block-base coded drones and robots, telepresence robots, and bio-technology kits. We have been effective in getting rural teachers to use these technologies, and now we think the field needs to evolve practices to better prepare our preservice teachers to use these technologies at the beginning of their careers – mentored by our rural teaching partners.

4. IMPLEMENTATION

Rural educators face unique challenges and opportunities within the vast scope of American education. Incorporating technology into education has transformed learning, but the path of its integration in rural areas is unique. The next section highlights the perspectives of educators from rural schools and how they utilize technological tools to drive classroom innovation. This data was collected using mixed methods methodology, utilizing quantitative survey data and qualitative interview data. For this chapter, we focus mainly on the qualitative data.

Our experience with innovation in rural schools has led us to two suggestions for teacher educators, and their programs, who want to better engage with rural schools using technology to increase recruitment and retention of teachers. First, through the Rural Education Center (REC) at our institution, we have created rural professional develop school (RPDS) network of 15 school districts that partner with us on all of our initiatives. The RPDS schools comprise a diverse and distinct group of rural communities across our state, with schools that want to provide equitable opportunities for their students. Having these partner schools facilitates cooperation, collaboration, and trustworthy relationships that allow for increased innovation (e.g., telepresence field experiences). Each partner school has multiple telepresence devices for our preservice teachers and colleagues to interact in their schools. Our colleagues are able to research and observe innovation in school sites they were unable to in the past. Second, teacher educators and their programs should maintain consistent dialogue and reflection with rural schools as they pilot innovation at their school sites, which is enabled by the first suggestion. Rural schools offer a lot of positive logistical attributes that allow for smooth facilitation of research and innovation. Primarily, most rural schools are smaller in all aspects of schooling. They typically have smaller class sizes, less administrational levels to gain approval, and fewer

teachers in each grade-level or content area. However, none of these attributes matter unless there is constant dialogue and communication as the innovations address the adaptive challenges (Heifetz & Laurie, 2001) of the schools. Secondarily, many rural teachers are innovation minded, given their limited amounts of resources, and the multiplicity of courses/subjects they plan and teach. They welcome the opportunities for innovative professional development and new resources for their classrooms. The REC has been fortunate to be able to provide those resources. The REC has done this through the lens of several initiatives: the SOARING project (Sharing Opportunities, Approaches, and Resources in New Geoscience), and the LEAPES program (Learning, Exploration, and Application for Prospective Engineering Students). These case studies will demonstrate educators' commitment to bridging educational gaps, pushing the limits, and ensuring that their students are well-equipped for the digital era. These two factors make rural schools very amenable to research and educational innovation, and valuable to teacher education programs.

Our first suggestion is to develop a network of innovative schools built upon relationships of mutual trust. The RPDS network has become vital to envisioning our rural schools as sites of innovation. We began our RPDS partnerships with eight school districts in which we knew the administrators were open to innovation. We built a relationship of trust between the schools and the REC through our presence and support of each school district. As our projects grew, we became involved with more districts who were interested in partnering with us further and with whom we had developed trusting relationships. Thus, we have found trust to be one of the key components in developing a network devoted to innovation for a few reasons. First, trust is important for establishing mutually beneficial relationships with equal amounts of individual and collaborative agency. Both the REC and the school districts want to make sure that the time and resources we are devoting to innovative initiatives will potentially benefit students, teachers, schools, and the future of education in the state. Second, trust is necessary in order to take creative risks and explore new possibilities for solving educational problems in schools. For example, Mr. Durden from one of our partner districts described our trusting relationship well in saying, “We have learned that innovation is a give and take type collaborative effort, we have an issue, they provide some solutions, we consider those solutions in our schools, and revise accordingly…the partnership allows us to address our issues more creatively for sure” (Interview, 10/09/22). Mr. Durden’s reflection highlights the amount of adaptive challenges that rural schools face, and the value of trust in collaborative problem solving. Lastly, trust is vital to innovation in rural schools because with anything new entering the classroom, there will usually be questions and push back from the community, parents, teachers, and maybe even students. Trust often helps soften these sorts of responses to change and allows for opportunities to discuss the changes and adapt if necessary. For example, we placed a telepresence robot in a 3rd grade classroom so that one of the student teachers could complete their field experience. The principal had all sorts of questions from parents, of which he handled well because of our trusting relationship. He told us, “one parent was concerned that the government was recording their child through the telepresence device, and was very concerned about their own and their child's privacy. I explained to them that we and K-State had accounted for that in various ways, and then the parent eased up and said, ‘Oh, I didn’t realize it was a K-State project’” (Interview, 09/01/2021) and was not concerned from then on out. Therefore, trust is important for creating a mutually beneficial and collaborative innovation environment, as well as providing the support from the stakeholders to fully implement the innovation.

Building upon this foundation of trust, we have worked collaboratively with our RPDS partners to engage in ongoing dialogue and reflection about the unique challenges facing both teacher education and rural schools, as well as the potential to address these challenges in new and meaningful ways. Each year, the REC hosts its virtual Rural Summit, bringing together educational leaders from across Kansas, and the nation, to identify unique challenges faced by rural communities and schools, as well as to highlight innovative approaches to teaching, recruitment and retention efforts. Through the summit, rural educators and leaders are able to reflect upon the diverse needs and attributes of their communities, while networking in ways that support their ongoing initiatives. The summit serves as a catalyst for defining the REC's goals and priorities, and its involvement in supporting rural school districts across Kansas. It is also an important event by which the REC and RPDS partners discuss how they may leverage technologies and research to support rural communities. Indeed, the RPDS has been central in leading the vision of innovation, which in turn, has led to a growing number of opportunities for our pre-service teachers. In addition to telepresence field experiences, RPDS schools have offered to host a variety of other field experiences such as, faculty-led weeklong internship trips to rural schools for preservice teachers; preservice teacher-led summer virtual STEAM camps, etc. These opportunities were made possible due to ongoing dialogue and reflection occurring between the REC and the RPDS schools.

Rural schools are great sites for piloting innovation because they have a constant flow of authentic adaptive challenges in which they must respond. Adaptive challenges are described by Heifetz and Laurie (2001) as complex or systemic problems without easy answers or ready-made solutions that leaders alone cannot solve, which requires collective wisdom and digging deeply into a problem to fully understand and solve it. Adaptive challenges may also require more significant paradigm shifts, challenging existing beliefs, or finding a new path forward together. As a partner in finding innovative ways to address adaptive challenges with these schools, dialogue and reflection are vital. As we work with schools to pilot innovation and address their adaptive challenges we focus on five actions. First, we spend time trying to understand the nature of the problem and getting to the root cause. We want to know if the problem is unique to that particular district or something more common across rural school partners. Second, we want to avoid leaping to quick to ready-made solutions, and want to build upon the effective resources in the rural schools and add innovations to support those existing resources. This helps develop authentic solutions unique to those schools. Third, dialogue and reflection are important because as bright spots and success stories emerge in our partner schools we want to consider what contextual or ecological conditions created and/or enabled those successes. Lastly, we always seek to document our work, whether it is a success or failure. Dialogue and reflection enable this process and a context in which there is collaborative assessment of the innovation and method of addressing adaptive challenges. The small nature of rural schools, as well as the willingness and experience of rural teachers to address these adaptive challenges, makes them ideal collaborators for innovation.

As a result of the trust and collaborative nature of these partnerships, our RPDS schools provide pilot sites and teachers with experience addressing adaptive challenges by trying out innovative approaches to professional development and using new technology. For example, our project *SOARING* introduced students and teachers to remote sensing. This initiative additionally utilized an innovative approach to Geoscience by allowing students to work with soil and water sensors directly. SOARING helped science teachers develop new approaches to learning science and connected the science and sensors to geoscience careers. The hands-on experiences allowed students to observe the practical

effects of their activities, moving learning beyond theory, but also allowing them to see the practical applications of science. While each rural teacher approaches technology integration differently, the majority of rural teachers value and emphasize these experiential learning opportunities.

Building on this emphasis on hands-on experiences, engaging with new technologies emphasizes the importance of lifelong learning. When teachers see themselves as lifelong learners, they are more likely to stay updated with the latest educational trends and technologies, ensuring their teaching methods remain fresh and relevant. One of the rural teachers stated, "…I went to the LEAPES thing, so that's where I started and then I actually got my pilot's license …and then this summer camp came up…"(Interview,6/28/23). Rural teachers' involvement in professional development programs demonstrates their continuous desire for self-improvement and intellectual progress.

This commitment to professional development highlights an evident enthusiasm for technology among rural teachers, as well as their drive to share newfound expertise with students. This demonstrates a culture of innovation that extends beyond the classroom. These educators, who are continually seeking ways to enhance their skill set, display an ongoing commitment to preparing students for the ever-changing industries of the future. They demonstrate a dedication to pioneering strategies that will improve their students' educational journeys in a variety of contexts and academic disciplines. A more in-depth examination of their viewpoints indicates a consistent dedication to embracing technology and promoting creative thinking, which has greatly shaped their instructional frameworks.

Given these observations, teacher agency emerges as a key benefit of increasing technology-related professional development for rural teachers. Innovative educational methods place equal focus on evolving teacher's professional learning and agency. Professional development programs guarantee that instructors foster innovation in their classrooms by providing them with cutting-edge skills. However, the availability of these programs is limited, and funding constraints are a recurring problem in rural educational settings. As one rural educator stated, "In rural education, a lot of the buildings are starting to have issues so then the budget goes a lot towards building maintenance …. so going to these training sessions to use these technologies, and also receiving the actual devices that we could use at school, is really important to us."(Interview,6/28/23). This restricted budget unknowingly limits the potential for technology integration and innovation, despite the growing need for such advancements. Furthermore, the limitations of rural schools can often limit the opportunities for teachers' professional learning, as well as constrain their agency in the classroom.

We understand very well the institutional barriers to the kind of implementation we have outlined. The local culture within most teacher education systems is strongly predisposed toward a traditional model of localized engagement, and while COVID-19 pushed some of those boundaries, any move toward technologically mediated engagement with rural schools (e.g, with remote supervision) will require adequate conversation among professionals to secure the necessary institutional will. Furthermore, the role of technology in the future of teacher education must extend beyond replicating old paradigms in new spaces. It must assist in envisioning new constructs by which we define best practice in teacher education. This includes leveraging technologies to connect geographically and culturally diverse school partners in collaborative efforts to diversify teacher education, and to construct more accessible teacher preparation pathways for non-traditional candidates. Institutional conservatism and inertia notwithstanding, we believe the need to engage teacher education with rural education provides a powerful incentive for new paradigms of practice, research, and innovation.

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AUTHORS' INFORMATION

Full name: J. Spencer Clark
Institutional affiliation: Kansas State University
Institutional address: 1114 Mid-Campus Dr., Manhattan, KS 66506 USA
Short biographical sketch: J. Spencer Clark is Director of the Rural Education Center (REC) and Professor of Curriculum Studies, in the Department of Curriculum & Instruction at Kansas State University (K-State). He has published books, journal articles and chapters on curriculum development, technology, and teacher professional learning. He has provided curriculum design support and professional learning experiences to rural and urban teachers across the world. His current research is focused on digital literacy, place-based learning, teacher education redesign, school curriculum redesign in rural contexts, and developing inquiry-based curriculum to enrich students problem-solving skills. He also teaches a variety of graduate courses focused on curriculum theory, educational equity, educational history, and research methodology. His work with rural schools brings together his teaching and research to address teacher shortages in rural communities to support the land-grant mission at K-State.

Full name: Eileen M. Wertzberger
Institutional affiliation: Kansas State University
Institutional address: 1114 Mid-Campus Dr., Manhattan, KS 66506 USA
Short biographical sketch: Dr. Eileen Wertzberger is Director of Field Experiences and an assistant professor in Curriculum and Instruction at Kansas State University. She taught in Kansas public schools for 13 years, and currently teaches doctoral courses pertaining to research methodology. Her doctoral research explored first-year teachers' induction experiences at the onset of the COVID-19 pandemic, specifically how they negotiated both virtual and in-personal spatial dynamics in their practice and efficacy building. In addition, she has published research in the areas of technology integration in teacher preparation, as well as issues of diversity, equity, and access in teacher education programs. Eileen currently holds the distinction of being the Jim and Sandy Tangeman Professor in Education.

Full name: Nooshin Darvishinia
Institutional affiliation: Kansas State University
Institutional address: 1114 Mid-Campus Dr., Manhattan, KS 66506 USA
Short biographical sketch: Nooshin Darvishinia is a doctoral student in Curriculum and Instruction at Kansas State University with a research focus on technology in education. Her research interests include the intersection of technology and interdisciplinary studies. Nooshin has experience in conducting interdisciplinary research and is currently working as a Graduate Research Assistant (GRA) at Kansas State University. She has co-authored a book chapter and served as a journal reviewer for IGI Global. Additionally, Nooshin has 14 years of teaching experience and has worked as a lecturer at three different departments at Najafabad University in Iran, teaching courses in English as a Second Language (ESL) and academic writing. She holds a master's degree in Teaching English as a Foreign Language. Through her research and teaching experience, Nooshin has developed a deep understanding of the potential of technology to enhance teaching and learning in diverse educational contexts.

Chapter #19

ANALYSING THE EXTENT TO WHICH STUDENT TEACHERS IMPLEMENT THEIR LESSON DESIGN DURING TEACHING PRACTICE

Mokete Letuka & Paseka Patric Mollo
Department of Educational and Professional Studies, Faculty of Humanities, Central University of Technology, Free State, Bloemfontein 9300, South Africa

ABSTRACT
Lesson designing focuses on the structure of a series of lessons. It incorporates the planning, organization, and sequencing of lessons to achieve learning outcomes. Student teachers are capacitated to master the skills of lesson planning so they can plan their teaching on a lesson plan template. However, what they do in the classroom is not a reflection of the lesson design itself. As a result, the researchers sought to investigate the reasons for this lack of synergy between the lesson design and the actual lesson presentations. This qualitative research was conducted through document analysis and semi-structured interviews. A sample of 20 B.Ed. degree student teachers who are in their third year of study were randomly and conveniently selected. The findings revealed that most student teachers do not have high regard for lesson designing. The assessment rubric used to evaluate student teachers' teaching competence does not outline aspects of the lesson design. Moreover, student teachers are unsure of how to implement some of the aspects of the lesson plan template. The study highlighted the need to put more emphasis on the importance of lesson designing. It was further recommended that lesson designing should allow for pedagogic flexibility.

Keywords: lesson design, synergy, lesson presentation, teaching practice.

1. INTRODUCTION

The Revised policy on the Minimum requirements for Teacher Education Qualifications (MRTEQ), 2015 is a policy that lays out a minimum set of agreed-upon competencies for initial teacher education (ITE) programs in South Africa (Department of Higher Education and Training, 2015). This policy sets minimum requirements for teacher education qualifications aimed at ensuring that the higher education system produces teachers of high quality, in line with the needs of the country. It describes clear, specific requirements for the development of learning programs, as well as guidelines regarding practical and work-integrated learning (WIL) structure. In this paper, the researchers use the term teaching practice. Teaching practice constitutes an essential part of the BEd program as is school-based work-integrated learning that is supervised and assessed. It is an approach that harmonizes academic and workplace practices for the mutual benefit of students and their intended workplaces, in most cases the school environment (Mudzielwana, Joubert, & Phatudi, 2016). During this teaching practice period, student teachers are provided with opportunities to practice as a teacher, to develop desirable characteristics of a teacher and values in order to display appropriate professional behavior (Mudzielwana, et al, 2016).

2. BACKGROUND

Lesson design is a deliberate process that entails the methodical creation of instructional experiences. It concentrates on the overarching framework of a set of teachings. It involves the alignment of learning objectives, evaluation techniques, and instructional tactics over a long period of time (Cohen, Manion., & Morrison, 2018). Lesson design entails the development of a curricular framework that outlines the learning objectives, assessment techniques, and logical sequencing of lessons. Its purpose is to develop well-designed lessons that promote flexibility and adaptation during each lesson and aid aspiring teachers in developing coherent and impactful learning experiences.

Student teachers are also presented with a chance to learn different teaching skills and to effectively plan and present lessons that they were taught during lectures at the institutions of higher learning. This is an opportunity for self-evaluation and to discover their strengths and weaknesses through reflection. They are mostly guided by mentor teachers and their lecturers who are tasked to evaluate them and give them reflective feedback on their performances in the classroom (Lombard, 2015).

The effectiveness of a teacher within a classroom environment is realized through the ability to plan lessons correctly. The lesson plan is a guide for the presentation of the lesson, without which the teacher may go astray (Drake & Jackson, 2016). Good lesson planning is an important aspect where teacher expertise exists (Li & Zou, 2017). According to Du Toit (2016:140), there are five basic questions that need to be considered and these are "what I teach; who my learners are; why I am teaching this; how I can teach this and how successfully do I teach.

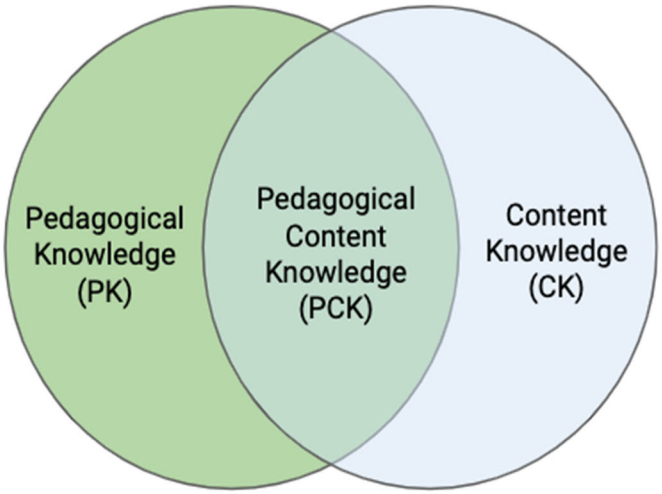
When training student teachers on lesson planning and lesson presentation teacher education institution should ensure that they have the knowledge and understanding of lesson aims and objectives. When formulating aims and objectives, student teachers should know that these should strive to develop the learners holistically. This can be achieved if aims and objectives can include the integration, interrelation, and interconnection between the cognitive domain, psychomotor domain, and affective domain (Drake & Jackson, 2016; Du Toit, 2016).

This is followed by the step on the identification of the major components of teaching and learning which are teacher presentation and learner practice (Drake & Jackson, 2016). Student teachers should know that during this phase they should display their knowledge of the content, the different skills of presenting the content, strategies for interacting with learners, and the ability to interact with different types of learners (Drake & Jackson, 2016; Rusznyak, 2011). The student should meticulously plan learner activities that are in line with the teacher's actions in order to achieve the required objectives. A dissimilarity should be made between guided practice and independent practice activities (Drake & Jackson, 2016). Guided practice activities are those activities that allow learners to demonstrate the application of the new content under the guidance of the student teacher. While independent practice activities are those activities that encourage learner-centered behavior. It allows learners to use the new concepts or skills in a relevant but new context (Drake & Jackson, 2016; Rusznyak, 2011).

3. THEORETICAL FRAMEWORK

The study is framed by Lee Shulman's Pedagogical Content Knowledge (PCK) model (Shulman, 1987). PCK was used because it emphasizes the importance of the three knowledge domains that teachers and student teachers must possess to present successful lessons. The three domains as proposed by Lee Shulman are presented in the diagram below and these are Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK) (Shulman, 1987). The knowledge domains that student teachers must possess are explained as follows.

Figure 1.
Pedagogical Content Knowledge (PCK) (Shulman, 1987).



3.1. Content Knowledge (CK)

This domain refers to the outstanding knowledge of the subject matter that teachers must have to teach. A teacher must have a thorough understanding of the subject matter or content that they are going to teach (Shulman, 1986, 1987; Koehler, Mishra, & Cain, 2013). The teacher must have expertise in the subject level that he/she will be teaching; for instance, the subject knowledge of mathematics at primary school, high school, and university differs. According to Shulman (1987:6), the teacher's "content knowledge should embrace subject concepts, theories used in the subject, relevant philosophies, organizational frameworks, evidence, and proof, as well as reputable tactics and ways of developing such knowledge".

According to Thompson, Bell, Andreae, and Robins (2013:1), newly qualified teachers must have content knowledge to delivers subject topics effectively. Sound content knowledge is essential for teachers to teach the curriculum at schools because a more knowledgeable teacher in their specialized subject teaches the subject better (Poulson, 2001). Beginner teachers are required to have a sound content knowledge to be able to teach the curriculum in a simplified manner to enhance learner understanding.

3.2. Pedagogical Knowledge (PK)

Pedagogical knowledge refers to a deepened understanding of strategies, methods, and processes that teachers should employ in the teaching and learning of their respective subject specializations (Shulman, 1986, 1987; Koehler et al., 2013). It involves a thorough understanding of the aims and objectives of a subject, the educational purpose and values of the subject, and the ability to plan activities that will make the learning of the subject easy and making make the subject relevant and enjoyable to learners (Koehler et al., 2013).

Also, PK is about teachers' understanding of how learners learn, classroom management skills, lesson planning, development of classroom activities, and assessment of learners (Shulman, 1986, 1987; Koehler et al., 2013). PK requires teachers' understanding of the cognitive theories, and social and developmental theories of learning, and these can be applied to learners in the classroom (Koehler et al., 2013). The teacher should have the ability to determine how best to present ideas and concepts to be in line with the needs of the learners in their respective classrooms (Shulman, 1986, 1987).

3.3. Pedagogical Content Knowledge (PCK)

PCK is about the knowledge and understanding of a subject matter taught, meaning the pedagogy of a specific subject. PCK relates to Shulman's (1986: 4) belief that "real teaching requires an understanding of both content and pedagogy". It does not require one to be just a content expert or just a pedagogy expert, but it requires teachers to have the expertise to match content with relevant pedagogy so that effective learning can take place (Koehler et al., 2013). According to Koehler et al. (2013, p. 14), this knowledge domain "revolves around the teacher's ability to properly teach, plan relevant activities for learning, understand the core and hidden curriculum, conduct assessment, and report results of a subject".

Hence, the concept of PCK is the transformation, by the teacher, of the content (Shulman, 1986; Koehler et al., 2013). A teacher who has a deep PCK can interpret the subject matter well, can present the subject matter in a way suitable to their learners, and can develop suitable teaching and learning materials to meet the needs of individual learners in their classrooms (Shulman, 1986; Koehler et al., 2013).

4. RESEARCH OBJECTIVES

- To determine whether student teachers understand all aspects of the lesson design and can complete lesson plans correctly.
- To determine whether student teachers can formulate lesson objectives, develop assessment strategies, logically sequence lessons, and develop strategies for differentiation.
- To determine the challenges that students are confronted with when they present lessons, that derail them from their lesson design.
- To suggest ways in which student teachers may as far as possible, synergize their lesson design with their lesson presentations.

5. RESEARCH METHODOLOGY

This study sought to investigate the reasons why student teachers at a university of technology do not synergize their lesson plans with their lessons during teaching practice. A qualitative enquiry which, according to Denzin and Lincoln (2011) involves the study of anything in its consistent environment to attempt to make sense of it regarding the meanings people assign to it, using among others, observations, interviews, and personal experiences, was used to carry out this investigation.

5.1. Data Collection

Qualitative data collection techniques that were used in this study are document analysis, semi-structured focus group interviews, and observations. Document analysis was in the form of the analysis of student teachers' completed university lesson plan templates.

Kutsyuruba (2017) defines document analysis methodology as a systematic process through which documents are reviewed and analyzed with the purpose of searching for meaningful data within them, as well as to gain understanding for knowledge development. The researchers collected student teachers' completed lesson plan templates with the aim of determining if student teachers gain an understanding of essential aspects of a lesson, and if they present their lessons according to what they have planned, as outlined on their lesson plans. Document analysis is a type of qualitative research method that entails the interpretation of documents where contents is coded into themes and sub themes. The data collected from the analysis of lesson plans in this study was coded into themes.

Secondly, the study employed observations as a research method. Observations is one of the primary research techniques utilized in many disciplines, including the natural sciences, social sciences, psychology, and more. It entails conducting systematic research by carefully and methodically examining a topic or event (Cohen et al., 2018). It is the process of gathering information by directly observing and documenting behaviors, occurrences, or phenomena without interfering with them. Because it seeks to accurately portray what is occurring without introducing prejudices or prior beliefs, it is seen as objective (Cohen et al, 2018).

A focus group interview is a type of group interview where data emerges from the interaction among participants (Cohen et al., 2018). Focus group interviews were conducted with student-teachers in their final year of study. According to Edwards and Hollands (2013), one of the core features of semi-structured interviews is the interactional exchange of dialogue between two or more participants. Dialogues were held with the student teachers to investigate the challenges they encounter during teaching practice, when they plan their lessons as well as present them as planned.

5.2. Sample

Random sampling was used in this study because according to Mulisa (2022), the results of random sampling can be extrapolated to the rest of the population in question. A sample of 20 third year student teachers was randomly and conveniently selected in this study. Maree (2016) asserts that the sample should be feasible in terms of resources, time, and accessibility. The proposed participants in this study are easily accessible as they are student teachers at our university.

The two researchers developed a schedule to visit the 20 student teachers at their respective schools where they were placed for teaching practice. Each one of the two researchers had to observe 10 student teachers in class teaching. This gave the researchers an

opportunity to observe the student teacher's presentation skills in front of the learners at schools. The researchers also had to collect two lesson plans from each of the 20 student teachers for analysis. In total 40 lesson plans were analyzed to determine whether there is synergy between the lesson plans and the presentations of the lessons.

5.3. Data Analysis

The explanatory nature of qualitative research is relatively lengthy and more descriptive and leads to the discovery and construction of new meanings, understandings, ideas, and deductions (Delport & Fouché, 2005). Deductions were made and new meanings of the ideas and opinions of the participants when analysing the collected data, were established regarding their challenges pertaining to presenting their lessons in accordance with their lesson plans during teaching practice.

Analysis and description of student teachers' responses and researcher observations were reported by means of rich and thick descriptive explanations which, according to Ponterotto (2006), have to do with lengthy elaborations and interpreting of meanings. The constant comparative method of analysis and interpretation of data was used. Themes were also developed from the analysis of the student teachers, lesson plans.

The data collected from the analysis of lesson plans in this study was coded into themes. Observations of student teachers conducting lessons were documented and their behavioral patterns coded and recorded according to similarities. According to Rädiker and Kuckartz (2020), when interviews are analyzed, data is categorized, and interviews are coded through basic coding. Data from the focus group interviews were categorized and coded.

6. FINDINGS

After the student teachers' lessons that they presented during teaching practice were observed and compared with their lesson plans, at the realization that there were aspects of the lesson plans that did not come out as outlined on the lesson plans, we decided to investigate the reasons why this was the case.

6.1. Document Analysis

The following themes were used when analyzing student teachers' lesson plans as part of document analysis:

No	Theme	Findings
1.	**Curriculum coherence**: Lesson plans created by student teachers were in line with the overall curriculum or academic requirements.	It was found that all 20 student teachers planned lessons around topics well within the scope of work as prescribed by the curriculum. Students presented content that was within the prescriptions of the university and school curricula.
2	**Learning outcomes**: What students are expected to accomplish at the end of the lesson is guided by specific and quantifiable learning outcomes.	22 of the lesson plans that were analyzed revealed that some student teachers could not formulate lesson outcomes correctly. Common mistakes that were made included student teachers failing to use appropriate action verbs to

		formulate lesson outcomes. Students started their lesson outcomes by writing: • At the end of this lesson, learners must "know" how to…… • At the end of this lesson learners should "understand…" "Know" and "Understand" are not appropriate action verbs used in the formulation of lesson outcomes.
3	**Pedagogical knowledge**: Sound pedagogical knowledge that guide the teaching and learning process	All 20 student teachers selected various teaching methods as listed on the lesson plan template. Scaffolding method was selected on 15 of the lesson plans, however, researcher observations revealed that student teachers did not have full understanding of this method as most of them rather used purely the "Question and Answer" method.
4	**Assessment**: Considering how learning outcomes will be evaluated and measured. Formative and/ or summative assessment outlined.	All students outlined their assessment strategies on their lesson plan templates, including questioning learners throughout the lesson and giving them classwork, but some of them run out of time before putting all their assessment plans to action. Only 8 of the lesson plans were implemented successfully in terms of assessment.
5	**Learner-centeredness**: Putting student needs and interests first to provide interesting and productive learning experiences	Of the 40 analyzed lesson plans, it was found that only 10 student teachers plan to actively involve their learners in the teaching and learning process, but that is only through asking as many questions as possible. Students are not able to facilitate learning by probing and leading learners to discover information.

6.2. Interviews

Students were further asked two questions that were coined to bring about an understanding of the reasons for the lack of synergy between their lesson plans and the actual lessons they presented.

6.2.1. Question 1

Students were first asked about the extent to which they understand the aspects of the lesson plan, and if they could confidently complete the lesson plan template?

Ten (10) students claimed they understood all the concepts that are outlined in the lesson plan, however, some of their responses indicated that they had some misconceptions about some of the aspects of the lesson plan. Five of the students acknowledged that there were some aspects that they were not sure of.

Here are some of the responses by those who claimed to understand the lesson plan in its entirety:

- *"The lesson plan template is easy to fill in and it is understandable." (P1)*
- *"The lesson plan template helps me a lot because it makes me aware of all the activities that are expected of me as a teacher" (P4)*
- *"I believe I do understand all sections of the template because I never leave out anything when I complete the lesson plan" (P3)*

Even though these students claim to understand all the lesson plan aspects, one of them, attempting to explain what "expanded opportunities" is, which is one of the aspects on the lesson plan, referred to it as a summary of the lesson where the teacher provides final explanations and remarks to the learners. We deduced from this explanation that students still have misconceptions about certain elements of the lesson plan because "expanded opportunities" refers to opportunities that the teacher creates for learners to learn what was discussed in class, outside of the classroom or even away from the school by sending them to a grocery store in their communities to investigate food prices, for example!

The following are some of the responses from students who acknowledged that there are some elements of the lesson plan that they do not quite understand.

- *"I always struggle with the section that requires me to mention the skills, knowledge and attitudes." (P7)*
- *"There are many teaching methods listed on the lesson plan template to choose from, but I always select question and answer because I am not even sure what scaffolding method is". (P2)*

6.2.2. Question 2

What challenges are you confronted with during your lessons, that derail or cause you to deviate from what you have planned on the lesson plan template?

This question was coined to elicit responses regarding the actual reasons student teachers do not present lessons as they planned them. These are some of their responses:

- *"Learner discipline and classroom management are the challenges that I mostly face in the classroom during lesson presentation. As learners are the ones rotating, they come late to class and disrupt the ongoing lesson. When learners misbehave in the classroom, they delay the lesson and I end up skipping some points in the lesson due to time wasted". (P10)*
- *"Time, class time is very short, and learners are unpredictable. Sometimes you must spend more time explaining one concept than you had planned, leading to not achieving some of the objectives you stated". (P13)*
- *"Having to discover that the teaching strategies that you are using are not helping the learners to acquire the intended knowledge, now you have to use other strategies within the same period, which puts you under pressure because you won't get extra time for these new adjustments. Also, sometimes gadgets are used to conduct a lesson and it happens that technical errors arise in the middle of the lesson, now you need to rearrange your lesson in such a way that you can still lead the learners to the objectives they need to acquire". (P15)*

- *"The reason I struggle to present the lesson exactly how I planned it is because of the disruptions caused by the learners in the class, as well as others who are roaming around outside making lots of noise to a point where the ones inside the classroom are not able to pay attention. Learners also do not participate or ask questions, and they always pretend to understand what we are doing." (P1)*

- *"Underestimating time: planning to teach a certain amount of content not being aware that the content is too much for the duration of the period. Learner corporation: sometimes learners take time to get to class and this reduces the duration of the class because time is wasted, then it becomes difficult to complete the lesson on time. Learner discipline: most of the time learners respect their teacher more than they do student teachers. Having to constantly discipline learners during the lesson wastes time and again, it becomes difficult to complete the lesson". (P12)*

6.3. Discussions

6.3.1. Question 1

Most student teachers view the lesson plan template as an understandable and uncomplicated document, and they do not struggle to complete it fully before their lessons. However, findings reveal that some of them have misconceptions about certain aspects of the template and thus do not complete it correctly. This provides evidence that student teachers lacking pedagogical knowledge (PK), as they have limited comprehension of a variety of teaching methods.

6.3.2. Question 2

Overall, student teachers indicate that they deviate from their plan as outlined on the lesson plan template because of issues related to learner discipline and time constraints. Student teachers in their final year of study are expected to demonstrate high levels of time management as well as competence in classroom and discipline management, but this is not the case.

One of the students indicates that learners are uncooperative and do not participate in class, as well as pretend to understand what is being taught. This is a clear indication of the lack of pedagogic content knowledge (PCK) on the part of the student teachers. Final year student teachers as facilitators and mediators of learning are expected to possess the skills to get learners engaged or involved in the teaching and learning activities, but again, this does not seem to be the case.

7. CONCLUSIONS

Subject didactics lecturers must be sensitized about the misconceptions that students have about the lesson plan so that they spend time reinforcing a deeper understanding of the lesson plan. Lecturers are also encouraged to spend more time facilitating and demonstrating various teaching methods that student teachers are expected to demonstrate competence in.

More intensive pedagogical training is requested to prepare students for both expected and unexpected situations that arise in the teaching and learning arena, such as the management of ill-discipline and the optimal use of time. Student teachers must be intensively trained to become facilitators and mediators of learning equipped with skills to be able to get learners involved in their classroom activities. Student teachers must be trained on pedagogic flexibility so that they are able to adapt and adopt their lessons as the unexpected happens during their lessons.

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AUTHORS' INFORMATION

Full name: Mokete Letuka
Institutional affiliation: Central University of Technology (CUT)
Institutional address: Private Bag x20539, Willows, Bloemfontein, 9300, South Africa
Email address: mletuka@cut.ac.za
Short biographical sketch: Mokete Letuka holds a Master of Education (M. Ed) degree and is awaiting final feedback on his PhD study. He is currently an undergraduate lecturer in the Department of Educational and Professional Studies (DEPS) under the faculty of Humanities, at the CUT. He is a member of the teaching practice committee in the DEPS. His research interest is around assessment in education, teaching practice, and micro teaching. Mokete Letuka enjoys attending international conferences on education and presenting as well as publishing papers.

Full name: Paseka Patric Mollo
Institutional affiliation: Central University of Technology
Institutional address: Private Bag x20539, Bloemfontein, 9300, South Africa
Email address: pmollo@cut.ac.za
Short biographical sketch: Paseka Patric Mollo holds a Doctor of Education (D.Ed.) degree. He is currently a lecturer in the Department of Educational and Professional Studies at the Central University of Technology in South Africa. He is teaching at the undergraduate level, supervising students at the master's level, and has delivered several papers at national and international conferences. His interest centres on teacher education and development, which includes the following fields of specialisation: Information Communications Technology (ICT) integration in the teaching and learning situation, Micro-teaching, General Subject Methodologies, and Assessment. Before joining the university, he held the following positions at the Department of Education: first as a Teacher and a Head of the Department for Mathematics and Technology at a school, then promoted to be a First Education Specialist, Senior Education Specialist, and Deputy Chief Education Specialist responsible for in-service training and professional development of teachers.

Chapter #20

UTILISING SOCIAL NETWORK ANALYSIS SKILLS TO MEET PEDIATRIC PALLIATIVE CARE NEEDS IN SOUTH AFRICA

Rika Swanzen
D.Lit.et.Phil (Social Work)
Deputy Dean: Research, The Independent Institute of Education, South Africa

ABSTRACT
Integrating Pediatric Palliative Care (PPC) within the curriculum of the social services qualifications is part of new and niche development in education. To meet the needs of terminally ill children requires the best practices from the inter-disciplinary teams involved. The social service professions have a strong history in impacting communities to meet the needs of vulnerable populations. A tried and tested framework on environmental networking, that may be at risk of only being seen as part of earlier innovation, provides a practice model for meeting the partnership goal of sustainable development. Considering the risk to terminally ill children when sufficient partnerships are not in place, as required by the seventeenth sustainable development goal, a case is made for a deeper understanding of the service context and the strengthening of support structures through social network analysis and environmental modification.

Keywords: social network analysis, pediatric palliative care partnerships, environmental modification.

1. INTRODUCTION

The United Nations Children's Fund (UNICEF) supports and encourages governments to focus on five specific asks for the implementation of global partnerships for sustainable development, with children needing to be at the center (United Nations Children's Fund, n.d). While South Africa (SA) is a signatory to the United Nations Charter on the Rights of the Child, underwriting the right for children to the highest possible standard of health and access to health and medical services through article 24 (UNICEF, 1990), a concerning lack of alignment between policy and funding for Pediatric Palliative Care (PPC) exists (Gill, Hashem, Stegmann, & Aoun, 2021). The World Health Organization defines pediatric palliative care as addressing the child's physical, psychological, and social distress, with support to the family, from the start of the diagnoses of the illness (Gill et al., 2021). Such services require the expertise of a specialist multidisciplinary team, and it is questioned whether existing PPC assessments and interventions comprehensively address parents' support needs (Gill et al., 2021).

Of interest for this article is the seventeenth sustainable development goal (SDG17) that calls for strengthening the means of implementation and to build and enhance partnerships with diverse stakeholders (UNICEF, 2022). Results from a case study done with a child and youth care center (CYCC), described in more detail and within another context in Swanzen (2022), also indicated a lack of sufficient partnerships to meet the needs of terminally ill children. This lack was evident in the poor access to quality and emergency health care, without significant expenditure, for which funding models across health and

social service departments are not integrated and responsive. This raises the level of concern regarding children's rights, since an average of 75% of child-related SDG indicators in every country by 2019, either had insufficient data or showed insufficient progress to meet SDG targets by 2030 (UNICEF, n.d). Against the backdrop of grassroot challenges caused by CYCCs not receiving support for PPC, the need for social networking skills (in the context of the person-in-environment framework) to be developed as a community level solution, will be unpacked in this chapter. The environmental modification enabled through these skills will address at least three of the key asks for SDG17. Some studies like one at the Universitat Politècnica de València (Leiva-Brondo, Lajara-Camilleri, & Lull, 2022) confirms that after activities related to sustainable development goals within subjects had been performed, students' awareness and literacy of sustainability improved. Similarly, an intentional focus on and organizational endorsement of the development of social networking skills, are believed to be part of the capacities to be leveraged to strengthen PPC service delivery.

From the author's own experience, a fitting part of foundational social work knowledge base exist around environmental intervention, but from a source that has not been updated with subsequent editions for over twenty-six years. A search for literature sources incorporating the detail on this framework, for inclusion in the curriculum, was found to be limited. While the theory has been referenced in various sources, some incorporated in this writing, the limited coverage of detail on the strategies motivated the attention drawn to this valuable tool. Not only will searches on social networking cross-over to internet-based social media concepts that become relevant for marketing strategies and public trust (Sadiku, Omotoso & Musa, 2019 and Paskarina, 2023), it is also presented as social networks or maps (what) only and not the skill of social networking (how). There are some promising applications of social network analysis in health (McKinlay, McDonald, Darlow, & Perry, 2017; Fortea-Cabo & González-Teruel, 2022; and Mukinda, Van Belle, & Schneider, 2022) and social psychology (Butts, 2008). The support offered through personal networks, as well as the role children play, in the treatment of substance abuse has also been highlighted (Min et al., 2013; Tracy & Martin, 2007; Falade-Nwulia, et al., 2022).

The usefulness of the social network analysis practice tool remains, both as origin of eco-maps used in the social service professions (Rogers, 2017) and as ecosystem metatheory contextualizing assessment of people's life situations in social and physical environmental influences (Kahan & Žiaková, 2021). Highlighted through this chapter will be how the comprehensive evaluation of partnerships as an intervention is needed to support critical PPC services in a more cost-effective manner than the high individual, medical care costs typically involved in the care provided to terminally ill children. "The person-in-environment concept is manifested in the dual aspirations of the profession to provide personal care and further social justice… The profession's dual aspirations are reflected in social work codes of ethics in different parts of the world… every social worker is obligated to work to foster change in the individual and the society" (Weiss-Gal, 2008, pp. 65–66). This forms the basis of the argument made for the inclusion of these skills in the higher education (HE) curriculum delivered to professions like social work and child and youth care work.

2. CONCEPTUAL FRAMEWORK TO ADDRESS PARTNERSHIP GOALS

While the importance of acknowledging social network analyses will become evident, the core references are becoming older, with only its application being referenced in newer literature. A risk therefore exists of the original descriptions, especially as this skill relates to building partnerships in social and health services within a community development context, to get lost. Following a search for easily available resources, the main aim of this chapter is

to provide a more recent reference for this very relevant tool, aimed at meeting the SDG partnership goal. Newer references enable more recent engagement with the framework, to consider its inclusion within the rather niche curriculum scope of pediatric palliative care (PPC).

2.1. Building Partnerships for Sustainable PPC

"Palliative care is a key facet of high-quality pediatric … care as it addresses physical symptom burden, goals of care, advance care planning, medical decision making, and end-of-life (EOL) care" (Massie, et. al., 2021, p. 452). An important link between SDG17 and PPC therefore lies in the economics of PC and how these impacts on the quality of care required. The European Association for Palliative Care (EAPC) presses acknowledgement of the cost of EOL care, since out-of-pocket, higher medical expenditure increases the poverty trap, while sufficiently trained psychosocial professionals advocating for and identifying responsive networks are critical in the reduction of this cost (EAPC, 2022). On the economics of palliative care (PC), the EAPC (2022) emphasized the return on investment to have already shown promise and that PC enabled 85% of patients and families to spend less on medicine, which is significant if one considers that caregivers often lose their income while caring for terminally ill family members. The World Health Organization and partner organizations published a number of documents on models of care to guide wider roll out of PC services. Specific advancement in the adoption of a rural model in SA was presented by O'Brien et al. (2019) who highlighted that in 2015 the country ranked 34th in the Economists 'Quality of Death Index', the highest-ranking African country, and that SA launched the National Policy Framework and Strategy for Palliative Care (NPFSPC) 2017-2022. The NPFSPC prioritizes PC and training of health workers involved in PC, with emphasis on addressing issues of universal health coverage and the need to reduce suffering and promote development and dignity for all (O'Brien et al, 2019). Considering that the training of social workers and child and youth care workers, the two recognized professions delivering social services to vulnerable populations in SA, hold the knowledge base and skill in working in resource constrained communities, including their expertise in the inter-disciplinary practices of the PC team, can reduce high medical EOL cost. Strong assessment information is required to facilitate improved partnerships and the next sections aim to demonstrate the detail required for understanding the environmental context of potential partnerships.

2.2. Environmental Assessment and the 'Key Asks'

Easing towards an understanding of social network analysis, the environment and the SDG17 asks will be touched on in this section. It is firstly worthwhile to note the allowance provided for alignment with the quintuple helix as a visualization for the collective interaction and exchange of knowledge. According to Schocair, Dias, Galina, and Amaral (2022) the *quintuple helix* includes the university as a leading sphere to generate knowledge and technology at the same industry and government level, including the influence from actors of the organized civil society, and consideration of the environment and sustainability. For the author this is further support for why HE needs to ensure that community-level practice models remain relevant within especially the curriculums preparing social service professionals. This multi-level engagement is more likely to lead to advocacy for the meeting of PPC needs in resource-restrained settings such as CYCCs.

Key asks for SDG17 are to build, strengthen, and expand partnerships; broker meaningful multi-stakeholder coalitions and alliances; engage with the United Nations system as key partner; enhance North-South, South-South, horizontal and triangular cooperation; and leverage and pool resources, capacities, technology and data (UNICEF,

n.d). It is evident why expertise in being able to analyze the environment towards networking is critical. Universally needed environmental resources include: adequate social support systems; access to health and day care services and recreational facilities; mobility to socialize; utilize resources and exercise rights as citizens; adequate housing; police and fire protection; sufficient nutritional intake; predictable living arrangements with caring others; opportunities for education; self-fulfillment and employment; and access to legal resources and religious organizations (Hepworth & Larsen, 1993). Needs-driven assessment remains one of the key drivers for relevant service delivery in the social service sector and parallel to this should be an understanding of the context of the lived settings of clients.

The environment is defined as having physical, cultural and social spaces, and are described as follows (Kemp, Whittaker, & Tracy, 1997): the *physical* environment comprises of the natural world and the built world; the *social* environment comprises the network of human relations at various levels of organization; and the *cultural* space is influenced by both the physical and social environments, and incorporates values, norms, knowledge, and beliefs. Adding the multidimensional entities of the *perceived* environment (individual and collective systems of meaning and belief); the *institutional and organization*, and *socio-political* environments, a comprehensive foundation is set for environmental assessment (Kemp et al., 1997). Environment assessment (EA) is defined as "an ongoing process in which client and worker, in partnership, gather and critically analyze information on the client or client system, in transaction with multiple levels of the environment, including strengths, resources, potentialities and opportunities, as well as risks, challenges, and issues of concerns, and with the attention to the meaning of these environmental experiences for the client" (Kemp et al., 1997, p. 85). The understanding of the potential for both growth and stress within the person's social network; the functions of network resources with their obstacles to being used, are essential parts of an environmental assessment (Tracy & Brown, 2017). Table 1 provides a summary of various EA tools and methods. The horizontal headings indicate the types of environments and vertical are the client system types. More detailed descriptions on these can be consulted in the original sources referenced.

Table 1.
Environmental Assessment tools and methods.

Client system	**Perceived**	**Physical**	**Social / Interactional**	**Institutional / Organizational**	**Social-political / Cultural**
Individual	Perceived support network inventory Multi-dimensional scale of perceived social support Socio-political control scale	Assessment of universal resources EA Index PIE system Life-space representations	Social Network Map Ecomap Community Interaction Checklist PIE system Matrices	Ecomap Nurturing / Sustaining Environment PIE system Map recovery capital & social identity	Culturalgram Power analysis Concentric circles
Family	Family support scale Narrative techniques	Family access to basic resources Family resource scale	Ecomap Inventory of social support Genogram	Ecomap Family Empowerment scale	Cultural Genogram Power analysis

Group	Ethnographic interviewing Participant observation	Participant observation Life-course changes	Sociogram Socio-environmental context of group	Context diagram of environmental transactions Force field analysis	Power analysis Nurturing / Sustaining Environment
Neighborhood	Organizational history of neighborhood Participant observation Concentric circles	Physical description of neighborhood Community profiling	Nomothetic ecomapping Community profiling	Capacity inventory Inventory of local associations Community inventory	Framework for conceptualizing community Power analysis

Adapted from Kemp et al., (1997, p. 122) and Tracy & Brown (2017)

Social ecology is both a cause and a solution to many problems, and professions like social work takes both a micro (helping clients make individual changes) and macro (helping communities through formal and informal services) approach to practice (Tracy & Whittaker, 2015). An ecological approach implies the building of supportive and nurturing environments through environmental helping, as well as the improvement of the person's life skills (Tracy & Brown, 2017). Considering that the top five needs of parents with children with life-limiting diseases are: having time for yourself in the day; practical help in the home; knowing what to expect in the future when caring for your child; financial, legal or work issues; and knowing who to contact if you are concerned about your child (Aoun et.al., 2020), it is evident why the variety of environmentally based assessment tools, as categorized in Table 1, are needed.

2.3. Social Network Analysis Skills

A social network refers to a set of individuals and the ties among them (Tracy & Brown, 2017). Sub-fields within social networks are the study of whole networks (patterns of relations in a geographically bound group, and personal social networks (the relations around a specific person (Tracy & Brown, 2017). With social network analysis (SNA) central concerns are defined as the creation, maintenance, transformation and dissolution of social structures (Doreian, 2001). Without information on where social actors are located, there is no network analyses (Doreian, 2001). At the start of the 21st century it was indicated that the roots of social network analysis used then, stemmed from sociometric analyses that depict group dynamics, the study of informal relations within large organizations by sociologist, and anthropologists' study of small communities (Tracy & Whittaker, 2015).

Stemming from writings of Ferdinand Tönnies, Max Weber, and Georg Simmel, a sociological framework was developed to view subjectively meaningful interactions in terms of large-scale social structures and the social relations among individuals in these structures (Crossleya, Prellb, & Scott, 2009). Jacob Moreno's work from 1934 was combined with the insights of Gestalt psychology and field theory to the early use of 'sociometry', where he charted the classroom friendship connections as graphical patterns of points and lines, inventing the term 'sociogram' to refer to these graphs (Crossleya et al., 2009).

Believing that ecological system theory alone does not offer a sufficient remedy, Kemp et al. (1997) expanded to social networks (the structure and number of a person's social relationships) and social support (exchanges within the network). Social support can occur through natural helping networks or can be professionally designed or mobilized, noting that more social network resources does not necessarily imply more social support (Kemp et al., 1997). "Accurate, multidimensional, and textured information on neighborhood environments is an essential foundation for practice that incorporates a community

perspective" (Kemp et al., 1997, p. 76). To analyze the personal social network, compositional and structural network qualities need to be considered (Tracy & Brown, 2017). Table 2 offers a summary of these variables.

Table 2.
Personal social network elements guiding assessment.

Compositional network qualities		**Structural network qualities**	
Variable	**Description**	**Variable**	**Description**
Size	Total number of people in the network	*Density*	The percentage of ties that exist out of all possible ties
Relationship type	E.g. Friends, family, professionals	*Components*	Members who are connected directly or indirectly
Frequency of contact	How often members interact	*Multiplexity*	Relationships that serve more than one function
Duration	How long members know each other	*Centrality measures*	Network activity and information flow
Reciprocity	Amount of give and take between members		

Summarized from Tracy & Brown (2017)

Structural links of the network differs from the resources or support exchanged within the network, with social support referring to the ways in which people offer assistance to one another, be it offering advice, encouragement or concrete assistance (Tracy & Brown, 2017). A social support network is instead a set of relationships that provide nurturance and reinforcement for coping with life, inferring that some social networks may not be supportive (Tracy & Brown, 2017). According to Israel (1985, p 67) "it is the quality (meaning, intensity, mutual sharing), not the quantity (size, frequency of interaction), of social relationships that is most strongly associated with physical and psychological well-being". According to Kemp et al. (1997) the social network analysis starts with these guiding questions to clients:

- The types of support perceived to be available?
- The extent to which network relationships are reciprocal?
- The extent to which network members are critical to the client?
- The closeness, frequency of contact and the length of relationships?

The answers are used to populate the social network gird in Table 3 as one example of how the analysis can be presented visually. The top 15 people in a network is captured, so the grid will normally have 15 lines.

Table 3.
Social network grid.

Respondent	**Area of life** Household Other family Work/school Organizations Other friends Neighbors Professionals Others	**Concrete support** 1. Hardly ever 2. Sometimes 3 Almost always	**Emotional support** 1. Hardly ever 2. Sometimes 3 Almost always	**Informa-tion / advice** 1. Hardly ever 2. Sometimes 3 Almost always	**Critical** 1. Hardly ever 2. Sometimes 3 Almost always	**Directions of help** 1. Goes both ways 2. You to them 3 Them to you	**Close-ness** 1. Not very close 2. Sort of close 3 Very close	**How often seen** 0. Not see 1. Few times p/y 2. Monthly 3 Weekly 4. Daily	**How long known** 1. Less than 1yr 2. 1-5 yrs 3 More than 5 yrs
1									
2									
3									
To 15									

Tracy and Whittaker (1990 in Kemp et al., 1997, p 111)

In addition to the specific variables derived from the grid, assessment information from the other tools in Table 1, will assist the worker to understand culturally specific patterns of giving help; identify sources to aid in the maintenance of intervention gains; understand family system boundaries; pinpoint sources for conflict within the personal network; appreciate the client's perception; and encourage the client to actively restructure the immediate social environment (Kemp et al., 1997). Later research on measuring social networks, extracted information on network size (number of members in the network), composition, and quality – with changes noted along three timelines: a baseline measurement and then six months and twelve months later (Henwood et al, 2015 in Tracy & Whittaker, 2015). Items identified in the measuring of social networks within drug use reduction programs included questions on who respondents approached in the last 6 months for help and who provided help in the same period, as well as network density (number of connections between members) and network size (Falade-Nwulia, et al., 2022). Through this thorough assessment of networks, the way will be paved for effective intervention within the environment.

3. ENVIRONMENTAL MODIFICATION

A classical source defined environment, for the purpose of social service interventions, as: (a) social structures, such as social class system and ethnicity; (b) social conditions, such as unemployment and discrimination; (c) social systems, like economic, health, and educational networks; and (d) specific neighborhood or community resources, like schools, churches, day-care centers, job training programs (Grinnell, Kyte, & Bostwick, 1981). It further classified the environment as primary or secondary, proximal or distal, natural or manmade, internal or external, and physical or social (Grinnell et al., 1981). These classifications have some similarities to the social network intervention types discussed later in this section. Searches of later sources on environmental modification or – intervention, deliver a different slant to its meaning, leading to another foundational source on this concept being at risk of getting lost in the huge influx of publications on environmentalism, as well as social development theory and approaches in SA since the later 1990s and early 2000s.

With social networking being the start of environmental intervention, person-environment practice forms the foundation through purporting the following building blocks (Kemp et al., 1997, p.4-6): *partnership* between clients and professionals, meeting on common ground as a unified team; *mutuality* where an open atmosphere is created for communication about sensitive concerns, built on mutual respect and trust; *reciprocity* in the helper-principle where giving and receiving help go both ways among all key players; *social assets* is where the assessment begins with looking at what is going wrong (deficits) and also what is going right (strengths); being alert to *resilience* as protective factors and mechanisms that blunt the effects of known risk factors and permit individuals and families to overcome extraordinary difficult life situations; *optimization* as the goal to always create conditions within which each individual client, family or neighborhood reaches the upper limit of its developmental potential; *natural helping* draws on the ability of clients and communities to aid themselves through rituals, spiritual practice, celebration and reflection; *social integration* involves working with 'private troubles' of clients in the context of raising public concern about the critical integrating function of individuals, families and neighborhoods in maintaining social order and promoting public safety, and thereby removing risk and change the environment; *coherence* describe processes through which the individuals, families and groups discern a sense of meaning beyond the struggles of day-to-day existence; and the fostering of *hope* that things can change for the better and that the power for change resides

within. From the social network analysis, a deeper understanding of the person within their environment will be obtained. Bronfenbrenner's basic concept that an individual's social field increases concomitantly with his or her overall development, highlights the value of the transactional space for increasing personal competencies to deal with environmental blocks (Kemp et al., 1997). Integrating the above building blocks then become principles directing environmental modification strategies.

To ground the environmental and social network interventions described next, it is pertinent to take note of key principles for implementation. In short these include the use of linking (identify, engage, assess, refer to and maintain resources); capitalizing on strengths; and striving for a collaborative worker-client relationship with shared power (Tracy & Brown, 2017).

3.1. Environmental Intervention Strategies

Environmental intervention (EI) is "both action in the environment and the process of transforming individual and collective perspectives through critical analysis of the impact of environmental conditions" (Kemp et al., 1997, p. 136). Core practice activities include gaining access to, developing and enhancing resources and services, including social networks that support, educate and empower clients and communities, and working to change toxic and oppressive environmental conditions (Kemp et al., 1997). The eventual goal is twofold: to create an environment that nurtures and support growth and change, and to enhance individuals and groups' abilities to act in the environment on their own behalf (Kemp et al., 1997). EI should be based on ecologically valid assessment of the influences on current functioning and are therefore applied at several levels of the environment (Kemp et al., 1997). When resilience, protective factors and environmental risks are added to the mix towards the comprehensive social networking analysis previously described, it will incorporate individual attributes, family or interpersonal factors, and community or neighborhood factors (Kemp et al., 1997). Table 4 summarizes the interventions per type of environment and across the various client groups. Detail on each fall outside the scope of this chapter but can assist with further exploring of environmental intervention options.

Table 4.
Interventions per environmental type and across client groups.

Client system	**Perceived**	**Physical**	**Social / Interactional**	**Institutional / Organizational**	**Social-political / Cultural**
Individual	Interview for client strengths. Empowerment. Critical reflection / dialogue	Brokerage & concrete services	Network facilitation. Skills training.	Service coordination / case management	Mediation. Advocacy.
Family	Use of narrative. Empowerment. Critical dialogue	Home-based interventions. Family development programs. Concrete services	Family education & support. Support groups & programs.	Consultation with larger systems. Family group conferencing.	Social action / advocacy groups.
Group	Empowerment group.	Therapeutic milieu.	Mutual aid / self-help / support groups.	Program development.	Social action groups.

Neighborhood	Community capacity awareness. Empowerment.	Locality development. Investment.	Community building. Natural helpers.	Social planning. Program development. Community liaison.	Grassroots groups.
Overall goal	Interventions designed to transform perceptions of the environment	Intervention in the natural & build worlds.	Interventions to mobilize social support.	Interventions to mobilize services.	Interventions for social & political change.

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3.2. Social Network Interventions

Social network interventions are typically directed toward either structural changes (increase or decrease size or composition of the social network) or functional changes (developing skills) in the network relationships (Kemp et al., 1997). It involves the following major strategies towards environmental modification, as summarized from Kemp et al. (1997, p. 141-157) and Tracy & Brown (2017, p. 488-489):

- *Natural helpers* are people to whom others naturally turn to for advice and support, consisting of gatekeepers, key informants, and indigenous helpers. The aim of the intervention will be to develop a consultative relationship between key helpers and social service workers, aimed at preventative or early intervention services. This is particularly useful for hard-to-reach clients and rural, cross-cultural settings.
- *Network facilitation* mobilizes the social network as a resource to supplement existing support. It should be individually tailored through the identification of potential network members and identification of their strengths and gaps. It is essential to determine the barriers for achieving change goals. Skills training of the network may be required, and even skills like the client asking for help. Lasting informal networks are mutual and reciprocal. Volunteer linking can assist to increase the network and family group decision-making to create a plan for meeting needs. Network meetings that ensure communication to avoid duplication of effort, are integral to this form of intervention.
- *Mutual aid or self-help groups* mobilize relationships among people who share common tasks, goals, or problems. Such groups also create more opportunities for members to learn from each other, engage in helping roles, and serve as vehicles for advocating for the disenfranchised.
- *Social network or social support skills training* teaches people ways of establishing and maintaining supportive interactions with others. Using cognitive behavioral interventions to achieve personal goals, encompasses the following implementation steps: to identify the new skill; instruct, model and practice the skill; plan opportunities for generalizing the acquired skills; implement a step-by-step social network improvement plan; coordinate, consult and train with network members; and monitor and evaluate the plan. The aim is to have a skilled support system and the person equipped to use the support system effectively.

"Social network interventions need to be grounded in the principles of culturally competent practice, including respect and appreciation for differential values, beliefs, and behaviors regarding help-giving and help-seeking" (Kemp et al., 1997, p. 158). It should not be assumed that more is better, or that the network you see is the one experienced by the client or that all members of the client system have the same needs (Kemp et al., 1997).

4. BENEFITS OF APPLYING SOCIAL NETWORK INTERVENTION

Unlike a mere capturing of online social engagement, the approach discussed in this chapter acknowledges the importance of the required environmental intervention that should follow a targeted assessment. In 1968 already, Allen Barton criticized the effect of mainstream research in social science – that for its reliance on empirical survey and random sampling, became a 'sociological meatgrinder' that tears the individual from their social context, 'and guaranteeing that nobody in the study interacts with anyone else in it' (Freeman, 2004, p.1). He argued that if our aim is to understand people's behavior beyond merely recording it, 'we want to know about primary groups, neighborhoods, organizations, social circles, and communities; about interaction, communication, role expectations, and social control' (Freeman, 2004, p.1). "In recent decades, research based on SNA has been increasingly used in health, including areas such as disease transmission, health behavior, organizational networks, social capital, and social support" (Fernández-Peña, Ovalle-Perandones, Marqués-Sánchez, Ortego-Maté & Serrano-Fuentes, 2022, p. 2). The SNA is therefore not only a more operational practice tool, but also serves a key function in the mergence between social and health science research.

Environmental interventions may allow for more effective use of professional time, while extending professional interventions over longer time periods than usual, as well as booster shots of EI at set intervals, which can extend the duration of change and prevent relapse (Kemp et al., 1997). Around the mid-1990s an Inter-ministerial committee on youth-at-risk in SA, issued recommendations for the urgent change of the social welfare structure of the time; mainly focusing on the change from case-based social service delivery to community-based service delivery (IMC, 1996). Social network research has used exchange theory; rational choice theory, social capital theory; and dynamic network theory; as well as drawing from structural network theory that links network structural properties (such as density) and the positions held by people within the network who exhibit certain behaviors (Tracy & Whittaker, 2015). In the health sector SNA studies have been used to show the relationship between the characteristics of the social network and different health-related outcomes such as "health behaviors, satisfaction with social support in chronic illness, quality of care and patient safety, the influence of social networks on HIV prevention and treatment outcomes, behavior change and risk of disease transmission, or performance in health care organizations and health care providers" (Fernández-Peña et al., 2022, p. 2).

The above shows support for the benefit of SNA in both social and health services. Another critical rationale for the adoption of community-friendly frameworks relates to poverty reduction. According to Maksum, Nugroho, Puspitosari, Susanti, and Prastiwi (2023) poverty alleviation depends on policymakers who prioritize community needs, and where policies are not aligned with community needs, they are deemed ineffective and a waste of resources. With centrally determined policies there is limited public involvement in decision-making, thereby reducing the chance to satisfy the communities' demands (Maksum et al., 2023). Using citizen participation only as a form of tokenism, will not lead to impactful environmental change. The process of SNA ensures relevant engagement of the social actors about their social contexts' capacity to meet their needs. More insights can be gained from

studying the impact of disrupted emotional bonds in childhood, which may produce insecure attachment. “Compromised attachment has a profound impact on developing capacities for regulating negative affect and mobilizing others as support in times of need by limiting an individual’s ability to relate to others and to participate in satisfying social interactions, which in turn, contributes to the development of a compromised personal network later in life” (Tracy & Whittaker, 2015, p. 646). During stressful periods, the social network can be seen as a ‘social fund’ that people could draw upon when they need to cope, although stressful life events disrupt social support resources (Tracy & Whittaker, 2015). “Families with seriously ill children face complex challenges including stress on siblings, physical and mental health issues, financial and work problems, relationship issues, social isolation and high distress” (Gill et al., 2021, p. 77). With these complex challenges a family caring for a terminally ill child experience, it is likely that their interaction style is affected. This in turn will affect their ability to access supportive networks, making it significantly more important that professionals delivering services to this vulnerable population are well equipped to facilitate the development of supportive networks.

5. CONCLUSION

Community work in SA is influenced by the sustainable livelihoods model. While its nature cannot be covered in this chapter, this is another approach that requires the skills discussed in this paper, as is also the case for the different set of guidelines for community profiling. The various applications of an environmentally focused approach demonstrated previously, is easier adopted to practice through the practical strategies linked to social network analysis and environmental intervention. The inclusion of this within the HE curriculum aimed at the professions delivering a service to terminally ill children, is therefore supported. Although more detail on the strategies discussed cannot be covered, a case was made for the importance of not losing the roots of analyzing and intervening in complex environmental matters. Environment intervention is more than community work with impoverished communities. The individual’s interaction with their environment is one of the strongest predictors of their quality of life. This link becomes even more critical when it comes to terminally ill children and their families trying to navigate EOL needs, especially with consideration of the poverty trap these needs can cause. More extensive classification systems like the Person-in-Environment systems, exist to more comprehensively describe the environmental systems, but the social networking approach is an easy adoptable process to ensure the interaction with, especially the social environment, is captured adequately. Significant development on understanding interventions within the client’s environment has been made, and acknowledging the rich social sciences history in this regard will ensure that practitioners are not perceived as only capable of limited environmental assessment and impact. Core to the benefits of allowing participation of the community networks in assessment and intervention, is the meeting of partnership goals towards ensuring sustainable services that increase the quality of life of terminally ill children and their families. The key asks of SDG17 being met through social network interventions include the strengthening and expanding of partnerships; brokering meaningful multi-stakeholder coalitions; and leveraging resources and capacities.

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ABBREVIATIONS

CYCC	Child and Youth Care Center
EOL	End of Life
HE	Higher Education
PPC	Pediatric Palliative Care
SA	South Africa
SDG	Sustainable Development Goal
SNA	Social Network Analysis
UNICEF	United Nations Children's Fund

AUTHOR INFORMATION

Full name: Rika Swanzen, Dr (or Rika Swanzen [D,Lit.et.Phil. Social Work])
Institutional affiliation: Deputy Dean of Research, The Independent Institute of Education, Varsity College.
Institutional address: 144 Peter road, Ruimsig, Gauteng, South Africa.
Email address: rswanzen@varsitycollege.co.za
Short biographical sketch: Dr Rika Swanzen has nearly 30 years' experience in child welfare, mental health, community development, residential care, programme management, research and curriculum development and teaching in the field of Child and Youth Care. Rika authored 24 peer reviewed publications and delivered 26 conference presentations from 2007 to 2023. The outcome of her doctoral study was the ChildPIE©; a classification system for describing childhood social functioning problems. Dr Swanzen held the position of Adjunct Associate Professor with the Caulfield campus of Monash University from 2015-2018. In 2016 she was appointed by the Minister of Social Development as council member, to represent education and training on the South African Council for Social Service Professions, for a 6-year term. She has been a postgraduate external examiner, co-editor of the Relational Child and Youth Care Practice journal (2015-2022) and peer reviewer for various journals in the field of social work and teaching and learning.

Chapter #21

THE INFORMATION DESIGNER ROLE ON HEALTH EDUCATION: PARTICIPATORY METHODOLOGIES TO CITIZEN EMPOWERMENT

Mónica Santos[1] & Suzana Dias[2]
[1]ISLA – Research Center – Polytechnic Institute of Management and Technology, Gaia, Portugal; ID+/ Research Institute for Design, Media and Culture/Polo FBAUP, Portugal
[2] ID+/ Research Institute for Design, Media and Culture/Polo of the Polytechnic Institute of Cávado and Ave (IPCA), School of Design (ESD), Portugal

ABSTRACT
The authors, Design research experts, explore Design Thinking's holistic methodology in this article. This burgeoning concept is gaining recognition and application in various contexts. Their aim is to emphasize the importance of collaboration and interdisciplinary work, fostering interactions among individuals from diverse domains and merging specialized and practical knowledge. This approach cultivates a participatory culture and stimulates innovative solutions. In this article, the authors present a segment of research conducted by (Santos, 2020), focusing on health education message co-creation and Information Design's role in healthcare, enabling population autonomy. After an extensive literature review involving health, Information Design, and Design Thinking experts, the study examined the clinical analysis report model used by the Portuguese National Health Service. Through co-design involving designers, users, and healthcare professionals, the study developed a prototype for a new clinical analysis report, which is showcased as a successful example in this paper. In conclusion, there's an urgent need to reassess longstanding power dynamics in decision-making centers. The authors stress that citizens/users shouldn't be relegated to passive content recipients based on assumptions but should be integral to the co-creation process, right from the beginning. With this paper, the authors aim to empower all individuals as direct agents of social innovation in their daily lives.

Keywords: design thinking, information design, heath message, co-creation design, visual literacy.

1. INTRODUCTION

There is no easy or definitive answer to the challenges of our age where environments are complex, as is the case with health or education. However, Design Thinking offers an integrative and flexible approach that makes it possible to identify, develop and deliver services that respond more effectively to the needs of the community and the individual. This approach requires existing systems in society (health, education, economy) to have the capacity to recognize and articulate the latent needs and desires of stakeholders, to involve a wide range of voices (mainly outside the system) and to work constructively with the different perspectives (tensions) rather than trying to identify one as the right one at the expense of the others, that they quickly begin to carry out small tests of the various hypotheses and possible solutions in the community that lives with the consequences of persistent problems, such as health, and that has more risks in solving them (Roberts, Fisher, Trowbridge, & Bent, 2016).

In this chapter, the authors, who come from the field of design, aim to highlight the importance of the participatory methodology of Design Thinking. This methodology originally emerged in their field of study but has increasingly been applied in other contexts. Collaboration and interdisciplinarity are crucial factors to foster a participatory culture, essential for achieving success solutions. The interaction between specialized knowledge and insights from both experts and non-experts promotes knowledge expansion, innovative solutions, and a sense of integration. Designers play a crucial role in applying Design Thinking to complex fields like health and education. They foster collaboration, embrace diverse perspectives, and conduct iterative tests, contributing significantly to identifying, developing, and delivering services that positively impact population health outcomes.

To do so, a portion of a research conducted by the author (Santos, 2020) within the scope of their doctoral degree is presented. The study analyzes the significance of Information Design for the autonomy of the Portuguese population in the context of healthcare, applying the Design Thinking methodology. The aim of this methodology was to adopt a bottom-up procedure in which people and the community were at the center of the process. It was discussed that Information Design tools are crucial for enhancing individual awareness and autonomy, but active user participation in the design process is vital.

The central issue addressed in this research was the lack of population autonomy concerning their own health and how design could positively contribute to this situation. Presently, despite government measures aimed at a preventive healthcare model, it is often observed that the population still utilizes healthcare services in a consumeristic or reactive manner, not considering their health as a life goal to achieve. This behavior results in various negative consequences, both on a personal level and in terms of the services' ability to respond effectively. Additionally, this research revealed that current health education messages were not tailored to user literacy, neglecting cognitive needs at cultural and social levels, as well as emotional needs.

Following an in-depth literature review involving experts in the field of health, Information Design, and Design Thinking, case studies were analyzed, and workshops were conducted, incorporating observation, interviews, and co-creation methods to identify challenges in accessing and comprehending information. The study focused on the current clinical analysis report model used in the Portuguese National Health Service.

Through co-creation, involving designers, users, and healthcare professionals, the study successfully developed a prototype for a new clinical analysis report, which is showcased here as a successful example. In short, in this paper we will discuss the definition of Design Thinking as a human-centered innovation method which, due to its comprehensive approach, can be applied to any area and to which various actors with different skills contribute, and in which new ideas are transformed into new products or services. Through collaboration, learning, visualization and prototyping, it makes it possible to discover real needs, mediate the creation of knowledge and improve the user experience.

2. DISCUSSION / LITERATURE REVIEW

Several studies, conducting a comparison of different versions of the layout of the clinical analysis document, before and after user collaboration, highlight the importance of user-centered Information Design (Nystrom, Singh, Baldwin, Sittig & Giardina, 2018; Meroni & Sangiorgi, 2011; Zikmund-Fisher, Exe, & Witteman, 2014). Most of them conclude that this collaboration is crucial because patients who are involved in making decisions about their health are more likely to achieve better health outcomes (Hibbard, 2003 cited by McCarron, Arora, Courneya, St-Pierre, & Elmohee, 2019). The most effective methods are those that involve direct intentional experiences that represent reality or as closely as possible, and the more sensory the forms of interaction with the informational object, the greater the probability of learning from it. As argued by Edgar Dale in 1946 (according to Anderson n.d., as cited in Dale, 1969), the amount of information retained and remembered depends on the way it is received. Similarly, we also 'store' more information through what we "do" rather than what we "hear" and "read".

In this sense, it is necessary to use methods that make it possible to integrate citizens into the Information Design process. Design Thinking, being a democratic, holistic, collaborative, integrative and human-centered process allows citizens to be involved from an early stage in the process and not just as passive spectators.

3. INFORMATION DESIGN

Information Design aims to create clear, organized, and visually appealing documents that can be easily understood and used for effective action. This can be challenging in the health field where complex relationships and low health literacy can make it difficult for the audience to access the message (Espanha, 2009). When messages are designed with preconceived assumptions from the person creating them, and without considering the informational needs of the audience, the information can result in inadequate communication and visually uninteresting presentations that are not suitable for the intended target audience. This can cause information to be rejected for being difficult to understand, irrelevant, boring, irritating, or unconvincing. The negative impact of this difficulty can lead to frustration for users who may not know how to act on the information they have received, leading to a dependence on doctors or health professionals for decision-making on health management.

Assumptions of Information Design are fundamental to health communication messages, as they often involve changing behaviors and presenting strategies to incorporate new actions into daily life. By applying the principles and process of Information Design, the audience can be engaged with the message, perceive it, agree with it, think about it, remember it, and have the intention to act on its content (THCU, 2002).

4. DESIGN THINKING

4.1. Concepts and Principles

The increasing complexity and ambiguity of design and its associated problems have highlighted the importance of understanding the design process and methods. This has led to the emergence of the study of the nature of design problems. The Conference on Design Methods held in London in 1962 marked a milestone in the development of design methodology as a field of research (Cross, 2007). In the book "The Science of the

Artificial," Herbert Simon argues that design is a process aimed at transforming existing situations into preferable ones and that design can be carried out by anyone. To address complex challenges, it is often not about finding 'definitive' answers but rather about having the ability to 'transform existing situations into preferable ones,' as suggested by Simon (1999). In line with Rittel (Rittel & Webber, 1973), he argues that there is no definitive solution to design problems, only the creation of other situations that may be more or less satisfactory. In 1973, Horst Rittel and Melvon M. Webber coined the term "wicked problems" to refer to the complex, ambiguous, and unique problems that design faces (Rittel & Webber, 1973). These are problems that are not isolated, and in seeking to solve one, we discover others, requiring a more creative approach than science can offer. An approach to problems informed by design theories and methods places the emphasis on synthesizing information and ideas from various sources in the search for new and unconventional solutions (Roberts & al, 2016).

By placing design at the level of a criminal activity, American designer Victor Papanek argues that, in addition to persuading people to buy what they do not need, with money they do not have, satisfying only fleeting desires, the true needs of humanity are often neglected (Papanek, 1984). He proposes identifying the real needs of people by promoting a social and human-centered approach characteristic of the Design Thinking process. For this to happen, design must move from being done "for" people to being done "with" people (Thackara, 2005). The author goes further by critiquing design education and highlighting the holistic nature of the process. He argues that design education should not be limited to teaching design alone but security, pleasure, affection, understanding, autonomy, meaning, and acceptance are the main human needs (Curedale, 2013). Involving the people for whom design is intended and their experience in the process, human perception (Rittel & Webber, 1973; Manzini, 2015; Tschimmel, 2011 adds human value. The Design Thinking process is a democratic process that anyone can use (Tschimmel, 2011) because every human being is creative (Manzini, 2015).

"Design thinking," initially written in lowercase, denotes the cognitive process of designers, with a primary focus on the attributes of creative design. Since the beginning of the century, the concept of Design Thinking (now capitalized) has expanded to other disciplines and is now recognized as an organizational resource for innovation (Tschimmel, 2018). The origin of Design Thinking, while uncertain, is often attributed to Peter Rowe's book "Design Thinking," gaining momentum with the methodological approach of the renowned American design and innovation company IDEO (IDEO, 2015) and Stanford d. School. It is presented as an innovative process (Brown & Wyatt, 2010; Buchanan, 1992) with a human-centered approach (Cross, 2011; Brown, 2009; Lockwood, 2009), using collaborative design tools and methods. Therefore, some argue that it is unique to design and designers, while other professionals claim that it is a blend of methods borrowed from other practices such as business, marketing, and creative arts (Martin, 2017). Integrating the needs of stakeholders, the methods used create value for users and are capable of developing better solutions for social problems, taking into account what is technologically feasible and viable for the organization's or institution's strategy (Brown, 2009). It provides society with a set of tools that help achieve its goals with less need for investment, helping to create a society in which citizens take control of their lives and decide what matters to them (Blyth & Kimbel, 2011). By including citizens and considering their needs in the process, it has a fundamentally social character. For the process to be truly social and human-centered, there must be a culture characterized by a participatory mindset, in which designers value people as co-designers in the process (Sanders & Stappers, 2008; Manzini,

2016), trust the abilities of non-specialists (Kimbell, 2011), and do not see people merely as passive users or consumers.

Higher levels of interdisciplinarity are associated with a broader field of knowledge, skills, and abilities (West et al, 2003), promoting a higher level of cognitive stimulation within the group. The integrative approach of the process, combining contributions from various specialties with those of the public (Chasanidou, Gasparini, & Lee, 2015), provides the foundation for generating new ideas and better outcomes, creating a strong sense of ownership of the ideas resulting from the integrative and collaborative process (Szebeko & Tan, 2010). This characteristic of an integrative process transforms the role of the designer into that of a mediator (Manzini & Rizzo 2011; Buchanan, 1992), or even a "provocateur" (Manzini & Rizzo, 2011) who may be more promising in making new initiatives happen. Their way of thinking and decision-making, according to Nigel Cross, sets them apart from other professionals (Cross, 2011).

New spaces are emerging in response to people's constant need for creativity (Sanders & Stappers, 2008). Design Thinking not only helps create solutions but also shapes these creativity spaces and existing problems, making them visible and more understandable through new ways of creating change. The center of these complex problems, such as health, poverty, and education, embedded in complex systems themselves, where information is confusing, there are many stakeholders with different interests, and boundaries are non-existent or blurred, makes these spaces complex as well. Complexity is a defining characteristic of the Design Thinking process (Buchanan, 1992; Jones, 2014), and complex environments lead to changes in the process to adapt to the new context, giving it an adaptive character. Therefore, the focus should be on the process and not just the problem.

Design is not limited to the creation of new physical products but includes new process forms, services, entertainment, and new ways of communicating and collaborating (Brown, 2009). According to Brown, the growing interest in design is a consequence of the shift of economic activity in the world from industrial manufacturing to knowledge creation and service delivery. For this author, the Design Thinking process is exploratory, with many unexpected discoveries and disruptions, and it would be unwise not to attempt to discover where the paths lead. He believes that design cannot happen without constraints; to improve, it is necessary to make mistakes and accept them as part of the process (Brown, 2009; Cross, 2011; Curedale, 2013; Tschimmel, 2012). This approach reinforces the importance of self-reflection in the design process, advocated by Donald Schön, in which "doing" and "thinking" are complementary, one feeds the other (Schön, 1983). Through different methods (testing, actions, and surveys), doing extends thinking, and in turn, reflection feeds action and its results.

Understanding the social, cultural, and economic context that encompasses the problem is essential for its proper framing. Design Thinking has methods that offer a holistic view of the problem, rather than an individual one. We can compare Design Thinking to the value constellation model, different from the Fordist model of value creation in a chain. In Design Thinking, there are multiple sources of knowledge from an open and large-scale system (Freire & Sangiorgi, 2010), leading to a new and multifaceted approach. The participatory nature of the Design Thinking process questions "power" and reformulates the role of stakeholders. The design professional or researcher contributes to the process with expertise in methods and theories, while the community contributes insights from practice, its needs, and its implicit understanding of social and cultural dynamics. In this paradigm, the designer is seen as a facilitator, not a creator as in the industrial model or as a communicator (Buchanan, 1992) seeking to discover compelling

arguments through a new combination of words and images. The mediator or facilitator designer must simultaneously consider human needs, available resources, and the constraints and opportunities of the service or business, in other words, the designer must be both empathetic and analytical; rational and emotional; methodical and intuitive (Tschimmel, 2012). The designer should guide the project without becoming the center, without hierarchizing the process, and without bringing preconceived ideas or biases to the research process, using systemic thinking to consciously work across different areas and domains of design knowledge (Friedman, 2000). There is still no consensus on recognizing the key elements of the Design Thinker mindset; however, Dosi, Rosatti, and Vignoli (2018) propose a table defining a set of elements that are common to most of the authors studied.

The emotional conditions under which Design Thinking can thrive include tolerance for uncertainty and comfort with ambiguity, holistic vision, accepting and learning from mistakes, human-centered, empathetic, learning-oriented, abductive thinking, interdisciplinary, experimental thinking, and creative confidence. There are other characteristics not as commonly mentioned but equally important: risk acceptance, optimism, teamwork spirit, and openness to other perspectives. Given the variety of contexts and situations in which Design Thinking can be applied and the variability of its complexity, the relevance of these attitudes may vary from one situation to another. Researchers recognise the complexity inherent in the practice of design and the change from the paradigm that answered the question "what do we solve?" to the paradigm that seeks to answer the question "how do we solve it?", highlighting the Design Thinking process as a cognitive style (Kimbell, 2011) and in order to achieve success in the design process.

The Design Thinking process promotes innovative ideas, yet human beings have an involuntary resistance to the new, a consequence of the way they have been trained to see the world through analysis. When there is no analytical proof of the effectiveness of something innovative, or at least a track record that provides data for this analysis and the necessary emotional comfort we need, it becomes difficult to adopt "innovation". The methods used in the Design Thinking process, through an intervention that pays attention to both logic and emotions, favour this emotional comfort (logic) that we need to commit to something new, increasing the likelihood of commitment from the different players in the process and the success of the results (Martin, 2017). The great levels of complexity that exist in the context of problems such as health or education, while expanding the potential for opportunities and directions for design, also imply difficulties. The Design Thinking process, in addition to the risk of the process, requires the limited acceptance of results and development (Sangiorgi, Patricio, & Fisk, 2017), the ability to deal with different domains and specialities (Friedman, 2000), and the vast network of interactions that implies that when one suffers it affects the others unfavourably.

The characteristics of traditional object-orientated design (products, services or systems), seen as a specialist activity (Manzini, 2016) that designs objects for industrial production, do not fit into this reality. The focus has shifted from "objects" to "ways of doing and thinking", to the process of designing solutions to complex and intractable problems (Manzini, 2016; Cross, 2007; Brown, 2009). Through the application of Design Thinking, we sought to move away from the traditional design process and bring the citizen into the process, analysing, observing, involving, exemplifying, and in this case testing clinical analysis documents in order to provide an efficient response to the problem that meets the needs of the users.

5. DATA SURVEY AND ANALYSIS

5.1. 1st Step: Visual Analysis

In a first approach of our survey, visual analysis of the sample of reports was carried out. We aimed, at first identify visual factors that could affect users with low literacy and second, to establish guidelines for the design of health communication supports. For this study, 30 reports selected from the main laboratories form Porto (Portugal) district, were analyzed regarding design elements as: support, structure, and organization. The relevant issues found, including the absence of graphics and images, the use of technical language, and the presence of unrecognized symbols, act as barriers to the understanding of the information.

5.2. 2nd Step: Perform Tasks_Co-Creation Method (Workshop)

After analyzing clinical analysis reports, two workshops, each lasting three hours, were developed. The workshops consisted of five phases where participants, selected through a random sample of 12 participants each, in which we sought to integrate different genders, ages and literacy levels, were asked to perform tasks such as reading and locating information, brainwriting/sketching, organizing information spatially, and evaluating final results. This document, in which the participants had to carry out the requested tasks, simulated the presentation of clinical results of a fictional patient, where the values were intentionally outside the reference parameters, and patients were asked to suggest preventive measures to avoid the onset of the disease.

5.3. 3rd Step: Analyzing the Results

The concept tests, in which a document containing 3 intentionally altered values for this experiment was used, yielded the following results: of the twelve participants, only one was able to identify the three altered values; seven participants correctly identified the Total Cholesterol result (Particular emphasis was placed on cholesterol because this research accompanied a study by the Dr Ricardo Jorge National Health Institute on the prevalence of cardiovascular risk factors in the Portuguese population, for which cholesterol is one of the most important analyses); three participants misinterpreted results that were normal; two participants mentioned confusing the symbols ">" and "<", revealing to be a barrier to correctly read the results;

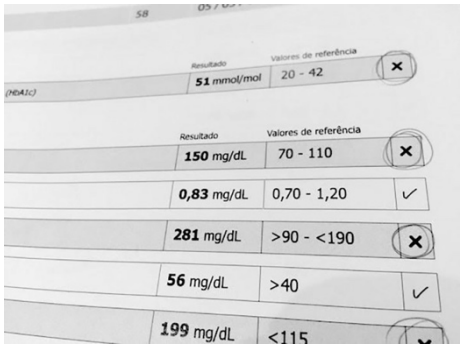
After this participation phase, the participants were asked some more incisive questions in order to gather more detailed information about their perceptions. When asked: "what should you do to prevent your Cholesterol value from rising?" five participants did not know what to suggest.

It was also observed that participants had difficulty keeping their gaze on the same line because there was no orientation in the text lines and mentioned being confused by the existence of two units of measurement for all outcomes. This was later validated by health professionals, who pointed out that the presence of two units of measurement, as well as not adding anything new, led to confusion and misreading on the part of both the public and the health professionals themselves.

5.4. 4rd Step: Developing a New Prototype

Based on the findings, a prototype (figure 1) was developed to address reading difficulties and incorporate user responses into graphical elements. Specifically, the results were presented with guiding lines for horizontal reading, highlighting results outside the reference parameters with a gray background. Icons representing right and wrong, chosen by participants, were added at the end of each line. Information on health promotion was included, irrelevant units of measurement were removed to reduce result interpretation ambiguity, and text regarding the sample's nature (e.g., blood, serum) was adjusted to prevent confusion with analysis names. A legend was included to aid symbol comprehension.

Figure 1.
New prototype detail.



5.5. 5rd Step: Testing a Second Concept Prototype (Increasing the Challenge)

The prototype underwent testing with users and health professionals, involving tasks similar to those performed with the 'original' report. At this stage it was considered important to include health professionals in analyses of the layout of the new document in order to validate the holistic and integrative nature of the methodology, which includes all those involved in the process. As a way to increase the difficulty and accuracy in verifying the participants' literacy, seven values outside the reference intervals were placed in this new report.

As a conclusion, all participants correctly identified all the values, except one participant who had doubts about one result, indicating a comprehensive understanding of the document. Some identified issues and improvement suggestions include: confusion caused by added health promotion information, potential anxiety caused by the presence of symbology according to health professionals, removal of irrelevant sample nature information, and inclusion of explanatory notes for interpreting "normal results".

This results and the evidence gathered allow us, in the context of this article, to validate the importance of adopting Design thinking methodologies. This study in particular and the data obtained could have a broader scope, if it weren't for the impediment of Covid at the time, which prevented the continuation of the project with a clinical analyses' unit.

6. CONCLUSIONS

This study allowed us to comprehend the crucial role of Information Design and Design Thinking methodologies as valuable tools in this specific context, thanks to their integrative nature. By co-constructing messages that fostered a strong sense of ownership and commitment, individual awareness and autonomy were enhanced, ultimately promoting informed decision-making regarding their health.

This study has confirmed that in order to enhance outcomes and develop effective health-related educational content, it is essential to work in collaboration with the public for whom the communication project is intended. To do this, it is necessary to bear in mind that a project of this nature cannot be based on isolated decisions, or decisions identified only by the designer or institution. Accessing people's direct experience and all the stakeholders in the process is a fundamental source of knowledge if the designer is to be able to respond successfully to the various day-to-day problems faced by ordinary users. In this increasingly aware scenario, it is imperative to re-evaluate the traditional design paradigm. Instead of viewing users as passive recipients of assumed content, they should be recognised as active participants in the co-creation process of health messages. Lastly, we emphasise that participatory methodologies that involve collaboration between users and designers result in integrated, retained, and memorable information, crucial factors in the educational environment.

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AUTHORS' INFORMATION

Full name: Carla Mónica da Silva Santos
Institutional affiliation: ISLA – Research Center – Polytechnic Institute of Management and Technology, Gaia, Portugal; ID+/ Research Institute for Design, Media and Culture/Polo FBAUP (Portugal)
Institutional address: Diogo Macedo St. 192 – 4400 107 Vila Nova de Gaia
Email address: monica.santos@islagaia.pt; monicasilvasantos@gmail.com
Short biographical sketch: Lecturer at ISLA - Polytechnic Institute of Management and Technology in Vila Nova de Gaia where she's also an assistant of Web Technologies and Systems Engineering master's degree, and of Superior School of Education of the Polytechnic Institute of Coimbra, as well as researcher at the Faculty of Fine Arts of the University of Porto, with a focus on the role of design in enhancing user-National Health Service relationships by raising health literacy. She is particularly interested in studying topics on information design, social design, and how design may address the definite, present requirements of society. Graduated with a degree in visual communication from the School of Art and Design (ESAD), earned a master's degree in multimedia arts at the Faculty of Fine Arts at the University of Porto, and earned a doctorate in design there as well. She is an integrated member of the ID+ Research Institute for Design, Media and Culture (Fine Arts Faculty – Porto/Aveiro University).

Full name: Carla Suzana Correia de Assunção Dias
Institutional affiliation: Polo of the Polytechnic Institute of Cávado and Ave (IPCA), School of Design (ESD) (Portugal)
Institutional address: Campus do IPCA / Barcelos, Vila Frescaínha, S. Martinho. 4750-810 Barcelos. Portugal.
Email address: cdias@ipca.pt
Short biographical sketch: Suzana Dias is a full-time lecturer at IPCA - ESD, holding a Graphic Design degree from the Faculty of Fine Arts of Porto (FBA UP) and a Master's degree in Sound and Image from the Catholic University. In 2015, she completed her Ph.D. in Art and Design at FBA UP, focusing on Design as Process and Design's Playful, Participatory, and Relational Aspects." Her teaching career began in 1994, initially at the secondary level until 2002. With over 20 years of higher education experience, she started at the School of Fine Arts of Porto in 2001 and has been at IPCA's School of Design since 2006. She is also the co-author and designer of the Design Theory Manual, published by Porto Editora in 2001. Suzana worked as a freelance, winning competitions in graphic and artistic digital design. Currently, she regularly publishes in scientific journals and actively participates in national and international conferences.

Chapter #22

WHAT DIFFERENCE DOES A SOCIAL PRACTICE APPROACH TO ADULT LITERACIES EDUCATION MAKE TO ADULT LEARNERS' QUALITY OF LIFE IN WESTERN RWANDA?

Peter Mtika[1], Pamela Abbott[1], Wenceslas Nzabalirwa[2], & Ismael K Byaruhanga[3]
[1]*Centre for Global Development, School of Education, University of Aberdeen, UK*
[2]*University of Rwanda, College of Education, Rwanda*
[3]*Institute of Policy Analysis and Research, Rwanda*

ABSTRACT
Provision of quality adult education has the potential to make a difference in the lives of adult learners especially those from poor and marginalised backgrounds. In this chapter, we report on the effect of implementing a social practice approach to adult literacies education in rural communities in three districts in Western Rwanda. Following the implementation of a social practice approach to adult literacies education, we interviewed a sample of 32 participants, two or three years after they completed adult classes, to understand what impact the classes may have had on improving their lives and wider capabilities. The findings indicate that a social practice approach to adult literacies education impacted participants in connection with health, hygiene and sanitation, nutrition, improved marital relationships, better support for children's education, and greater community involvement. Adult learners developed greater understanding and practical grasp of life skills, social competence, positive self-image, and personal and family wellbeing while developing their literacies. They retained and used the knowledge and skills to improve their lives, that of their immediate households and the wider community. Implications of the findings are discussed.

Keywords: adult education, adult learners, literacy as social practice, quality of life, Rwanda.

1. INTRODUCTION AND BACKGROUND

In this chapter, we report on the impact of participating in a social practice approach to adult literacies education (SPA-ALE) for adult learners. SPA-ALE was implemented between 2017 – 2023 in three districts (Karongi, Rubavu and Rusizi) in the Western Province of Rwanda. In our SPA-ALE project, we embraced UNESCO's definition of literacy to mean 'a continuum of learning and proficiency in reading, writing, and using numbers throughout life as part of a larger set of skills, which include digital skills, media literacy, education for sustainable development and global citizenship as well as job-specific skills' (UNESCO Institute for Statistics, 2018).

Globally, literacy is key to human development (Stromquist, 2016). It is an essential human right and a prerequisite to individual empowerment and development (McCaffery, Merrifield, & Millican, 2007; UNESCO, 2009; Wagner, 2011). Literacy is liberating since literate individuals are capable of exercising agency to improve their lives by disrupting structures and symbols of inequality (Robinson-Pant, 2008; Stromquist, 2016). Literacy can extend human capabilities and enable individuals to lead a life they value (Sen, 1999). Given the importance of literacy, the United Nations has adopted literacy within the Sustainable

Development Goal (SDG) 4.6 "By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy" (United Nations, 2015, n. p.). Adult education is essential in the global efforts to achieve inclusive and sustainable development (United Nations, 2015; Zarestky & Ray, 2019).

The Government of Rwanda acknowledges that adult education is essential for poverty reduction, improved health, and increased participation in community development (Ministry of Finance and Economic Planning [MINECOFIN], 2000). To this end, the Rwanda Government developed an adult education policy to combat 'illiteracy' by 2020 (Ministry of Education [MINEDUC], 2014). However, this has not been achieved for a number of reasons. For example, adult literacy education provision is underfunded; there is lack of training for adult literacy tutors (Abbott, Mugisha, Mtika, & Nzabalirwa, 2020); and there is a prevalence of the use of ineffective teacher-centred approach which is unsuitable for adult learners (Knowles, 1980; Stromquist, 2009). Nevertheless, the government is committed to addressing the problem of illiteracy in the country.

Internationally, adult literacy education is essential, and its importance was highlighted through the Belém Framework for Action, which noted that it can enhance people's quality of life (Milana, Holford, Hodge, Waller, & Webb 2017). However, there is a global concern regarding illiteracy, which is estimated to affect more than 773 million young men, women, and adults, aged fifteen or over in low and lower-middle-income countries (LMICs) (UNESCO, 2022). Within sub-Saharan Africa, illiteracy is fuelled by inefficiency within the education sector. It was previously estimated that 88% (202 million) of primary and lower secondary school-age children and adolescents would not be able to read proficiently by the time they completed school (UNESCO, 2017). Illiteracy is gendered and two-thirds of those who cannot read, write, or perform numeracy globally are women (World Bank, 2022). For Rwanda, adult literacy rate (% of people ages 15 and above) is estimated to be 76% (World Bank, 2022).

Illiteracy is associated with various negative outcomes. Those considered illiterate are sidelined from the mainstream socio-economic and political activities (Abbott et al., 2020). Such individuals face stigma which generates low self-esteem (Helliwell, Huang, Wang, & Norton, 2020). Illiteracy is also associated with poor general health of mothers and poor-quality nurturing care given to their children (World Bank, 2018). At household level, parental illiteracy is linked to poor educational outcomes for their children (Zheng et al. 2018). More specifically, mothers' education has a strong influence on children's development of reading, numeracy, and other foundational learning skills (UNICEF, 2022). It is essential therefore that adults who look after children gain relevant literacy capabilities (Mtika & Abbott, 2023).

We designed and implemented a collaborative SPA-ALE project in Rwanda. The overall objective of the SPA-ALE project was:

> "to develop, implement and embed a social practice approach to adult literacies education in Rwanda that can be managed and delivered by local institutions to support people's livelihood through poverty reduction and inclusive socioeconomic development" (Mtika, Abbott, & Byaruhanga, 2023).

This project supported local educational institutions, namely, the University of Rwanda-College of Education and three Teacher Training Colleges (TTCs) and other stakeholders, such as Rwanda Basic Education Board (REB), to improve the provision of adult education in the country. The project was underpinned by literacy as a social practice framework, which we will discuss in the next section.

2. SOCIAL PRACTICE APPROACH TO ADULT LITERACY EDUCATION

The project involved adapting an existing Rwanda adult education curriculum. We designed and implemented a culturally responsive, learner-centred approach to adult education. This was a departure from the predominant teacher-centred adult education, which has been the practice in Rwanda (Abbott et al., 2020). This teacher-centred approach is unsuitable for adult learners (McCaffery, Merrifield, & Millican, 2007). Our baseline findings show that most adult learners in Rwanda who had undergone teacher-centred adult education do not retain literacy skills (Abbott et al., 2020).

Literacy as a social approach acknowledges "the plurality of literacies - that there are different literacy practices that carry with them different values and affordances" (Street, 2016, p. 336). Literacy is embedded within the socio-cultural set of activities, which provide the material for teaching and learning (Rogers & Street, 2012). The approach encourages adult learners to exercise their agency in the formulation of learning objectives and teaching activities with the adult tutors. It uses learner-centred and practical approaches (McCaffery, et al. 2007). This approach is empowering for the adult learners as they work closely with their tutors to identify problematic issues that matter to them as the basis for the planned learning activities. In this way, learners have a say about lesson contents and teaching approaches.

SPA-ALE considers the curriculum to be less prescriptive and adaptable in that it can be contextualised and tailored to the learners' livelihood practices and needs. Some of the topics covered during the adult classes included balanced diet, causes of stunting, family planning, community-based health insurance (CBHI), hygiene, saving clubs/association, kitchen garden, soil erosion causes and prevention, farming practices, role of women in development, income generating activities and use of mobile phone. SPA-ALE adopts teaching approaches that are participatory, such as group problem solving, role play, ethnographic walks, case studies, etc. Participatory approaches have other by-products for adult learners such as enhancement of 'community cultural wealth' (Trigos-Carrillo, 2019). By contextualising learning, adult learners are more likely to be motivated to practice what they have learned, to alleviate their day-to-day concerns. When learners gain relevant literacy skills and knowledge that matter to them and successfully apply them in their day-to-day activities, it may positively impact their quality of life.

SPA-ALE implementation involved re-orienting adult literacy tutors to work closely with adult learners. This enables adult learners to develop appropriate knowledge and skills for alleviating their individual and socio-cultural concerns in their lives within their communities (Street, 2016). In other studies, it was found that adult literacy education that had close community connection produced social capital outcomes for learners (Balatti, Black, & Falk, 2007). Volunteer community adult literacy tutors (CALTs) were trained by tutors from three primary teacher training colleges (TTCs) through an apprenticeship model in the social practice approach. An apprenticeship model is a form of experiential learning where less experienced practitioners gain knowledge, skills, and attitudes by observing and conducting activities with more experienced practitioners. During adult learning classes, trained TTC tutors acted as role models and mentors for CALTs.

Altogether, 209 female and 289 male CALTs were trained. The CALTs delivered adult literacy courses to learners using the social practice approach. The adult literacy classes lasted nine months leading to a certificate for all adults who successfully completed the courses. Classes were conducted in several settings such as church buildings and primary schools. The classes were conducted on weekends for no more than three hours per session. During the

life of the project (2017 - 2023), CALTs taught an estimated 13,996 female and 3,139 male adult learners mostly in the Western Province.

The findings from course evaluation showed that the use of the social practice approach for teaching adult learners was well-received. The adult learners enjoyed the participatory learning approaches that involved group discussion, group work, case studies, and exploring social practices within their social contexts, which went beyond reading, writing and numeracy.

3. CONTEXT OF THE STUDY

Rwanda has a problem of adult illiteracy (Ministry of Education [MINEDUC], 2014; National Institute for Statistics of Rwanda [NISR], 2018). Literacy rate (the ability to read a simple passage) for those aged 15 years or older in Rwanda was around 73% in 2018 (NISR, 2018) and is currently around 76% (World Bank, 2022). However, it is estimated to be nearer 50% if it excludes those who can only read the passage with difficulty (Abbott et al., 2020). Literacy rate of men was 77.5% whereas that for women was 69% (NISR, 2018). In most LMICs, factors associated with illiteracy include inefficiency of primary education (UNESCO, 2017), being female, being from a marginalised group, living in a rural area and growing up in poverty and larger households (Abbott et al., 2020; McCaffery et al., 2007).

The Government of Rwanda is committed to achieving adult literacy for *all* as demonstrated by the development of an adult education policy and implementation strategy (MINEDUC, 2014; MINECOFIN, 2013). Rwanda aims to have "a literate society where every citizen has access to and makes full use of reading and writing, numeracy and life skills for personal, family, community, and national development" (MINEDUC 2014, xi).

Western Rwanda is the poorest province, with 69% of the population living in poverty (Abbott et al., 2020). The province is also largely rural than the Rwanda average. The province's main source of livelihood is agriculture with most of those aged 18 and above undertaking agrarian related activities. The region has lower educational attainment than the national average (Abbott et al., 2020).

4. THE STUDY

4.1. Research Methods

In this semi-structured-interview-based qualitative study, we consider perspectives of adult learners who had successfully completed the SPA-ALE project in terms of how they felt the project had influenced their lives after graduation. The impact we are interested in relates to both literacy capabilities and changes to other aspects of quality of life (e.g., self-esteem, confidence, social competence, agency, etc.). Our research question is:

> What impact does participation in a social practice approach to literacies education has on adult learners' lives, their households, and the wider communities in three districts in Western Rwanda where it has been undertaken?

Qualitative data collected directly from the participants has the potential to provide rich and personal evidence of the causal processes and 'stories of change' (Remnant & Avard, 2016). The research participants were asked to talk about the main changes in their lives over a pre-defined period of their participation in SPA-ALE, and were prompted to share what they perceived to be the main drivers of these changes, and to whom or what they attribute any change (Remnant & Avard, 2016).

4.2. Sampling and Data Collection

We drew a simple random sample of adults aged 18 years and over who had completed SPA-ALE in 2021 and 2022. Participants' ages ranged from 20 to 69 years. Most of the participants were married and had children. Participants' livelihoods revolved around subsistence farming and other informal income sources. The participants had identified themselves as 'illiterate' before joining the SPA-ALE project. Table 1 shows the profile of research participants.

Table 1.
Profile of participating adult learners.

	Female	Male
Gender	26	6
Marital status		
Married	23	6
widowed	2	-
Single	3	-
Age-range		
20 - 29	2	-
30 - 39	13	4
40 - 49	8	-
50 - 59	1	-
60 -69	2	2
Main occupation		
Farming	17	6
Basket weaving	1	-
Trader/vendor	17	2
Casual worker	2	-

Semi-structured interviews were conducted with 32 adult learners after they had completed SPA-ALE classes, to elicit their views about what they perceived to be the impact of the adult classes and how they were making use of the knowledge and skills they had developed. The participants had completed the literacy classes 2 or 3 years prior to the interview. We interviewed participants in three districts in Western Rwanda (Rusizi, Rubavu and Karongi) in 2023. The interviews were conducted in the local language, Kinyarwanda. The interviews lasted between 45 minutes to one hour.

Applicable ethical principles and practices were followed during the research. We obtained research ethical approval from the University of Aberdeen's Committee for Research Ethics and Governance in Arts, Social Sciences and Business (CREGASSB). In addition, participants gave informed consent after being told the purpose of the project and what their involvement entailed. The participants were assured of their rights to withdraw, anonymity and confidentiality. The research assistants who supported data collection had relevant experience and received further training before embarking on data collection on the project.

4.3. Data Analysis

Thematic analysis was used to make sense of the semi-structured interview data. Through this, we generated several themes relating to how adult learners perceived the impact of attending SPA-ALE classes on their quality of life. The findings show that adult learners developed greater understanding and practical grasp of life skills, social competence, positive self-image, and personal and family wellbeing while developing their literacies within certain areas of social practices. The specific themes we focus on in this chapter include (i) improved maternal health, hygiene, sanitation, and nutrition (ii) improved marital relationships (iii) support with children's education (iv) greater involvement in community development. The adult learners retained the knowledge and skills they developed during the classes and used these in their day-to-day lives for the benefit to the individual, their households, and the wider community.

5. FINDINGS

5.1. Improved Maternal Health, Hygiene and Sanitation, and Nutrition

The theme 'improved maternal health, hygiene and sanitation, and nutrition' was evident from the participants through the ways they perceived the knowledge and skills gained through SPA-ALE and how it influenced changes in behaviour and practices. In connection with maternal health, the following illustrative quotes highlight the change in behaviour regarding managing childbirth and family planning.

> I could give birth without attending any hospital but now I follow all the pregnancy check-ups. I did not know about preparing birthing clothes but now I get them at earlier stage due to the teachings we got from adult literacy class (Rusizi, female, 38 years).
>
> Family planning information was shared at the literacy class…I was able to grasp it better and see its significance (Rubavu, female, married, 35 years).

In relation to hygiene and sanitation, participants highlighted ways in which they made changes to their practices after taking part in SPA-ALE.

> Today, I am aware that I must bathe my child, dress her in clean clothes, and do the same for myself (Rubavu, female, 28 years).
>
> Hygiene has improved. Toilet has been built and roofed which was not the case before (Karongi, male, 43 years).

Participants also indicated that the knowledge from SPA-ALE was helping them to have healthy meals.

> They taught us how to cook healthy meals at home. Now, I put this into practice. If I prepared potatoes and beans today, I must add vegetables tomorrow. If I had fish the other day, I must add carrots (Rubavu, female, 35 years).
>
> I have a kitchen garden that was built from the skills I got at adult literacy classes. It has saved me from buying vegetables. We eat fresh fruits and vegetables which cost less. I offer my children a balanced diet meal (Rusizi, female, 38 years).

The findings indicate how participants changed their lives for the better because of attending SPA-ALE.

5.2. Improved Marital Relationships

In relation to familial impact, taking part in SPA-ALE was viewed to have positive impact in marital relationships which had not existed before. The main issue that they highlighted was marital conflict.

A male participant indicated that there was a power imbalance between him and his wife, which was a source of conflict but that he was now able to resolve this due to the knowledge and skills gained at SPA-ALE.

> My wife and I had regular confrontations to the extent we were about to divorce. The issue was that she is literate, and she wanted to take over my power as husband at house. I felt very disrespected. We were always quarrelling with endless fights. After joining adult literacy classes, I was taught different ways of resolving relationship issues as well as forgiving our partners…We are now a happy family… (Rusizi, male, 45 years).

A female participant highlighted how attending adult classes reduced arguments with the husband as both the wife and husband were now literate.

> My inability to read frequently led to arguments within our family. For instance, my husband might give me money to go shopping and then he would get upset with me because I was taken advantage of by traders. However, because I can now read, write, and count… our relationship has improved (Rubavu, female, 38 years).

Another male participant described how SPA-ALE brought about a change in his stereotypical attitudes towards his wife in relation to household chores.

> Family relationships were not that perfect because I used to argue with her about house chores. I did not help with house chores because I thought these were for women only, but at the adult literacy classes, we learnt to help our spouses and I am now doing it (Karongi, male, 43 years).

The participant further added,

> "I used to not value her opinions and thinking that she cannot contribute anything to the family development but now we sit together and make every decision together" (Karongi, male, 43 years).

These findings highlight the marital challenges which were alleviated by attending adult classes. Apart from developing literacy skills so that one was not taken advantage of when shopping, they also developed different ways of thinking about issues from the tutors and the materials used for teaching. This led to positive changes to social practices such as gender relations and distribution of family labour.

5.3. Support with Children's Education

Another dimension of familial impact resulting from participating in SPA-ALE relates to support with children's education. The findings from the study highlight ways in which participants felt that they had been impacted to support their school-going children. This was through change in attitudes towards education, helping children with their primary education and buying necessary school materials for their children.

A parent reflected on how adult classes had influenced her to support her children's education. She noted,

> After taking the literacies class, I now place higher priority on my children's education. I am now aware that my children need books, pencils, and other necessities to attend school because I need them myself. To prevent them from not learning, I also ensure that the children do not arrive at school hungry (Rusizi, female, 42 years).

Another participant highlighted how she used her own local Kinyarwanda language skills gained at adult literacies classes to support her child's education.

> Even though I do not speak English, I can teach her Kinyarwanda consonants, vowels, reading, and writing. To prevent her from becoming like me, I advise her to pursue education while she is still young (Rubavu, female, 28 years).

The change of attitudes towards education was further reflected in the following remarks,

> There was nothing I could do to support my kids academically, such as with their homework prior to taking the literacy classes. I was illiterate and uninformed…I was not even interested in whether they attended school. I now ask my children when they get home from school what they learned… (Karongi, male, 36 years).
>
> I did not care about their education and believed they would still be able to survive without it. I started paying more attention to my children's education after taking the literacy classes. When they missed school, I would discipline them for not attending to school. Now, I believe that my children's education is important… (Rubavu, female 42 years).

The findings show how adult learners who were also parents started to pay keen interest to their children's education. They changed their attitudes and saw the value in educating their children by ensuring that the children were properly fed before going to school. They also monitored children's school attendance.

5.4. Greater Involvement in Community Development

The findings highlight the impact that graduates of SPA-ALE had on community development. This was mainly through learners developing self-confidence, social competence and playing active roles within their communities. They did this by taking on leadership roles and acting as roles models. Through the citizenship roles these adult learners took on, adult literacy classes benefited the wider communities. A participant noted,

> I was promoted to be acting village leader. People gave me that trust due completing adult classes. I felt the adult literacy gave me courage that I can do whatever I want (Rusizi, male, 45 years).

Another participant who was actively involved in the community noted that she was trusted by the community. Her status within the community was elevated and her ability to use the literacy skills acquired enabled her to fulfill a community role of record keeping.

> Today, due to the trust leaders and the people in the village have for me, I regularly help the Isibo leader (smallest decentralised community unit) to collect funds from the residents and recording those who have paid and those who have not (Rubavu, female, 38 years).

Those who had completed adult classes were also acting as role models within their communities. This shows how individual's self-image and status within the community changed. Individuals also enhanced their religious literacy practice and took on active religious roles such as leading their congregations.

> Most of the people who know that I am now literate are contacting me to know when adult literacy classes will be resuming and how they can join. Whoever sees me read the Bible and preach to a big congregation testified that adult classes are very important (Karongi, female, 32 years).

The findings highlight the impact of completing SPA-ALE and how this benefited the individuals and the wider community.

6. DISCUSSION AND CONCLUSION

Our findings suggest that participating in SPA-ALE led to several learning outcomes for the adult learners. These learning outcomes had impact on the individuals, members of their households, and the wider community. Adult learners enhanced their literacy

capabilities and developed greater understanding and practical grasp of life skills, social competence, positive self-image, and personal and family wellbeing while developing their literacy skills. They retained and used the knowledge and skills to improve their lives, that of their immediate households and the wider community. These findings highlight the potential for literacy to extending human capabilities in various ways (Sen, 1999).

The findings indicate that adult learners, especially women, saw improvement in maternal health, hygiene and sanitation, and nutrition because of taking part in SPA-ALE. The classes enhanced practical knowledge and skills and influenced changes in attitudes, behaviour, and practices. While low literacy is associated with poor health outcomes including poor health status (Zheng et al. 2018), our findings reveal some of the ways that literacy as a social practice addressed certain health challenges, thereby enhancing the quality of life. For women, this was in connection with maternal wellbeing through better preparation for childbirth and family planning strategies. The findings further suggest improvement to the social practices around hygiene and sanitation, and dietary practices. These findings are important for Rwanda, where evidence show prevalence of stunting among children whose parents have little or no education (World Bank, 2018). The findings resonate with the ambition of the Government of Rwanda which developed adult literacy education policy to improve health and wellbeing of its adult population (MINEDUC, 2014). The findings are also significant for other low-income contexts grappling with high level of illiteracy globally.

Our findings highlight marital challenges that participants were facing before enrolling in SPA-ALE and how taking part in adult classes in which topics such as gender relations were covered, had positive impact on husbands. The findings show that male participants enhanced knowledge about gender relations, leading to improvement in their marital relationships. Adult classes influenced gender equality and the disruption of 'a culture of patriarchy' (Abbott, Malunda, & Byaruhanga, 2023) whereby husbands no longer saw themselves as sole custodians of power at household level. Adult classes challenged the distribution of household labour, which was previously predominantly undertaken by women. The improvement in gender relations and redistribution of household labour is essential for the improvement of quality of life (Abbott et al., 2023). These findings highlight the view that literacy education is emancipatory in that it helps raise awareness of patriarchal structures that suppress women (Robinson-Pant 2008; Stromquist, 2016).

The findings show that participation in SPA-ALE improved relationships between parents and their school-age children. As previously suggested, parental illiteracy has been associated with poor educational outcomes for children (Zheng et al. 2018). The findings show that the parents who participated in adult classes changed their attitudes towards education and were more committed to supporting their children. This echoes findings from other research which showed that adult education enhances adult learners' understanding of the importance of educating their children (Stromquist, 2016). This change of attitude and support has the potential to improving children's engagement with school, leading to better educational prospects. Research evidence shows that parental education has an impact on children's development of reading and numeracy (UNICEF, 2022). This can help address intergenerational reproduction of illiteracy.

Lastly, the findings indicate that participants in SPA-ALE enhanced their interpersonal wellbeing in terms of self-esteem and self-confidence. They became more altruistic and took on grassroots citizenship roles which benefited their communities. Similar findings were reported in another study (Stromquist, 2016). These findings echo the aspiration of the Government of Rwanda's adult literacy education policy to increase participation in community development (MINECOFIN, 2000; 2013).

7. CONCLUSION

Given the findings in this study, the Government of Rwanda, local and international development partners should consider exploring strategies for funding and scaling up literacy as a social practice-oriented adult education so that it can benefit more adult learners and communities across the country. Other providers of adult literacy education in Rwanda, such as local NGOs, should consider adopting literacy as social practice in their programmes. This has the potential to make adult literacy an attainable human right (UNESCO, 2009) and a truly public good (Boyadjieva & Ilieva-Trichkova, 2018) for all deserving adults in Rwanda. Finally, given the global problem of adult illiteracy, this study is a significant contribution to efforts aimed at reducing illiteracy through a culturally responsive approach which considers literacy as a social practice.

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AUTHORS' INFORMATION

Full name: Peter Mtika
Institutional affiliation: University of Aberdeen
Institutional address: Centre for Global Development, School of Education, Aberdeen AB25 5UA, UK
Email address: p.mtika@abdn.ac.uk
Short biographical sketch: Peter Mtika PhD, is a Reader in Education, and Director of Postgraduate Research in the School of Education at the University of Aberdeen, UK. His research interest is in the broad area of international education and development with a focus on equity, inclusion, and social justice. He has published several papers in international journals. Peter has been involved in educational research in a number of countries such as Malawi, Rwanda, Ghana, Cambodia and Scotland. Peter previously worked in Malawi as a secondary teacher and as a university lecturer. He joined the University of Aberdeen in 2008. Peter's ORCID profile can be found on https://orcid.org/0000-0001-6017-4617.

Full name: Pamela Abbott
Institutional affiliation: University of Aberdeen
Institutional address: Centre for Global Development, School of Education, Aberdeen AB25 5UA, UK
Email address: p.abbott@abdn.ac.uk
Short biographical sketch: Professor Pamela abbott FAcSS, is Director of the Centre for Global Development and Professor of Education at the University of Aberdeen, UK. Her research interests are in socio-economic and political transformations and well-being. Her research has been published widely in international journals, edited collections and research monographs. She has carried out research relating to the former Soviet Union, the EU 27, East and Central Europe, North Africa and the Middle East, China, Bangladesh, and East Africa. Her current research mainly focuses on Rwanda, Ethiopia, Tunisia and Bangladesh. Before moving to the University of Aberdeen, she worked in the universities of Plymouth, Derby, Teesside and Glasgow Caledonian University. Pamela's ORCID profile can be found on 0000-0002-5013-343X.

Full name: Wenceslas Nzabalirwa
Institutional affiliation: University of Rwanda
Institutional address: College of Education, P.O. Box 55, Rwamagana, Rwanda.
Email address: wnzabalirwa@gmail.com
Short biographical sketch: Wenceslas Nzabalirwa has over 25 years' experience of the university life in teaching, research, community engagement and academic management. He holds a PhD in Education and is a Professor of Teacher Education in the School of Education, University of Rwanda-College of Education. He is a researcher, consultant, and coordinator of research grant projects on teacher education including learner-centered pedagogy, competence-based teaching, learning and assessment. His focus is to adapt these approaches from the north by applying them to the context of the sub-Saharan Africa including Rwanda. Findings from research in these areas of interest resulted into the publication of a series of articles, book chapters and conference proceedings. He has supervised PhD dissertations of students from the College of Education and other national and foreign higher education institutions. His ORCID profile can be found on https://orcid.org/0000-0002-8299-2001.

Full name: Ismael K. Byaruhanga
Institutional affiliation: Institute of Policy Analysis and Research (IPAR-Rwanda), Rwanda
Institutional address: Street KG 627 St Building 4, Kimihurura, Kigali, Rwanda
Email address: byaruismail@gmail.com
Short biographical sketch: Ismael K. Byaruhanga is a Researcher at IPAR-Rwanda. Prior to working with IPAR-Rwanda, Ismael gained teaching and research experience from the University of Rwanda where he participated in the staff exchange program under the Inter-University Council for East Africa lecturing at the International Leadership University. At the University, Ismael published several research articles and a book chapter. His research interests are diverse and includes areas such as education, decent work, agriculture, gender, financial inclusion, and organizational citizenship behaviour.

Chapter #23

ANALYSING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SKILLS OF SETSWANA STUDENT TEACHERS AT A UNIVERSITY OF TECHNOLOGY IN SOUTH AFRICA

Bridget Kesaobaka Mangwegape & Paseka Patric Mollo
Central University of Technology, Free State, Bloemfontein 9300, South Africa

ABSTRACT
The use of ICT has become an indispensable component of education in modern times. Recently, most teachers, including indigenous language teachers, have been involved in integrating technology into their classroom practices. But there is a lack of research on integrating ICT by Setswana student teachers at higher education institutions. This study aims to investigate the competency levels of Setswana student teachers in using ICT in their classrooms. A total of 20 student teachers were purposively selected to participate in this study. Data was collected using classroom observations and interviews. The SAMR model was used as a data analysis tool to determine the extent to which Setswana student teachers can integrate ICT in their classrooms. The results of this study indicate that the student teachers' competence to use ICT was still at a lower level. They predominantly only have basic computer literacy skills, such as word processors, PowerPoint, and other digital resources. The study revealed that the student teachers' ICT integration levels were still at the substitution and augmentation levels.

Keywords: SAMR model, Setswana language, information and communication technology, teacher education, integration.

1. INTRODUCTION

Technology's evolution and application play a role in every aspect of modern life. In education, to enhance learning outcomes, most higher learning institutions have been investing in providing students and teachers with access to technology and enhanced learning through various types of computer technology, ranging from personal computers (PCs) in the "conventional" form of desktops and laptops to the relatively more portable form of tablet PCs. Setswana students are now better positioned to integrate technology into classrooms than in the old education system.

The use of technology provides Setswana student teachers with many opportunities to practice the Setswana language and involve themselves in authentic environments of language use (Kramsch &Thorne, 2020). Tseng (2019) has identified some language learning areas in which technology holds great promise, including phonetics, grammar, vocabulary, reading, writing, translation, auditory comprehension, literature appreciation, and testing. Mello (1996) has stated that Setswana vocabulary learning through technology can be flexible and effective. Internet-based technology has increasingly developed for years, by using the Internet of Things (IoT) for learning Setswana vocabulary has become more common than before. Turgut and Irgin (2009, p.761) reiterate, "The internet has opened up a world of possibilities for improving the vocabulary of students". It is observed that although

many students are born in a technologically rich world, they might not be skillful users of technology (Bennett, Maton, & Kervin, 2008). In the context of the higher education institution, student teachers could learn Setswana mainly using smartphones, computers, or laptops; however, they could not use such tools for their Setswana language learning in general and particularly learning Setswana vocabulary, indicating that Setswana students struggle in employing appropriate strategies for Vocabulary Learning Strategies (VLS) through technological tools.

2. LITERATURE REVIEW

Setswana is an indigenous African language belonging to the Sesotho language group of the Sintu language family. It is also the language spoken by the Batswana people. This is a group of tribes of Sintu origin that makes up a significant part of the population of the country of Botswana. Setswana is one of South Africa's 12 official languages, and is also spoken in Botswana, Namibia, and Zimbabwe. It is therefore designated by the African Academy of African Languages (ACALAN) as a cross-border language, and as a scarce skill by the South African Qualifications Authority (SAQA). Setswana speakers are the fifth largest language group in South Africa and are found mainly in North-West. The language is spoken by more than four million people, which constitute about 8% of the South African population.

Technology in Language Learning (TELL) refers to using computers as a technological innovation to display multimedia to complement teaching methods (Patel, 2014). The main objective is to determine ways to use all kinds of technology, including computers, hardware, software, and the internet, to develop and improve language learning. Research studies have affirmed that technology and technological devices could be used to engage Setswana vocabulary learning in developing skills (Kramsch & Thorne, 2002). Groot (2000) maintained that TELL tools could be effective in helping students to learn a considerable number of words in a short period. Furthermore, Song and Fox (2008) stated that using mobile devices could motivate students to learn and remind them to work on the entailed learning vocabulary tasks.

However, TELL provides more learning, as it promotes learner autonomy and independence to Setswana student teachers who control the pace of progress and the materials presented to them. Additionally, it increases students' engagement and motivation while facilitating communication and meaningful interactions in which technology-related tasks approach more real contexts (Lamy & Goodfellow,1999; Ortega, 1997) point out that technology provides an equal opportunity to Setswana students.

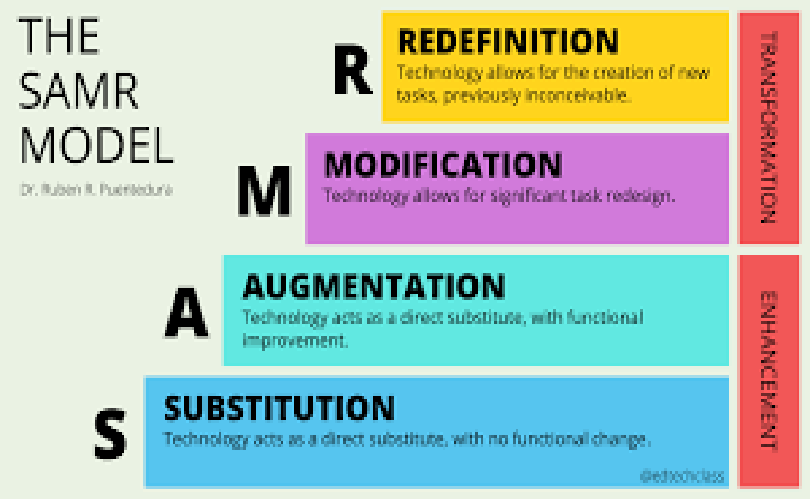
2.1. Theoretical Framework

The Substitution, Augmentation, Modification, and Redefinition (SAMR) model was employed as the framework of the study. The theoretical importance of enhancing the integration level of Information and Communication Technology (ICT) by Setswana student teachers is justified by Substitution, Augmentation, Modification, and Redefinition (SAMR) model. Dr Ruben Puentedura (2006) developed the SAMR model that divides classroom technology integration into four levels. Substitution, Augmentation, Modification, and Redefinition are abbreviated as "SAMR". Then, in 2013, Puentedura categorized the Substitution and Augmentation levels into Enhancement and the Modification and Redefinition levels into Transformation.

At the Substitution level, digital technology is substituted for analogue technology. For example, in a Setswana teaching and learning classroom, the student teacher chooses to substitute a set of hard copy test review questions for digital versions. At the Augmentation level, technology is exchanged, and the function of the task or tool positively changes in some way. However, a student teacher may describe and accurately interpret and apply the SAMR model Puentedura (2014) shared Mueller and Oppenheimer's (2014) comparative study of student teachers taking digital or longhand notes. In his presentation materials, Puentedura focused on the change in the task (i.e., typing on a computer versus writing longhand on paper), this substitution negatively impacted Setswana student teachers.

To help teachers personalize learning and aid pupils in visualizing challenging topics, the SAMR model was developed. When integrated classroom technology makes teaching and learning for both teachers and students smoother, such as during remote and blended learning, the SAMR Model can be particularly effective. Puentedura (2006, 2013) was used as the framework to evaluate technology integration. The SAMR model was developed to examine how technology is infused into teaching and learning activities. Furthermore, it is to encourage Setswana student teachers to augment instructional activities by using technology.

Figure 1.
Dr Ruben Puentedura (2006) SAMR Model.



At the **Substitution** stage, technology is directly substituted for a more traditional teaching tool or method. It is a simple, bare-bones, direct replacement (Puentedura, 2006; 2013; 2014). Substitution stage might help student teachers to save time and space by eliminating arduous pen and paper operations. Rather than printing out twenty-plus paper resources that clutter the closet, student teachers can use technology to manage resources with a few clicks. Substitution is also a far more approachable way to learn technology soft skills than modification and redefinition. It's the ideal time for pupils to become acquainted with new technology before student teachers begin to improve their learning (Puentedura, 2006; 2013; 2014).

With the **Augmentation** stage, the technology is again directly substituted for a traditional tool or method, significantly enhancing the student experience (Puentedura, 2006; 2013; 2014). At the augmentation stage, technology contributes to the learning process in ways other than convenience. It may provide your students with a better knowledge of a hard topic or make it more engaging in ways that traditional techniques cannot Puentedura (2006; 2013). It also enables the introduction of more self-directed and student-centered learning. Students can begin actively learning without requiring ongoing teacher-led teaching by using technology as a source of information.

Using the SAMR Model, teachers are starting from enhancement to transformation at the **Modification** step; this is a real modification to the lesson's design and learning objectives, not a replacement or addition. "Does the technology significantly alter the learning task?" is the crucial query here (Puentedura, 2006; 2013; 2014). Students, for example, can collaborate on shared documents or work in big groups, enabling seamless cooperation and knowledge exchange. Peer-to-peer collaboration fosters a more cooperative and dynamic class culture. Technologically enhanced activities also enable students to produce inspired and innovative work that is not limited to paper. Some students will leap at the chance to appear in front of a camera, while others would go to any length to climb the worldwide Mathletics leaderboard. (Puentedura, 2006; 2013; 2014).

The SAMR model's final stage, **Redefinition,** illustrates how integrating technology in the classroom can improve the student experience. In this situation, the question is whether teachers' use of technological tools enables them to reimagine a conventional learning assignment in a way that would not be feasible without technology, producing a novel experience (Puentedura, 2006; 2013; 2014). Learning can be redefined to integrate it with the actual world and achieve meaningful results. It also teaches students valuable technology soft skills including digital collaboration, communication, computer literacy, and the capacity to adapt to new systems and processes.

The model satisfies the need of student teachers to use the integration level of Information and Communication Technology (ICT) in the classroom to make teaching and learning more effective. ICT are powerful tools in teaching as teachers believe that using technology in teaching is inevitable, they like to and want to learn more Gonen (2018).

Figure 2.
Integration of ICT by Setswana students.

The above figure illustrates how Setswana students use technology and how does their learning get an impact if they use technology. They also find it more interactive, as well as full of interesting areas, when aided by ICT.

3. RESEARCH METHODOLOGY

The research design was qualitative and focused on classroom observation and focus group interviews. This study investigated the extent to which university student teachers specializing in Setswana teaching used ICT for their studies and for their teaching practice. To carry out this investigation, a qualitative inquiry was used, which according to Denzin and Lincoln (2011) involves the study of anything in its consistent environment to attempt to make sense of it regarding the meanings people assign to it, using among other things, observations, interviews, and personal experiences.

The first research approach used in the study was observations. Observations are a key research technique used in a variety of fields, including the natural sciences, social sciences, psychology, and others. It comprises conducting systematic study on a topic or event by thoroughly and deliberately examining it (Cohen, Manion, & Morrison, 2018). The researchers immersed themselves in the Setswana II subject classes, spending approximately six (6) months in the classroom. Different, ICT equipment, for example, Laptops and cell phones were used to take notes during the classroom observation sessions, and a checklist was used with the following categories: Substitution, Augmentation, Modification, and Redefinition.

The second phase was the focus group interviews conducted with second-year student teachers who have registered Setswana II. A focus group interview is a sort of group interview in which data emerges from participant interaction. One of the key characteristics of semi-structured interviews, according to Cohen et al (2018), is the interactional flow of dialogue between two or more participants. Dialogues were undertaken with student teachers to study the difficulties they face when using ICT, when they organize and present their classes. The population of this study comprised 20 second-year students registered at the University of Technology in Setswana II. In both phases of the study, purposive sampling is used in this research (Maree, 2016). The second-year students who participated in the study were divided into groups for the first and second phases of the study, and a checklist was used as a guide for observations.

3.1. Aim of the Study and Research Questions

This study aims to investigate the competency levels of Setswana student teachers in using ICT in their classrooms and using the integration of technology categorized into each SAMR level. That is Substitution, Augmentation, Modification, and Redefinition.

The study sought to answer the following research questions:

- What problems do Setswana student teachers experience when integrating ICT in their classrooms?
- What are the students' perceptions regarding using laptops, projectors, smartphones, and tablets in the classroom?
- Does the SAMR model assist student teachers in improving their involvement in integrating technology into their classroom practices?

Procedure

The following steps taken to equip students with modern technology in the classroom.

Stage 1. Internet connection and connectivity

The use of internet allows students to find amazing convenience, they can find various kinds of help, tutorials, and other kinds of assisting material which could be used to academically improve and enhance their learning.

Stage 2. Using projectors and visuals.

Visual images always have a strong appeal compared to words. PowerPoint presentations and projections are used in the classrooms to keep the learning interactive and interesting.

Stage 3. Digital footprint in the classroom.

The digital footprint has resulted in round the clock connectivity with students that are available for different kinds of assignments or be of assistance with applications in development and learning.

Stage 4. Online classes with the use of technology.

Online classes have now been used as a platform since COVID 19. This is a concept that would be used to facilitate teaching and learning. The online classes scenario around the world is more prominent among students who look for flexible times to their convenience.

Students' attitudes were predicted by computer attributes, cultural perceptions, and computer competence. The observation points to the importance of students' vision of technology itself, their experiences with it, and the cultural conditions that surround its introduction in classrooms, in shaping their attitudes toward technology and its subsequent diffusion in their educational practice.

3.2. Data Analysis

Data were analysed using checklist analysis, and the responses were grouped into themes and later into subthemes according to research questions.

Table 1.
Levels of SAMR model.

Level	**Percentages**
Substitution	15%
Augmentation	15%
Modification	35%
Redefinition	35%

From the table above, the Setswana student teachers preferred learning without functional change. Only forty-eight per cent (48%) of the respondents of Setswana student teachers refer to technology to substitute other learning activities.

Only twenty-eight per cent (28%) of the respondents of Setswana student teachers refer to the technology used to replace other learning activities but with additional functions.

Only twelve per cent (12%) of the respondents of Setswana student teachers refer to technology to redesign learning activities.

Only 10 per cent (10%) of the respondents of Setswana student teachers refer to the technology used to create tasks.

4. FINDINGS

The Setswana student teachers have infused varied types of technology into instructional activities. The technology integration has undertaken the enhancement (Substitution and Augmentation) and Transformation (Modification and Redefinition) stages. It implies that technology, which falls into Modification and Redefinition levels, enables Setswana student teachers to transform learning for students. On the part of the Setswana student teachers, it can be inferred that the use of technology may widen Setswana student teachers' knowledge and skills of Setswana.

Technology integration could encourage students to be more creative and autonomous learners. The use of technology is expected to enhance Setswana student teachers learning effective teaching. Furthermore, the findings display that the Setswana students' perception of applying Technology in the classroom, signifies that even though Setswana students were enjoying and experiencing the usage of technology in the classroom, they should be given more time to work with computers and learn more by using them regularly in the classroom.

5. DISCUSSION

The study sought to answer the following research questions:

- What problems do Setswana student teachers experience when integrating ICT in their classrooms?
- What are the students' perceptions regarding using laptops, projectors, smartphones, and tablets in the classroom?
- Does the SAMR model assist student teachers in improving their involvement in integrating technology into their classroom practices.

First question

Lack of students' confidence

S3: I am not confident when using ICT in the classroom because I lack skills in using it.

S12 I am not confident, I lack behind, my fellow students are doing better than I am.

S8: I think we need sufficient time to work on the computer to gain confidence.

This clearly shows that students do not have enough time to work on computers, they lack confidence as they doubt their skills of using the computers in the classroom.

Second question

Students' perception about using ICT in the classroom.

S2: ICT are powerful tools in teaching and learning. Students can watch videos that are closer to real life, presentation compared to printed books.
S20: Through technology I can get important information for Setswana lessons, e.g. the Setswana songs, and learn more about Setswana culture.

This clearly shows that students are excited by using ICT in the classroom. Materials related to Setswana language can be used for teaching and learning. Students know how to access the internet and get some information from it.

Third question

Technology integration in the classroom

S12: Technological developments like projectors, computers, PowerPoint presentations, have become great sources to help grasp the concept easily.
S11: ICT has made our lives easy by attending online classes during COVID 19.

S5: With the introduction of online programs there is hardly any need to be present physically in the classroom.
S17: Students can participate more in the classroom and that makes the classroom more interactive and interesting.
S6: ICT allow students to discover and learn through new ways of teaching and learning in the classroom.

Students' views about The SAMR model show that they have improved their ICT skills. They enjoy and understand in using computers in the classroom. Most of them find it very easy to access ICT.

6. CONCLUSION

Although Setswana students are faced with some difficulties in implementing technology in the classroom, they see the significance in technology and in need of using technology in the classrooms. The findings of the research on Setswana teachers' perceptions and challenges to the implementation of technology in the Setswana classroom could be seen as students who are eager to learn more about the techniques of ICT. The researcher as well has a positive perception of the use of technology to teach in the classroom to assist students facilitate their lesson. The use of ICT in the classroom helps them to obtain information easily and quickly. What makes the classroom conducive is that ICT becomes more interesting than discussion and teaching without using any tool.

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AUTHORS' INFORMATION

Full name: Bridget Kesaobaka Mangwegape
Institutional affiliation: Central University of Technology, (South Africa)
Institutional address: Private Bag x20539, Bloemfontein, 9300, South Africa
Short biographical sketch: Dr Bridget Kesaobaka Mangwegape, born on 7 March in Kimberley. A teacher by profession. She started her teaching career at Kagisho Comprehensive Secondary School, specialising in Setswana language in 1989. She served as a Setswana Provincial examiner for the Free State from 2006 to 2008. She was then appointed as a Provincial Internal Moderator for Setswana from 2009 to 2014. She is currently a member of Pan South African Language Board (PANSALB) serving on the interim Setswana National Language Body (SETNLB). In the year 2015, Dr Mangwegape was then appointed as a Setswana lecturer at the Central University of Technology in the department of Languages and Social Sciences. IN 2021 she was promoted as a senior lecturer. Her core function is to promote African languages.

Full name: Paseka Patric Mollo
Institutional affiliation: Central University of Technology, (South Africa)
Institutional address: Private Bag x20539, Bloemfontein, 9300, South Africa
Short biographical sketch: Paseka Patric Mollo holds a Doctor of Education (D.Ed) degree. He is currently a lecturer in the Department of Educational and Professional Studies at the Central University of Technology in South Africa. He is teaching at the undergraduate level, supervising students at the Master‘s level, and has delivered several papers at national and international conferences. His interest centres on teacher education and development, which includes the following fields of specialisation: Information Communications Technology (ICT) integration in the teaching and learning situation, Micro-teaching, General Subject Methodologies, and Assessment. Before joining the university he held the following positions at the Department of Education: first as a Teacher and a Head of the Department for Mathematics and Technology at a school, then promoted to be a First Education Specialist, Senior Education Specialist, and Deputy Chief Education Specialist responsible for in-service training and professional development of teachers.

Chapter #24

THE 'THIRD SPACE', WHERE EVERYDAY AND FORMAL WRITING PRACTICES MEET

Paolo Sorzio & Caterina Bembich
Department of Humanities, University of Trieste, Italy

ABSTRACT
In this chapter, the development of literacy competence is intended as a process of progressive connection of the everyday writing repertoires with the more formal writing genre characteristic of schooling, through students' participation in innovative activities in the "third space" (Gutiérrez, 1993; 2008; Gutiérrez, Rhymes, & Larson, 1995). Moving from Jack Goody's conceptualization of writing as a "technology of intellect" (Goody, 1987; Olson, 1996), it is considered that young people work out highly contextualized writing repertoires in their everyday life to achieve specific goals in practice. These repertoires may differ from the literacy competencies required in school and this divergence may produce in students from non-mainstream backgrounds an experience of "cultural discontinuity" (Mehan, 1998) that, in turn, may be an element of school failure. To mediate the development of appropriate literacy repertoires in multicultural schools, it is required the construction of a "third space", in which the existing everyday writing repertoires may be transformed to achieve expressive and argumentative goals in social communication. The empirical basis for the analysis derives from a school ethnography, conducted in a secondary school serving a student population of recent immigration in Italy in a working-class town in Northern East Italy.

Keywords: cultural discontinuity; literacy; third space; writing practices; collaborative writing.

1. INTRODUCTION

Literacy is a pivotal competence to be promoted in classrooms to contrast school failure, since educational activities are strongly based on writing and reading processes.

La scrittura è un'attività di apprendimento complessa, il cui processo è determinato da una pluralità di fattori connessi alle situazioni di apprendimento, alle vite individuali, all'intenzione e al significato veicolato dal testo

Writing is a complex learning activity, the process of which is determined by a plurality of factors connected to learning situations, individual experiences, intention and the meaning conveyed through the text (Bazerman, 2019).

Students are required to read textbooks and other sources of information; they are expected to express their reasonings in written expository texts. However, texts in schools are organized according to a specific literate genre: they are closed systems, in which all the relevant information can be inferred by reference to other explicit information; they differ from popular texts that are open artefacts, further developed and incremented by the reader's knowledge (Cook-Gumperz, 2006; Lee, 2007). According to Olson, writing systems should be conceptualized as specialized categories of thinking and communication, rather than the neutral codes to transcribe speech on paper or digital supports (Olson, 1996).

Freebody and Luke (1990) consider textual production as the integration of 4 dimensions (called "4 Resources Model"):

- Syntactic: the expressive rendition of the intended meaning of the text; it requires competence in the linguistic code, the correct use of pronouns, the selection of the information to be made explicit and the connection of different aspects of a text into a consistent whole;
- Semantic: the intended meaning, characterized by a core idea and the related information; the appropriate lexicon to highlight different aspects of the meaning;
- Pragmatic: the social objective the author intends to provoke in the community (to inform, to convince, to call for an action, to request, …);
- Affective: the strategies adopted to communicate feelings and to provoke emotions in the readers.

Traditional schooling tends to overlook the practical competencies people develop in their reading and writing activities during their everyday lives; furthermore, it tends to introduce students into literacy practices that are based on a western/schooled used of texts, at the expenses of different approaches to literacy.

The goal of a democratic approach is to offer the students more opportunities to learn (Greeno & Gresalfi, 2008), based on the recognition of their writing repertoires they have developed in their out-of-school activities, as well as valuing their collaboration with peers.

2. THE CULTURAL DISCONTINUITY THEORY

Social-cultural systems are characterized by a multiplicity of institutional practices (in family, in the community, at school); each practice sets up its own tasks, offering specific cultural repertoires that people acquire and use according to the expected norms of communication. As consequence, the individual will develop specific competencies in relation to the specific practices in which is engaged in (Heath, 1986).

When the requirements to pursue the goals in a new practice allow the use of previously acquired repertoires, the individual has the resources to participate effectively in the new practice and the transition between different institutional practices is straightforward. This process is well documented by Heath (1986), who analyzed the school success of pupils from family backgrounds in which the use of children's books was very similar to the requirements in primary schools.

However, there are cultural discontinuities when the requirements and repertoires in everyday practices are dissimilar from what is expected in school. In these cases, the repertoires developed in everyday practices are not recognized by the teachers as relevant resources in classroom and their use is discouraged; therefore, the individual experiences a difficult transition (Mehan, 1998). This is particularly evident in social contexts in which the specific use of writing is different and the associate literacy repertoires highly diverge from those recommended in schools (Cook-Gumperz 2006; Gee, 2004).

In everyday life activities, writing is used to achieve social goals, such as communicating pieces of information, memorizing procedures (i.e., cooking recipes), taking notes, expressing feelings, creating lists. Being a highly contextualized process, writing in everyday life does not require many explicit information, since its meaning is easily reconstructed from the situation in which it occurs.

School writing is a specialized discursive genre; written texts are closed systems, and their meaning should be derived from the internal logic of the text, rather than on reference to the contextual information directly accessible to perception (Olson, 1996). Through the systematic use of literacy, paradigmatic knowledge has developed and meaning depends on the structural relations between informational elements.

Whereas the use of writing in everyday life is largely distant from the conventions of the specialized writing genre of school literacy, the learner experiences a large discontinuity between the repertoires has acquired and the school educational demands; as consequence, the learner's participation in the writing practices remains peripheral and at risk of failure.

Democratic education should consider urgent the creation of innovative opportunities to bridge the distance between the everyday uses of writing and the requirements of formal education, especially for students from non-mainstream backgrounds. The reason is two-fold:

1. the unevenly distribution of literacy among social groups reproduces unequal access to power; emancipatory movements have always posed the right to access the writing practices in formal education for women, working class people and other traditionally excluded groups as a political aim (Cook-Gumperz 2006);
2. many jobs in the future require literacy competencies in terms of the use and interpretation of big data sets, as well as the capacity to understand highly specialized argumentations in written texts (OECD, 2017).

Schools should promote the acquisition of differentiated literacy competencies to enable the students to access literacy as a complex and sophisticated technology of the intellect.

3. BREAKING DOWN THE INSULATION OF SCHOOL FROM EVERYDAY LIFE

A more encompassing vision of the cultural nature of writing as well as of its different uses may be encouraged in schools, by creating some transitional zones in which the experiential use of everyday writing intertwines with the more formal aspects of the specialized genre of school literacy. Kris Gutiérrez (1993, 2008) (Gutiérrez, Rymes, & Larson, 1995) defines the transitional zone as a "third space", in which different writing repertoires coexist and it is possible to explore innovative students' participation that allow them a sustained process of sharing ideas, in order to produce original cooperative texts on relevant social themes (Thompson, 2014); the "third space" becomes the educational zone of opportunity to connect different writing repertoires:

> "Where teacher and student scripts - the formal and informal, the official and unofficial spaces of the learning environment- intersect, creating the potential for authentic interaction and a shift in the social organization of learning and what counts as knowledge" (Gutiérrez 2008, p. 152).

The activities in the "third space" consist in writing collaborative text on topics that are relevant for the students, that are not in the service of the teacher's assessment of the levels of individual competencies. The teachers listen carefully to the students' contributions as moves towards the transformation of their everyday repertoires through new educational demands, according to democratic norms of collaboration, collective revision and public discussion.

In the "third space" some shortcomings of everyday repertoires emerge but they can be recontextualized in more advanced genres, by incorporating the existing writing functions into more formal conventions: increased cohesion among different parts of the written text, explicitness of information, extension of the lexicon that becomes more articulated and precise.

Many studies highlight how collaborative writing can help students to produce texts that are more articulated and more complex than those produced individually (Pham, 2021; Villarreal & Gil-Sarratea, 2019). Collaborative writing learning activities are more motivating for students and increase their engagement (Dobao, 2012). Through collaborative writing, students can improve their skills, enhance precision in the use of grammar and expand their vocabulary. Furthermore, students have more opportunities to interact and debate, exchange their views, and develop critical thinking skills (Talib & Cheung, 2017; Dobao, 2014). Studies highlight that writings produced through collaborative activities are more fluid, better organized and more complex and articulated in terms of content (Pham, 2021).

4. METHODOLOGY

21 students attending the second year of a professional school in North-Eastern Italy participated in the project (21 females; age M=16,5; SD= 0.28). The composition of the class was complex: 6 foreign students with low knowledge of Italian language, 9 students were repeating the year, 6 present special educational needs.

The context in which the professional institute is located present a high rate of immigration, especially from Bangladesh; it is a phenomenon linked to the development of the shipbuilding industry that characterizes the economy of the town.

The school has a high percentage of non-Italian-speaking students, most of them coming from culturally and economically disadvantaged situations. The school organization provides for an Intercultural Commission "with specific tasks for welcoming and for planning personalized interventions" and for a Working Group for Inclusion. Every school year Italian L2 courses are activated both as initial literacy and as a language suitable for study.

In the school practice, the classroom communication is based on students sitting individually in front of the teacher, who frames the topic and the pace of the lessons, although they are encouraged to put questions, to ask for clarifications, and to express their views; students have little opportunities to work together in working out complex ideas, recognizing the main ideas of a topic, relating it to the contextual information, designing and producing the text, respecting the formal rules of production.

Together with the teachers of the Intercultural Commission and the Working Group for Inclusion, we designed a project that departed from that established classroom organization and we proposed small group activities in which the students are invited to jointly reflect and write a text as a commentary on a meaningful and authentic theme for them. To construct a positive students' attitude towards school literacy, a perspective based on their existing repertoires of writing is proposed[1].

4.1. The Framework of the Classroom Activities

The students responded to a small questionnaire about their literary practices in their everyday lives and were invited to collaboratively write a text as a commentary to the "Manifesto of non-hostile communication", published by the 'Parole O_stili' Association (2016)[2]. The Manifesto can be considered an appropriate choice, since it refers to meaningful experiences in the lives of the adolescents (i.e. hostility; microaggressions, misunderstandings, deception); these topics involve an affective tone that should be communicated through a written text that integrates the students' reflections both at the semantic and at the syntactic planes. The tool has stimulated students to reflect together on the communication styles adopted by young people, the possible consequences of the use of

non-empathic language, and on the importance of considering the point of view of the other. In this "third space", the students were free to choose the genre (expository or narrative), modality (written or graphic text), and then to integrate the texts in an artefact that could circulate, be discussed, and further integrated. The proposed perspective is consistent with the 4 resources model by Freebody and Luke (1990).

The activity was organized in 6 lessons oriented to changing the practice of writing through the mediation of collaborative processes. Students work together in the production of a text: collaboration allows students both to connect personal ideas and to work out a text, to make explicit different writing functions (planning, execution, revision), assessing relevance (what to make explicit on the background of presuppositions); by sharing ideas on an interpersonal plane, students may develop metalinguistic awareness.

We adopted the ethnographic observations on the writing situations, to highlight the opportunities to learn emerging during collaborative writing. Ethnographic approaches require the researchers' engagement in the contexts of daily practice of the subjects and the documentation of the activities through fieldnotes and open interviews. In the fieldnotes, narrative reports of the students' interactions are gathered, to analytically reconstruct the structure of participation of each student in the collaborative writing processes (Erickson, 2004; 2017). In this perspective, the opportunities and constraints of the collaborative activity in promoting students' participation and learning can be highlighted, shared and discussed between the research team, the teachers and the students, to develop more engaging writing practices in the classroom.

4.2. Results

Questionnaire: Writing as a practice

The students' answers to a short questionnaire highlight that they use writing in their daily lives for pragmatic reasons: some use writing as a support for homework, some express pleasure in writing (" it is a way to blow off tensions" (answer 16); "I like to write at home, where I am quite and more inspired" (answer 21); "It is an opportunity to escape reality" (answer 19); "Writing makes me understand better what happens to me" (answer 15); "I write my daydreams" "In writing I throw out my bad feelings"; "Writing helps me to understand homework" to a dislike "Because it is like at school" (answer 4); (Table 1).

Table 1.
Questionnaire: Writing as a practice.

Question 2: why do you write?		*Question 3: Whom do you write to?*		*Question 4: Which are your preferred topics?*	
To overcome my difficulties to express orally my thoughts	01	Just write down	04	No	09
In conducting some activities	05	To myself	02	Everyday facts	03
To Imagine, to think	06	Messages	01	Schooling	01
Dialogue	04	Friends and relatives	08	My dreams	01
No answers	05	No answers	06	What it emerges	02

Ethnographic observations: the process of writing

The collaborative writing activity is an opportunity to develop a relevant unit of analysis of the process of learning literacy. In our ethnographic observations, we gathered data on:

- the organization of the setting,
- the interactions among students, each with her/his personal writing experiences and repertoires,
- the material and informational resources they use,
- the rules of the activity and the evolving talk in interaction. Talk is not only a means to express ideas, but more crucially is a means to construct ideas together (Mercer, 2000).

The products of two groups are selected to highlight both the students’ expressive potentialities and their difficulties in managing the four dimensions of formal writing, as defined by Freebody and Luke (1990).

In the first group three students (Alessia, Giada and Veronica) worked out collaboratively on the Manifesto and co-constructed the final text:

> [5] Giada: what can be done?
> [6] Alessia: if I talk to someone about a concern of mine, but she doesn’t listen to me
> [7] Alessia (dictates to Veronica): if I have a concern, the other has to listen to me =
> [8] Giada: =anyway, not that she has to=
> [9] Alessia: =then (0.4)
> [10] Giada: I expect her to give me an advice, not making comments (0.3) uhm (0.3) talking about her concerns:
> [11] Alessia: comparing her problems to mine
> [12] Giada (looks at Veronica who is writing what the peers are saying and proposes): without the comma (after ‘comments’) I mean=

In this extract, Alessia introduces one rule of kindness and friendship [6], on which Giada further elaborates [10]; meanwhile, she supports Veronica in her writing effort [7]; also, Giada helps Veronica in correcting her syntax [12].

Veronica writes down the text of the discussion; she is joined by Alessia who takes the role of the revisor: “If I have a concern, the other person should listen to me and give me advice, without interrupting me or comparing her concerns to mine. Do not give a comment on something you don’t know. Before attacking someone, reflect and understand her”. The girls worked out collaboratively the ideas by interpreting rude and hostile social acts in terms of consequences in the states of mind of the others (humiliation, vulnerability, confusion, …); the group decides to give itself the name of “Listening is above anything else”.

Finally, the definitive text is the following:

> A says (angrily): you tripped me!
> B: No, you are wrong
> C: you are quarrelsome
> B: No, you are unfair, you lie
> C: if you give a gift, you cannot ask it back
> B: she had pushed me
> the moral of the story is “Don’t take part in a quarrel, without even knowing why”

In the text, the students introduce three fictional characters (A, B, C), and refer to different layers of meaning: The girl C takes part in favor of A, based on what A said her about B in a previous situation in which C didn't take part. However, A was unfair in her report to C, and therefore C does not know some relevant information of the situation that made B angry (A was rude to B).

The students used all the dimensions of writing as they are proposed by Freebody and Luke (1990):

- Syntactical: the girls were able to support each other. Other girls in the group took the role of attentive listeners (looking at the talking peer, smiling at jokes, offering postural hints of agreement about the unfolding of the activity). They silently participated and their peers never perceived their presence as an obstacle, an opposition or as a condition needing an explanation.
- Semantic: they try to introduce different levels of complexity, that is the different frames of understanding each character is following (A: knowing the situation but having said only a partial truth to B; B knowing only a part of the situation; C knowing the situation but not knowing what B knows). However, the group was not able to manage all that complexity and did not make the relevant information explicit in the text, and therefore a reader loses its complexity.
- Pragmatic: they rely on a very rhythmic dramatic genre to show the consequences of deception on others.
- Affective: they are interested in deception, lie, misunderstanding.

Students' collaboration creates opportunities to learn elements of writing (working out the semantic aspects of the situation: Alessia and Giada jointly elaborate the consequences of lack of close listening [utterances 7, 10, 11]; furthermore, Veronica receives help in her syntactic competence. However, they are not yet able to compose an effective text. Many elements of the intended situation are left implicit, and a reader faces many difficulties to understand which is the correct frame of reference and therefore to attribute the correct meaning to the characters' utterances.

The second group, called "Kaliumbapé", works out a text based on the joint analysis of the concept of "embarrassment":

"We have learned that in given situations, embarrassment is normal; in other ones, it produces uneasiness (in other people). There are different types of embarrassment: when two or more people quarrel, embarrassment arises because one person would like to say something, which in turn produces offence in the other; when two people who are not enough close, stay together for a period.

It could be embarrassing also the situation in which a group is formed by people who do not know each other".

The students create a list of different types of "embarrassment". In their text, they use mental verbs which refer to individual mental states as consequences of social situations. Their definitions open either to the possibility of the reciprocal understanding of people, or to misunderstanding and conflict, if the interpretation of others' embarrassment is failing.

The students can write down sophisticated strategies of understanding of the psychological consequences of specific social situations. Dealing directly with their experiences and personal reflections, they were able to elaborate on the 4 dimensions of writing:

- Syntactical: the dimension is developed in terms of a series of definitions of a psychological concept ("embarrassment").
- Semantic: they work out the conceptualization of the different conditions that compose the meaning of "embarrassment".
- Pragmatic: they present a text that can help other to reflect on embarrassment and uneasiness.
- Affective: they make systematic connections between social situations and psychological states.

Their use of the writing process enables the systematicity and organization of their reflections, leading to a structured text. Through their collaborative activity, the students in this group have developed a strategy of joint design of the text. Each student proposed an aspect of "embarrassment" (related to her experience) and together they searched a hypothetical social situation in which embarrassment was a consequence. During the dialogue, also other stereotypical situations were considered such as the adults asking adolescents about friendship, or parents urging their children to make visit to grandparents. However, those situations were considered too obvious and discarded.

5. CONCLUSIONS

The results emerged in this study, highlight how collaborative writing is a participatory process, in which the meanings expressed by students in their texts, derived from a process of exchange of shared knowledge and experiences lived in the social world (Bazerman, 2017). Collaborative writing stimulates student participation and motivation and allows the sharing of ideas, thoughts and experiences which can make textual production more complex and meaningful (Pham, 2021; Villarreal & Gil-Sarratea, 2019).

The study highlights that co-designing a collaborative writing activity in a vulnerable school context can be effective if teachers and researchers recognize and value the non-formal writing repertoires that students develop in their everyday lives and connect them to the academic writing on relevant topics in students' experiences (Elola, 2010; Thompson, 2012). Improving the understanding of learning processes that are based on informal practices and incorporating them into formal practices, could therefore help students who find in a condition of disadvantage, to feel more valued in their skills and recognize in their potential (Bourke, O'Neill, & Loveridge, 2018; Spencer, 2021).

For the students, writing is more an informal practice (directed to oneself, to relatives and friends): they use some writing repertoires to achieve practical goals in their everyday lives; it supports interiority, or deeper understanding of daily experiences.

During the collaborative activity in the classroom, the writing process appeared more difficult; the students reasoned by prototypical scenarios and some relevant elements in the writing were not sufficiently developed. However, they showed a sophisticated analysis of the consequences of hostile communication on others' feelings, self-confidence, and interpersonal relationships: students were able to identify different layers of meaning and introduce different levels of complexity.

The process of learning to write should be consider in the complexity of the elements that are involved: not only linguistic and cognitive skills, but also social, relational ones, communication methods and personal experiences that can contribute to the creation of meaning (Bazerman et al, 2017). The results highlighted through this study, can offer useful suggestions for teachers regarding collaborative writing processes and the potential that this form of learning can offer to students. The practice promotes the development of expressive repertoires, which may be recognized and encouraged also in school. More educational practice is needed, to promote their competence in designing a complex text.

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AUTHORS’ INFORMATION

Full name: Paolo Sorzio
Institutional affiliation: Dept. of Humanities, University of Trieste
Institutional address: 8, via Lazzaretto Vecchio, 34123 Trieste, Italy
Short biographical sketch: Paolo Sorzio is Associate Professor of “Qualitative Research Methodologies” and of “Educational Design” at the School of Education, University of Trieste. His interests are related to the analysis of structure of participation in school context and on professionals’ in-service training programs. He is co-author with Caterina Bembich of *La ricerca empirica in educazione* [Research Styles in Education], Rome: Carocci, an introductory text about different reasoning styles in educational research.

Full name: Caterina Bembich
Institutional affiliation: Dept. of Humanities, University of Trieste
Institutional address: 8, via Lazzaretto Vecchio, 34123 Trieste, Italy
Short biographical sketch: Caterina Bembich is Researcher at the University of Trieste, where she teaches "Experimental Pedagogy" and "Tools and techniques for educational research". Her research focuses on risk and protective factors in vulnerable educational contexts; on inclusive processes addressed through innovative methodologies. Among her publications with P. Sorzio (2021). *Misurare e Interpretare i processi di contrasto al rischio educativo* [Measuring and Interpreting the Educational Interventions to Contrast Risks in Education], Lecce, Pensa MultiMedia Publisher.

ENDNOTES

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2. The Manifesto is available on the site of the Parole O_stili Association: https://paroleostili.it/manifesto/; it is made up of a 10-sentence handbook, which identifies the fundamental principles of a positive, respectful, empathetic and responsible speech.

Section 3
Teaching and Learning

Chapter #25

INTEGRATING SCIENCE IN RELIGIOUS EDUCATION USING AN ARGUMENT-BASED INQUIRY APPROACH IN KAMPALA ISMAILI SECONDARY CLASSROOM

Bilquis Hamid
Ismaili Muslims Charitable Trust, Uganda

ABSTRACT
Current secular and Religious Educational (RE) systems in Uganda are registering improvement, but not fast enough to meet the needs of its students. Most secular and religious classrooms still follow a teacher-centred approach where students depend on their teachers' instructions to perform any task and rarely think critically beyond the curriculum. Extensive research indicates that students' critical thinking skills improve when science teachers use an Argument-Based Inquiry (ABI) approach. Relatively, less research is done in RE using science subject knowledge to prove religious claims through argumentation. Thus, this small-scale study aimed to enhance critical thinking in students by integrating science into religious education through discourses using the ABI approach. Data collection methods included students' written and verbal responses to religious claims and reflections from students and teachers. Data collected from sixteen sessions were analysed using codification. The findings suggest that the ABI approach facilitated critical thinking, extended discussions, and improved justification of scientific claims beyond the RE curriculum. This small study can inform global RE teaching practices to develop critical thinking skills in students using argumentation. Affirming that argumentation is at the heart of classroom practice, this paper concludes that teachers need to develop their argumentation skills through ongoing professional development.

Keywords: argument-based inquiry approach, critical discourse, integration of science in religious education.

1. INTRODUCTION

In most of the secular and Religious Education (RE) classrooms in Kampala, Uganda, the traditional teacher-centred environment prevails. In such an environment students depend on their teachers' directions to perform assigned tasks. Hence, the teaching-learning processes tend to focus on knowledge transmission rather than knowledge construction (Watkins, Carnell, Lodge, Wagner, & Whalley, 2002). As a result, students who acquire knowledge through memorisation are unable to think beyond the content taught. As critical thinkers, students are assumed to be able to challenge their peers', their teachers' along with their own presumptions, and justify their claims by giving reasons and providing evidences. Toulmin (1958) termed this process of engagement of students in justifying knowledge claims through reasons and evidences as argumentation. Research has been conducted across the curriculum to enhance students' critical thinking skills, and results have proven that the Argument-Based Inquiry (ABI) approach is one of the efficient strategies to make thinking visible (Braaten & Windschitl, 2011). However, in a RE classroom, teachers face challenges in engaging students in a critical discourse where they can provide evidence for a religious claim. Berkey (2003) acknowledges this issue in the RE and suggested that subjects from modern sciences such as English, Math, and Science should also be included in the religious curricula. Meanwhile Reiss (2013) argues that in

addition to the inclusive RE curriculum, the pedagogical approach should enable students to understand religious claims using scientific truths, and to be tolerant of how people of other faiths have understood the world. Thus, it is essential for RE teachers to relate religious information with that of science, during the religious formation of their students, while cultivating students' critical thinking and reasoning skills. Therefore, I adopted an argument-based inquiry approach in my RE sessions to enhance students' critical thinking while engaging them in critical discourses and to help them understand religious claims with authentic scientific knowledge.

The overarching aim of this study is to investigate whether the argument-based inquiry approach used by RE teacher during critical discourses allow students' critical thinking to develop. Additionally, the report would critically examine Barbour theory of integrating science (1991) in RE and observe whether critical discussions are generated through the argument-based inquiry approach. Furthermore, the chapter would focus on higher-level questions engaging students in the thinking and reflection process to produce critical responses (Şeker & Kömür, 2008). Finally, the chapter ends with a discussion of findings and recommendations for future research, while providing input into my learning as a teacher-researcher from the study.

2. CONTEXT

The RE classes for the Shi'i Ismaili Muslim community in Kampala, Uganda, currently runs voluntarily where the RE teachers lack formal training, and there is still a need for skills development, especially in argumentation. The *Ta'lim* (Arabic for education) curriculum is the religious and cultural educational curriculum for the Shi'i Ismaili Muslim community developed by curriculum writers at the Institute of Ismaili Studies (IIS) for the implementation in pre-school, primary, and secondary levels of religious education for Ismaili students globally. Recent developments in the secondary *Ta'lim* curriculum deal with challenging subjects like religion and integrates it with secular scientific concepts so that students can make meaning of their learning.

My class comprised twenty-five 16-year-old students (thirteen girls and twelve boys of mixed ability). The classes were held once a week in a STEP classroom equipped with all teaching resources. The length of each class was two hours, and these classes lasted for six months. I taught the IIS secondary curriculum modules: *The Quran and its Interpretations; Faith, and Practice in Islamic Traditions; and Muslim Devotional and Ethical Literature.*

3. BACKGROUND

Various hands-on and minds-on activities motivate students towards the learning process, but to ensure they understand, teachers mostly concentrate on students' responses during discussions and debriefing sessions. Watkins et al., (2002) affirms the notion that engaging students in classroom activities is not enough; however, reflecting on these activities would serve the purpose of learning. Dewey (1938) further proposes the necessity of monitoring, reviewing, and summarising the learnt skills for effective learning. According to my observations in the study, students reflect and process the information received from different sources and construct the knowledge according to their understanding while learning in a social setting (Moon, 2008). Thus, intellectual engagement of students in knowledge construction is at the heart of the teaching-learning

process and is attributed to critical thinking. Brookfield (1993) believes that those students who are involved in an active thinking and reflecting process develop their critical thinking skills. Similarly, Brookfield (1993) and Fisher (2001) stress that critical thinking is a complicated but a fundamental thinking process, which allows the learners to think differently and challenge others' statements by providing evidence for their claims. I concur with the authors and have implemented an argument-based inquiry approach in my RE session activities to observe students' thinking patterns while presenting scientific arguments to approve or disapprove religious claims.

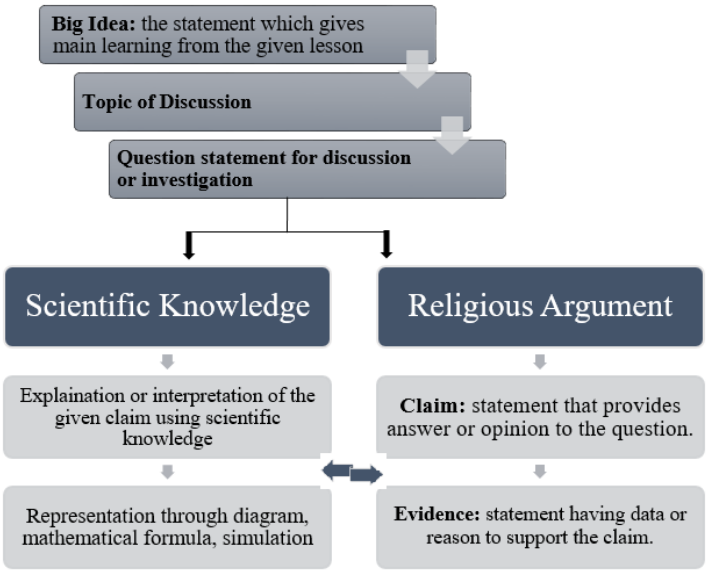
Due to disagreements regarding their conventional epistemological and ontological differences, religion and science are typically seen as being at odds with one another.

However, Ian Barbour's taxonomy of the interplay between religion and science illustrates the connections between both fields (1991). Moreover, both subjects have a common objective to develop curiosity in students to think and use logical proofs to justify a claim. Kelly (2004) emphasizes that religious education should have an evolving pursuit, which has its applicability rooted in the changing times. For instance, scientific advancements in Artificial Intelligence inspire our students to examine religious texts and support their claims using logic and scientific approaches. Hence, integrating scientific knowledge to prove religious claims would be a step towards eliminating the divide between the two subjects. And argument-based inquiry would provide a systematic structure to observe the development of students' critical thinking and reasoning patterns. However, all scientific claims cannot be relatable to religious claims, which is the limitation of the study.

4. DESIGN AND METHODS

This study has investigated the integration of science in RE using ABI approach during the teaching and learning process. This research study took action research approach as the methodological framework, whereby I saw myself actively participating in the process and anticipating the change in my students' critical thinking (Robson, 2002). The purpose of action research is to bring change in real-life experiences based on a cyclical process of identifying a problem, planning a solution, acting out the method, and lastly reflecting on the outcomes (Denscombe, 2007; Hopkins, 2008; Watkins et al., 2002). Detailed lesson plans were designed and implemented with an ABI approach using Toulmin's (1958) framework of questions, claims, and evidence (refer to *Figure 1*) to observe how science integrated into RE.

Figure 1.
A framework for ABI approach in RE arguments using scientific knowledge.



The ABI framework helped foster students' critical thinking skills. It allowed them to participate in discussions where they could question religious claims and support their opinions with evidence. Throughout the study, the ABI approach proved to be an effective process that enhanced students' critical thinking. However, during the initial stages of the intervention, students found it challenging to ask questions about religious claims and provide evidence using scientific facts. For instance, when I asked questions related to natural phenomena, most of the students provided scientific justification for the question; however, they found it challenging to prove that necessity through a religious claim. Therefore, I had to develop more questions on religious claims during the planning and implementation sessions to elicit critical responses from students. In addition, some misconceived notions of RE and science got highlighted while relating the religious concept with scientific knowledge that are elaborated in the analysis and discussion. Hence, I had to explain those scientific and religious concepts again to clear any misconceptions, which was time-consuming. Therefore, I reflected on each lesson and planned activities according to the thinking level of my students and then executed the lesson plan. Thus, my lesson plans were continuously in the process of change during the research study.

This change was not an instantaneous event rather it was an ongoing process of human experiences in which results developed over a period of time. Therefore, during the study, I was continuously engaged in a reflective process and improving my questioning techniques in order to nurture the critical thinking skills of my students (Brooker & Macpherson, 1999).

5. ANALYSIS AND DISCUSSION

Data analysis was an integral process throughout this research study. After each intervention, the data collected through students' reflections and class observations were analysed and adjustments were made for the next lesson as a part of action research. The data collection methods involved ensured triangulation, as varieties of sources were used (Hopkins, 2008; Bell, 2005; Denscombe, 2007). However, to maintain the validity and reliability of the data, careful interpretation was needed for the results of this study,bearing in mind the complex context in which this study took place (Bell, 2005; Denscombe, 2007). The main aim of the study was to observe how ABI approach integrates science into RE and encourages learners to question religious claims, and justify their claims through evidence. Additionally, it also focused on students' critical thinking through their verbal discussions and written responses given in their reflections.

A pre-coded (**Bold**, Underline, *Italic*) analysis approach was used to analyze the data, because I was looking for argumentation such as questioning the religious claims and giving their judgements through evidence in my students' responses (Denscombe, 2007). To analyze students' responses in the classroom discussions and the written reflections, I looked for various elements of argumentation which I coded as in the example below. The elements I was looking for were: claims (**Bold**), logical reasoning (underlined) and making judgements with evidence (*Italic*). Initial results showed that questioning religious claims was challenging for students, the discussions generated lasted for a brief period, and only a few students participated. Additionally, they were unable to provide evidence for their judgments. Transcription conventions include ST referring to student and TR referring to teacher researcher.

For instance:

Religious Claim: Prophet Muhammad (Peace Be Upon Him) said, "The Hour will not be established till the sun rises from the west".

ST1: **The statement is wrong.**

TR: What is the reason for your statement?

ST1: **Because the sun always rises in the east.**

TR: **The given religious claim cannot be wrong** because, as Muslims, we believe that God is the ultimate truth and Prophet Muhammad (PBUH) is the final messenger of God and the messenger of God always speaks what God shares with him. As is stated in the Holy Quran:

"Nor does he speak out of [his own] desire; it is just a revelation that is revealed [to him]" (Sura 53: verse 3-4)

(Pause)

ST2: It is actually **the earth that moves round the sun which makes the day and night, sun never moves.**

ST3: Whatever be the case the sun rises or the earth rotates, **day starts from the eastern side of the earth.**

ST2: Let me illustrate through diagram.

(pause) {the student draws on the board and showed his thinking}

Here is **the sun stationary, and this is the Earth, moving around the sun**. One day it is the final hour or end of times, and **the Earth will turn around and start moving in the opposite direction.**

ST1: What are you saying? **The Earth can't move in the opposite direction** as *it rotates on its axis, and it will always move from east to west. Therefore, the eastern side of the Earth will always face the sun first.*

TR: What makes the Earth remain on its axis and move in its orbit?

ST4: *the force of gravity.*
It means because of the gravitational force, all the planets are moving in their orbit around the sun, and if we remove this gravitational force from the milky way, then all the planets will move in different directions. As we know, *there is no force of gravity in the universe, and when space shuttles and astronauts reach the universe, they start moving freely*. Hence, **if there is no gravitational force in the milky way**, then the Earth will move freely without the attraction, and that will cause it to move from west to east.

The student 1 only gave a claim initially and provided another claim without the evidence for justification. However, when I modeled the process of question-claim-evidence, on the given religious claim with reason and evidence, it enabled students to rethink on their statements and justify their position, and informed the outcomes of the study.

It is evident from the aforementioned discourse that when students are not pressured to provide right answer, it helps them to develop their thinking and content knowledge (Brown, 1994). Thought provoking questions such as, "What makes the Earth remain on its axis and move in its orbit?", initiated the argumentation process in ST4 as she started analysing the claim more deeply and presented a different perspective. Students were making meaning of the religious claims, using their scientific knowledge, questioning their beliefs, and justifying their assumptions. Hence, ABI approach in teaching and learning process acted as scaffolding in students' construction and co-construction of knowledge.

Near the end of the my six-months intervention, I observed that my students sustained group discussions for a longer time when posed religious claims. They also demonstrated improved skills to justify their views with evidence and engaged in critical discussions. The implementation of the ABI approach in my classroom teaching also helped me as a teacher researcher to identify some religious and scientific misconceptions in students' understanding. For instance, during discussions student immediately claimed the religious claim was wrong, due to his lack of religious knowledge, where I intervened to clarify the misconception and presented my claims with evidence from scripture. Secondly, when I observed that the scientific information was misconceived, I asked another question to let students think further. Therefore, teachers need to simplify and modify their complex religious and scientific claims by rephrasing them according to students' cognitive level such that they easily understand them and respond.

6. FUTURE RESEARCH AND CONCLUSION

The small-scale study in the Kampala STEP RE classroom focused on whether the ABI approach used during classroom discussion enhances students' argumentation and critical thinking skills. Initially, the argumentative claims posed during sessions were challenging for students to argue. However, the teachers' intervention proved to be scaffolding students' construction of knowledge (Vygotsky, 1978). The results of this study have important implications for educational practice. The findings suggest that the ABI approach used in teaching and learning develops students' argumentation skills.

Additionally, the ABI approach helped students to think beyond the curriculum and make informed decisions.

The findings of this study revealed some misconceptions related to religious and scientific information during the interventions. Therefore, teachers should be well-informed about religious and scientific knowledge to facilitate students learning. Hence, professional teacher training is required for teachers to understand the underpinning concepts of science and religious education. Additionally, teachers need ongoing professional development in designing argument questions and understanding the effectiveness of the ABI approach. Hence, a future research study could explore the impact of trained teacher-generated critical discourses in classroom practice to develop students' argumentation skills.

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AUTHOR INFORMATION

Full name: Bilquis Hamid
Institutional affiliation: The Ismaili Muslims Charitable Trust, Uganda
Institutional address: 9/11 martin Road, Namirembe road, Kampala-Uganda, Post Box No.10658.
Biographical sketch: Bilquis is a Secondary Teacher Education Programme (STEP) teacher-researcher serving the Ismaili *Tariqah* and Religious Education Board (ITREB) for Uganda. Previously, she was working with ITREB Pakistan for ten years. From 2002 to 2009, she led the Mathematics department at the AKES in Pakistan. Additionally, she has worked as a visiting faculty member at Hamdard University Karachi (HUK). She obtained MA and MTeach degrees from IOE & IIS London in 2011. In 2008, she was awarded a Gold medal in the M.Ed. program from HUK. As a consultant at Premier DLC, she created curriculum modules and conducted training sessions for teachers at Sindh Education Foundation, funded by USAID. In 2018, she worked as a content Master trainer for Rays of Light, and in 2020, she was a PGPP professional for the ASST team at IIS London and led workshops at Camp CONNECT.

Chapter #26

CONCEPTUAL TRANSITION IN STUDENTS' LEARNING FROM ARITHMETIC TO AN ALGEBRAIC CONTEXT
A conceptual way from rational numbers to rational equations

Natalia Karlsson & Wiggo Kilborn
Department of Pedagogy and Didactics, Södertörn University, Huddinge, Stockholm, Sweden
Faculty of Education, University of Gothenburg, Gothenburg, Sweden

ABSTRACT
Our current research addresses students' arithmetic and algebraic knowledge, focusing on conceptual connections, and relationships between two aspects of knowledge. The contents in question are rational numbers and rational equations in grades 7, 8 and 9. The study contains three tests given to 400 students in grades 7-9. The tools for analysis comprised an algebraic concept of rational numbers, the theory of generalizing arithmetic into algebra, and theoretical approach about the relationship between arithmetic and algebra in a conceptual context. Current research shows that students' knowledge of algebra and arithmetic has a limited conceptual connection and a weak relationship with each other. Their knowledge of arithmetic operations and solving rational equations used to be solely procedural and relied on formulas learnt in a procedural – and often mixed – manner. This caused conceptual consequences for students' knowledge of rational numbers and their essential properties, as well as shortcomings in students' ability to operate with rational numbers. This study highlights that conceptual transitions from rational numbers to rational equations play a crucial role in students' learning, focusing on the conceptualization of arithmetic concepts and their ability to operate in an algebraic context.

Keywords: rational numbers and algebra, conceptual knowledge, students' arithmetic and algebraic knowledge, conceptual continuity in students' learning.

1. INTRODUCTION

The generalization of algebraic concepts and the ability to create meaning from symbols is a long-term process linked to the expansion of students' arithmetic knowledge (Kieran, 2007). Algebraic reasoning is important for conceptualizing algebra and for using it to expand arithmetic knowledge into abstract algebraic knowledge. According to Mason (2008), the generalization of algebraic patterns calls for concept-based knowledge and the ability to analyze arithmetic situations. This means that students' learning of algebra, related to previous experience of learning and conceptual knowledge, plays a crucial role in operations with rational numbers and solving rational equations (Hackenberg & Lee, 2015). This means, among other things, that students understand conceptual relationships previously used for natural numbers in a way that can be generalized to whole, rational, and real numbers, even if the operations themselves must be modified. At the same time, it is important that students perceive subtraction as the inverse operation of addition, and division as the inverse operation of multiplication. To help students make such generalizations, the teacher must have sufficient knowledge of algebra and understand how an extension of arithmetic works in a conceptual sense, before they start teaching such

content (Kieran, 2004). It is also a matter of how students can learn algebra by working informally with the four rules of arithmetic methods in the younger grades, but in such a way that they will later be able to apply this to whole, rational, and real numbers. To understand these generalization processes, students need pre-knowledge about the characteristics of rational numbers before they apply rational numbers in problem solving.

2. BACKGROUND

2.1. Students' Pre-Existing Knowledge

Arithmetics taught during early school years is often based on preliminary and more perceptible concepts, and it is important that these preliminary arithmetic concepts can be gradually developed into correct mathematical concepts. This is often carried out with metaphors or by using different representations, such as pictures. However, according to Kinard and Kozulin (2008), the aim of all representations is abstraction, students' verbal understanding of arithmetical concepts and their crucial properties. Learning rational numbers is a matter of conceptual meaning (Ni & Zhou, 2005; Gözde & Dilek, 2017), a process that successively presupposes adequate pre-existing knowledge of algebra. According to Vygotsky (1986), mathematics is a social construct that implies an ability for abstract thinking. For that reason, students are not able to learn mathematics without support from sufficiently trained teachers.

Students' understanding of rational numbers as arithmetical concepts assumes an ability to think and reason in terms of algebraic abstracts. For students to assimilate the abstract concept of fractions, there is often a need for some kind of representation, a variation of tasks and problem-solving. The aim is to facilitate the verbalization of crucial properties. However, as Ohlsson (1988) emphasizes, fractions are often a "bewildering array", and it is important for a student to know which property of rational numbers is currently represented. For this reason, it is important for students to have suitable pre-existing knowledge of arithmetic (Zazkis & Liljedahl, 2002; Kieran & Martínez-Hernández, 2022). Moreover, when students are introduced to a new phenomenon, they are usually more inclined to assimilate it according to their current understanding than to accommodate and develop a new, deeper understanding (Pajares, 1992).

2.2. Conceptual Continuity in Instruction and Learning

Mathematics is an abstract and general science for problem-solving. This, in turn, is a condition for being general i.e., applicable in a variety of situations. An important follow-up question is what is meant by abstract and abstraction. Skemp (1986) explains the meaning of the terms, linked to school mathematics, as follows, "abstracting is an activity by which we become aware of similarities …among our experiences" and "abstraction is some kind of lasting change, the result of abstracting, which enables us to recognize new experiences as having similarities of already formed classes" (p. 21).

The case that mathematics is abstract and general does not only apply to the academic subject of mathematics, but also to school mathematics. 2+1=3 is an abstraction that is general in the sense that it is applicable no matter what objects you add, and not only objects, but also minutes, ideas, age, etc. It is important to pay attention to this in students' learning, as well as in formal studies in mathematics. Continuous reflection on relationships between arithmetic and algebra and on the complex nature of an arithmetic problem can be expressed as algebra. This will create conditions for continuity in student learning and provide the knowledge needed for understanding algebra (Carraher, Schliemann, Brizuela, & Earnest, 2006).

A central aspect of mathematics is the field of algebra. A common perception of algebra among students is that it is about complicated "counting with letters". In fact, basic algebra deals with the conditions for the arithmetic operations that students are already learning informally during the first years of school, and how they later can use this to derive and operate with negative numbers and numbers in fractional form. The "letters" are only used to describe the fact that something is general. To describe what is meant by an equation of the first degree does not require a presentation of all such equations. Using symbols, this can be written as $ax + b = 0$, where $a \neq 0$. The conceptual relationship between rational numbers and equations is an important part of students' learning of algebraic symbols and abstracting the ideas behind them (Karlsson & Kilborn, 2014).

Making conceptual generalizations from arithmetic concepts and operations and understanding how an extension of arithmetic works in a conceptual sense, are important parts in students' learning of algebra (Kieran, 2004). They provide conceptual continuity in students' learning of algebra and help them understand symbols and their meaning in equations. It is a matter of how students can learn arithmetic and algebra by working informally with four rules of arithmetic in younger grades, but in such a way that the students later will be able to apply this to whole, rational, and real numbers. To understand this conceptual generalization process in grades 7-9, students need to acquire knowledge about the characteristics of rational numbers before they apply rational numbers in problem solving and in solving rational equations. Therefore, the learning processes such as the transition from arithmetic to algebra are given special attention in the current study.

The purpose of the study is to examine conceptual connections in students' arithmetic and algebraic knowledge of rational numbers, and their ability to use this in problem solving and to solve rational equations. The research questions are: (RQ1) How do students interpret and represent rational numbers? (RQ2) How do students handle transitions from rational numbers to symbols and rational equations? and (RQ3) How do students apply this to problem solving?

3. METHODS

3.1. Participants and Procedure

The study was designed to examine students' arithmetic and algebraic knowledge in a conceptual context with special focus on students' perception of rational numbers and their properties, and how to handle this in solving rational equations and problems dealing with proportion and ratio (Ralston, 2013). The participants were 400 students in grades 7, 8, and 9, with three teachers A, B, and C in 15 classes (see Table 1).

Table 1. Participants.

Class	7a	7b	7c	7d	7e
Teacher	A	A	B	B	C
Number of students in grade 7, n=135					
Class	8a	8b	8c	8d	8e
Teacher	B	B	C	C	A
Number of students in grade 8, n=135					
Class	9a	9b	9c	9d	9e
Teacher	C	C	A	A	B
Number of students in grade 9, n=130					

Table 1 illustrate numbers of students (n) respectively in grade 7, 8 and 9 and their belonging to the teacher A, B or C.

The study includes a quantitative and a qualitative approach. The instrument consists of three diagnostic tests: DT1, DT2 and DT3. Test DT1 focused on representations of rational numbers and operations with rational numbers, test DT2 focused on algebraic equations like $\frac{3}{5} = \frac{x}{8}$, and test DT3 focused on problem solving related to proportion and ratio. Each test consists of 7 tasks of increasing complexity. The tasks were designed with two empty spaces, one for the answer and the other for written explanations of the calculation. The qualitative part consisted of careful analyses of students' answers, the methods they used, and how, why, and when their answers went wrong.

Moreover, the results were interpreted and then explained in the form of a written recommendation intended to develop the skills of the teachers involved as well as their colleagues. The careful and verbatim interpretation of the results on the study together with teachers led to interesting discussions about a practical didactical sense of teaching and how teaching can ensure continuity in students' learning. An important topic in joint discussions related to how teachers can create possibilities for students in grade 7 to repeat and systematize their own pre-existing knowledge and connect this to learning algebra. This question showed that thinking about continuity in teaching is a big challenge for teachers because teachers place a lot of importance on formulas and rote learning methods. This illustrates that the collaboration between researchers and teachers within this project plays a much greater role for the further development of teaching, and joint reflections led to positive effects in ways of thinking about teaching for researchers and teachers alike.

4. THEORETICAL FRAMEWORK

4.1. Generalizing Arithmetic into Algebra

An important feature of teacher training is that student teachers develop skills in algebraic reasoning based on generalizing mathematical ideas linked to algebraic concepts (Blanton & Kaput, 2005). This particularly applies to concepts that constitute the basis of modern algebra, conceptual relationships between algebra, the generalization of arithmetic, algebra and patterns, algebra and mathematical models, and the meaning of algebraic symbols (Kaput, 2008). For students to understand symbols and abstract algebra, they need to generalize algebraic concepts by reasoning with symbols (Kaput, 2008). Students' ability to express themselves using algebra and transform arithmetic concepts into algebraic concepts depends on their conceptual knowledge of the relationships between arithmetic and algebraic concepts, and how numbers are transformed into algebraic symbols. For instance, students' conceptual knowledge of rational numbers is a key to understanding equations, their constructions, and their conceptual meaning. According to Kieran (2004), the generalization of algebra requires algebraic activities with a focus on students' ability to explain and express their knowledge and understanding. Such activities include several main components: (1) generalization of arithmetic concepts; (2) conceptual transformation from arithmetic into algebra; and (3) analyzing and applying this in problem solving. Mastering algebra means not only knowing different algebraic expressions and equations, but also understanding conceptual connections between numbers and expressions and between numbers and equations as tools in problem solving. This means that mastering algebra not only includes a path from separate algebraic expressions and equations to their generalizations, but also the way back – from generalization to arithmetic.

The transformation of student knowledge from arithmetic to algebra presupposes a fundamental understanding of crucial properties and representations of numbers, and their connection to algebraic expressions and equations. Important in Kieran's view of this is that student mastery of algebraic knowledge includes an ability to apply their conceptual knowledge to different problem-solving situations. Such a systematic pattern in students' learning can effectively help them to understand the conceptual relationship between arithmetic and algebra, and how to use this in problem solving. One example is students' conceptual understanding of rational numbers as equivalence classes, such as $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$ etc., which constitutes conceptual pre-existing knowledge in understanding operations such as the extension of rational numbers, conceptual understanding of symbols, and how to add two fractions with different denominators (van der Waerden, 1971). It also offers a method to solve equations like $\frac{x}{2} = \frac{2}{4}$ using algebraic reasoning, and without using procedurally learned formulas (Carpenter & Levi, 2000; Karlsson & Kilborn, 2015).

5. DATA ANALYSIS

The main purpose of the study was to answer research questions RQ1, RQ2 and RQ3 about student conceptual understanding of rational numbers and rational equations, and their ability to use this in problem solving. The theoretical model was based on van der Waerden (1971), Kaput (2008) and Kieran (2004) and was used to analyze and present students' accuracy in tests in a conceptual meaning. The two-level analysis – consisting of quantitative and qualitative parts – enabled researchers to highlight students' conceptual repertoire. The special attention to students' conceptual understanding related to how students perceive the connections between arithmetic and algebra in terms of transition from rational numbers to rational equations and on to problem solving.

6. RESULTS

6.1. Test DT1 (RQ1). Rational numbers and operations with rational numbers

Table 2 shows the correct answers to some chosen tasks.

Table 2. Students' correct answers.

	Task 1 $3 \cdot \frac{2}{7}$	Task 2 $\frac{3}{4} \cdot \frac{2}{7}$	Task 3 $\frac{4}{7} \div 2$	Task 4 $\frac{4}{7} \div \frac{3}{5}$
Grade 7 (n=135)	45%	28%	37%	6%
Grade 8 (n=135)	73%	54%	72%	48%
Grade 9 (n=130)	62%	79%	67%	60%

6.1.1. Test DT1, Qualitative Data

Almost all students in grade 9 relied on formulas to solve the tasks, for example, to solve a simple task such as $3 \cdot \frac{2}{7}$ (Task 1). Moreover, 38% of the students in grade 9 failed to solve that task. A low ability in terms of algebraic reasoning also became evident. In fact, most students tried to use the formula $\frac{a}{b} \quad \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$ already in grade 7 and most of them failed.

As the formula was learned in a procedural way, it was often mixed up with the formula for division of rational numbers or with cross multiplication.

Just 67% solved the task $\frac{4}{7} \div 2$ in grade 9. Most of them tried to use the formula $\frac{a}{b} \div \frac{c}{d} = \frac{a \cdot d}{b \cdot c}$. The same method was used already in grade 7. Since this formula was also learned in a procedural way, it was often mixed up with the formula for multiplication of rational numbers or with cross multiplication.

Comments by the authors:
Task 1

A simple conceptual solution to the task $3 \cdot \frac{2}{7}$ is to use repeated addition: $\frac{2}{7} + \frac{2}{7} + \frac{2}{7} = \frac{6}{7}$. This is the same reasoning as 3 · 2 cm = 2 cm + 2 cm + 2 cm = 6 cm.
Task 4

A simple conceptual solution to the task $\frac{4}{7} \div 2$ is = $(\frac{1}{7} + \frac{1}{7} + \frac{1}{7} + \frac{1}{7}) \div 2$ or $(\frac{2}{7} + \frac{2}{7}) \div 2 = \frac{2}{7}$, Like in 6 ÷ 2 = (2 + 2 + 2) ÷ 3 = 2.

6.2. Test DT2 (RQ2). Rational Equations

Table 3 shows the correct answers to some chosen tasks.

Table 3. Students' correct answers.

	Task 1 $\frac{2}{4} = \frac{x}{12}$	Task 2 $\frac{3}{5} = \frac{x}{8}$	Task 3 $\frac{3}{5} = \frac{7}{x}$	Task 4 $\frac{5}{6} = \frac{x}{y}$
Grade 7 (n=135)	63%	9%	7%	2%
Grade 8 (n=135)	47%	8%	1%	7%
Grade 9 (n=130)	83%	40%	7%	3%

6.2.1. Test DT2, Qualitative Data

According to Table 3, 63% of the students in grades 7 and 83% in grade 9 solved the equation $\frac{2}{4} = \frac{x}{12}$ (Task 1). When the denominators were different, it became more difficult. Just 40% of the students in grade 9 solved the equation $\frac{3}{5} = \frac{x}{8}$ (Task 2) and only 7% solved the equation $\frac{3}{5} = \frac{7}{x}$ (Task 3) with x in one of denominators. Most students in grade 9 failed to carry out basic arithmetic operations. Those whose solved the equation $\frac{3}{5} = \frac{x}{8}$ used cross-multiplication. An interesting observation was that few of the same students used cross-multiplication to solve the similar equation $\frac{3}{5} = \frac{7}{x}$ (task 3). Concerning Task 4, students' accuracy was very low in all grades. This kind of task requires students to have a conceptual understanding about what two equal fractions (rational numbers) mean and what proportion means. This confirms a lack of ability for reasoning about and conceptual understanding of the concept of fractions and essential properties of fractions. This also illustrates that solely applying procedurally learned formulas has serious limitations.

6.3. Test DT3 (RQ3). Problem-Solving and Rational Numbers

Table 4 shows the correct answers to some chosen tasks.

Table 4. Students' correct answer.

	Task 1 For 24 kronor you get 3 dl of juice. How much juice do you get for 20 kronor?	Task 2 Anna can cycle 80 km in 3 hours. How long does it take Anna to cycle 50 km at the same speed?
Grade 7 (n=135)	76%	3%
Grade 8 (n=135)	74%	8%
Grade 9 (n=130)	89%	26%

6.3.1. Test DT3 and Qualitative Data

76% of students in grade 7 solved Task 1 through reasoning. Most of them used the constant of proportionality, 8 kronor/dl. However, Task 2 was very difficult to solve for most students. The solution $50 \cdot \frac{3}{80}$ was too complicated like the mathematical model ratio as $\frac{x}{50} = \frac{3}{80}$. This confirms once again that this task requires conceptual understanding about what two equal fractions mean and what proportion means. This kind of conceptual knowledge can also give students understanding about the constant of proportionality.

7. FUTURE RESEARCH DIRECTIONS

This study shows that students' conceptual knowledge in arithmetic and about rational numbers and operations with rational numbers is very important to provide continuity in students' learning (Vygotsky, 1986; Pajares, 1992). It also has an influence on their ability to express arithmetic into algebraic terms in order to understand algebraic equations and use them in problem solving. It also illustrates how students' accuracy in tasks such as those in tests DT2 and DT3 depend on pre-existing knowledge of tasks like the one in test DT1. Conceptualization of arithmetic with rational numbers and its transformation into algebra has been recognized as a crucial yet difficult issue in students' learning of mathematics (Kinard & Kozulin, 2008). This study illustrates that students' pre-existing knowledge of arithmetic (Ohlsson, 1988; Zazkis & Liljedahl, 2002; Kieran & Martínez-Hernández, 2022) and their pre-existing knowledge of rational numbers (Ni & Zhou, 2005; Gözde & Dilek, 2017) play an important role for students in solving algebraic equations and problem solving, and more generally in students' learning of the abstract nature of algebra, expressed in symbols (Carpenter & Levi, 2000; Carraher et al., 2006; Karlsson & Kilborn, 2014; 2015).

An aim in future research is to focus on the didactical aspects of teaching, such as how to plan for better continuity in teaching and how to clarify the relationship between arithmetic and algebraic concepts. The transition in students' learning from rational numbers to proportion and ratio requires careful and proper analysis, like the use of rational numbers in solving rational equations and problem solving connected to ratio and proportion. A careful and proper analysis of this is a crucial conceptual key in students' learning of algebra.

8. DISCUSSION

The analysis of RQ1, RQ2 and RQ3 indicates low conceptual development from grade 7 to 9 in terms of students' ability to handle rational numbers (fractions), rational equations, and algebraic reasoning, as well as in understanding the relationship between rational numbers (fractions) and rational equations, and between fractions and problem solving.

The students' solution of the tasks was largely procedural, essentially only using formulas or methods like cross-multiplication, with few examples of conceptual reasoning. Moreover, a lack of understanding of the formulas and methods resulted in these being mixed up, often causing absurd answers. Students' procedural knowledge also had an influence on the expected progression in their understanding from grade 7 to 9. For example, most students in grade 7 attempted to solve the task $2 \cdot \frac{3}{7}$ by using the formula $\frac{2}{1} \cdot \frac{3}{7} = \frac{2 \cdot 3}{1 \cdot 7}$ and often made mistakes, like 38% of the students in grade 9.

A low ability in terms of algebraic reasoning also became clear in problem solving. Most students simply tried to apply a formula that they did not know how to use. For example, only 26% of the students in grade 9 were able to solve the task "*Anna can cycle 80 kilometers in 3 hours. How long does it take Anna to cycle 50 kilometers at the same speed*?". The descriptions of their solutions show that most of the students were unable to reason, choose a correct formula, or perform the correct calculation. When comparing the solutions in grade 7 and 9, it became obvious that there had been very little development of knowledge from grade 7 to 9. In grade 7, the students already used the same formulas as in grade 9. The problem with such procedural knowledge is that it offers insufficient grounds for developing algebraic reasoning and make abstracting (generalization) of rational numbers and rational equations (Skemp, 1986; Kieran, 2004).

One crucial task was "*For what values of x and y are* $\frac{5}{6} = \frac{x}{y}$*"*. The response rate was low in all grades. All students who solved the task answered x = 10, and y = 12. This confirms a lack of both reasoning ability and conceptual understanding of fractions (Kaput, 2008). It also shows the students' limited understanding of the important property of fractions as equivalence classes, which is a gateway to understanding and solving the current rational equations.

9. CONCLUSION

The purpose of the study was to examine conceptual connections of students' arithmetic and algebraic knowledge of rational numbers, and their ability to use this in problem solving and to solve rational equations. The results show that the transition from arithmetic to algebra is a difficult process for students and impossible to carry through with only procedural knowledge. Van der Waerden (1971), Kieran (2004) and Kaput's (2008) theoretical frameworks visualize fundamental conceptual limitations in students' solutions of rational equations and their dependence of conceptual knowledge. More specifically, the generalization of algebra cannot take place without the generalization of arithmetical concepts (rational numbers). However, conceptual knowledge of rational numbers implies students' ability to achieve solutions for equations through reflection and reasoning, even without use of formulas.

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AUTHORS' INFORMATION

Full name: Natalia Karlsson
Institutional affiliation: Södertörn University
Institutional address: School of Teacher Education, Department of Pedagogy and Didactics, Alfred Nobels allé 7, 141 89 Huddinge, Stockholm, Sweden.
Email address: natalia.karlsson@sh.se
Background in brief: Natalia Karlsson is an Associate Professor of Mathematics at Södertörn University, Sweden. Her qualifications include a Master's degree in Mathematics, a Master's degree in Education and a PhD in Mathematics and Physics. Her research areas are mathematics education and applied mathematics. Her areas of expertise in the field of mathematics education are mathematical content in teaching and students' learning of mathematics. Her research has a focus on developing theoretical and methodological approaches to teaching, crucial mathematical content, and the variation of and the relationships between the teaching and learning of mathematics.

Full name: Wiggo Kilborn
Institutional affiliation: Faculty of Education, University of Gothenburg
Institutional address: Läroverksgatan 15, 41120 Gothenburg, Sweden
Email address: wkutbildning@gmail.com
Background in brief: Wiggo Kilborn is a researcher whose PUMP project initiated a new methodology and a new technique for studying the teaching process. He has also contributed to the development of the didactics of mathematics in Sweden. He has applied his experience to developing courses for teacher training and in supporting the development of research and education several countries such as Portugal, South Africa, Mozambique, Zimbabwe, Tanzania, and Guinea-Bissau.

Chapter #27

IMMERSIVE VIRTUAL REALITY AND ARTIFICIAL INTELLIGENCE TO PREPARE STUDENTS FOR CLINICAL EXAMINATIONS: DEFINITIONS AND APPLICATION

Brendan Concannon[1] & Shaniff Esmail[2]
University of Alberta, Edmonton, AB, Canada
[1]Faculty of Rehabilitation Medicine
[2]Department of Occupational Therapy

ABSTRACT
This chapter explores the potential of virtual reality (VR) and artificial intelligence (AI) to reduce test anxiety in health science students. The chapter provides basic definitions of VR, AI, GPT and campus anxiety. The chapter describes an investigation which used a generative pre-trained transformer (GPT) to generate responses from virtual patients in a virtual clinic, allowing students to familiarize themselves with the clinical setting. The immersive VR simulation allowed students to practice for their clinical practical exams with history-taking and cognitive assessment modules. Results show that students exposed to VR had significantly lower anxiety scores compared to those who did not use it. Interviews and focus groups revealed themes related to student background, exam feedback, fear of the unknown, self-consciousness, and the exam environment. The study highlights the potential of AI-enhanced VR as an effective tool in increasing student familiarity with clinical exam environments and reducing test anxiety.

Keywords: virtual reality, artificial intelligence, student anxiety, examination preparation, learning tools.

1. INTRODUCTION

This chapter will briefly define immersive virtual reality (VR), artificial intelligence (AI) and demonstrate how these technologies can work together to supplement student learning in post-secondary health sciences. VR can enhance learning experiences by providing immersive and interactive environments (eg, simulated environments depicting a student's clinical setting during patient evaluation), allowing students to familiarize themselves with complex decision-making situations and user inputs. AI in VR simulation is capable of utilizing real time information to improve student adaptability while simulating complex scenarios (Loftus et al., 2020), as well as improve the expressiveness of AI-driven virtual patients during history-taking exercises (Maicher et al., 2023). AI-powered adjustments can be implemented to personalize virtual environments for students, based on their learning patterns and preferences, leading to more effective learning experiences (Loftus et al., 2020). AI-powered learning platforms can analyze student data, learning patterns, and engagement levels to optimize learning experiences.

1.1. Virtual Reality Defined

VR refers to a range of computer-based applications often utilizing visual and immersive 3D characteristics, allowing users to navigate and explore a simulated environment that appears to be real (Lioce, 2020). VR is also defined as a human-machine interface that allows users to project themselves into a computer-generated virtual environment, where specific objectives can be achieved (Zhang, 2014, p. 2427). The specific features of a virtual reality experience are typically determined by the technology employed, including head-mounted displays, stereoscopic capabilities, input devices, and the degree to which various sensory systems are stimulated. *Immersion*, *interactivity*, and *imagination* are the three key components of VR (Concannon, Esmail, & Roduta Roberts, 2019, 2020; Rebelo, Noriega, Duarte, & Soares , 2012). Immersion determines how a user perceives the virtual environment around them, ranging from nonimmersive (e.g., desktop computer display) to fully immersive (e.g., head-mounted display) (Rebelo et al., 2012). Interactivity is the accuracy between a user's action and applicable response within the virtual environment (Rebelo et al., 2012). Imagination is the degree a user feels they are existing within the virtual environment (Rebelo et al., 2012). *Presence* in virtual reality refers to a user's psychological sense of understanding, knowing where they can move and interact within the virtual environment. The degree of presence experienced by an individual is subjective and is influenced by the level of *involvement* (ie, level of attention they feel) while engaging with virtual objectives. These components represent a VR's level of *fidelity,* which is the degree a user's actions, senses and thought processes within a virtual world represent those of the real world. For this chapter, the focus will be on immersive VR, which is achieved by head-mounted display units.

1.2. Artificial Intelligence Defined

AI is based on computer science disciplines, which involves the design and development of machines and computer programs, capable of performing tasks that traditionally required human intelligence to complete. AI leverages algorithms and other mathematical models to simulate human decision-making and problem-solving processes, and is used in a wide range of industries to improve efficiency, accuracy, and productivity. AI typically falls under one of two types (Murphy, 2019; Sajja, 2021): those based on *capability* and those based on *functionality.* Functionality AI refers to a system designed to perform a specific task (eg, computer chess AI), including those with machine learning algorithms (Murphy, 2019). Capability AI refers to machine cognitive abilities including narrow, general or super AI (Sajja, 2021). These capabilities include natural language processing, deep learning and neural networks (Mikalef & Gupta, 2021). An example of a capability AI includes a generative pre-trained transformer (GPT), generative AI, which features a large language model used in natural language processing, utilizing deep learning algorithms to generate human-like text based on a given prompt or input (Radford, Narasimhan, Salimans, & Sutskever, 2018). GPTs use a neural network that has been pre-trained on a large amount of literature found on the internet. When a GPT generates text, the model uses this knowledge to select the most probable word to follow the previous words in the sequence, based on the probability distribution of words learned from the training data. This process is repeated for each subsequent word in the sequence, resulting in a coherent and natural-sounding sentence. For this chapter, the focus will be on GPT, which was used to generate virtual patient responses to student verbal inputs within a VR environment.

2. BACKGROUND

This experiment in this chapter is a replication study that builds upon a previous study by Concannon et al. (2020). The faculty professors noticed students were showing symptoms of test anxiety, while they were performing their clinical practical exams. The aim of the previous study was to help alleviate anxiety symptoms experienced by health science students as they prepared for their clinical practical exams. Concannon et al.'s (2020) investigation made use of head-mounted immersive virtual reality (VR) for one group of students to simulate the exam setting. This group showed significantly lower mean-state anxiety levels compared to the group that did not have access to VR. The VR simulation was designed to represent the history-taking interview aspect of the Objective Structured Clinical Examination (OSCE), allowing students to interact with a virtual standardized patient. The investigation did not gather student feedback on the specific benefits of VR. The following contents in this chapter sets the stage for the replication study, featuring the use of immersive VR and AI together to enhance the clinical practical exam experience.

2.1. Campus Anxiety

Anxiety is a natural and innate reaction, readying the body for upcoming situations that are perceived to be risky or harmful (Perrotta, 2019). This implies a theoretical concept that has the potential to occur in either general or specific contexts, with *predisposition* (i.e., trait anxiety) representing how often or strongly the response generally occurs and *transitory* (ie, state anxiety) representing a reactionary response, prompted by a present circumstance (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs , 2015). Anxiety experienced in post-secondary education may cause numerous long-term implications, including higher risk of student drop out, decreased academic performance, reduced employment opportunities, and financial losses in billions of government dollars per year (Pascoe, Hetrick, & Parker, 2020). The Intolerance of Uncertainty model (IUM) theorizes that people may inherently have an intolerance of the unknown, resulting in ambiguous situations being perceived as threatening, resulting in increased worry and anxiety (Dugas, Gagnon, Ladouceur, & Freeston, 1998). It is common for students to feel symptoms of test anxiety, when preparing for practical exams with uncertain elements.

2.2. Reducing Anxiety

One method of conditioning individuals to cope with anxiety-inducing scenarios is through *in vivo* exposure, where individuals are gradually exposed to real-world situations until their stress levels are reduced (Freitas et al., 2021). VR can also be used to create computer-generated environments that replicate real-world situations to help alleviate anxiety, which is known as VR exposure therapy (VRET). VRET is also referred to as *in virtuo* exposure. For more details about the immersive and interactive aspects of VR, refer to the studies conducted by Concannon and colleagues in 2019 and 2020 (Concannon et al., 2019) (Concannon et al., 2020). For cognitive adaptation (e.g., improvement of memory, information processing, problem solving and logical sequencing), VR training of procedural tasks has shown improvements in the brain's frontal lobe, which is responsible for cognitive functions such as the ability to recall prospective memory tasks and achieve precise objectives based on time and events (Yip & Man, 2013). VR may improve procedural memory by altering neural plasticity to improve working memory (Grealy, Johnson, & Rushton, 1999). VR training of daily living activities may improve attention and cognitive function (De Luca et al., 2019). When researching how students respond to VR simulation,

a mixed-method approach recommends combining quantitative evaluations with student feedback to better understand their motivations (Bennett, Rodger, Fitzgerald, & Gibson, 2017).

3. OBJECTIVE

To assess the efficacy of a VR simulation of a clinical setting in reducing student anxiety for a clinical exam and gather student perspectives on the VR simulation and coursework to better understand their learning environment.

4. DESIGN

This investigation rebuilt the VR simulation based on the system mentioned in Concannon and colleagues' (2020) study (Concannon et al., 2020), utilizing the same interdisciplinary team members' expertise in computing science, physical therapy, communication and science disorders, rehabilitation medicine and OT. Student and researcher feedback from the aforementioned study was implemented to further improve the system used in this investigation. The VR simulation in this investigation included the following components:

1. Meta Quest 2 headsets that ran the VR software, uploaded using SideQuest. These headsets were portable and free of cables. The headset could detect a user's hand gestures, without the use of controllers. The headset was also equipped with a microphone to detect user speech for communicating with the virtual patients.
2. A virtual environment depicting a health sciences clinic, rendered with Unity game engine software (Unity Technologies). The environment allowed the student to select from one of two modules: History Taking or the St. Louis University Mental Status Exam (SLUMS) cognitive assessment (*SLU Mental Status Exam*). Once the student entered the virtual exam room, a buzzer sounded the start of the virtual OSCE and a miniature timer on a desk began counting down from either 8 minutes for the History Taking module or 15 minutes for the SLUMS module. Students could grasp and turn pages on a virtual clipboard to read notes. The History Taking clipboard contained preliminary notes about the virtual patient, similar to what the student would receive before interacting with their real-world OSCE standardized patient, while the SLUMS clipboard contained a scoring rubric and question sheet. Refer to Figure 1 for a screenshot of the History Taking module.
3. Three virtual avatars. The first appeared in the history taking module as a virtual standardized patient who would respond to a user's questions; the second appeared in the cognitive assessment module as a virtual standardized patient, who would respond to a user questions from the SLUMS cognitive assessment; the third being a virtual exam evaluator (present in both modules) who observed the user and would write notes into their clipboard during each module.
4. Speech recognition and response software using Azure Cognitive Services. The student could ask the virtual patient questions in natural language, with the user's voice being detected by the headset's microphone to convert the question from speech to text. The process pipeline includes user speech-to-text, open AI for language processing and generation of virtual avatar's text response, avatar's text converted from text-to-speech. The virtual standardized patients' text responses

were generated using a generative pre-trained transformer (GPT-2), which was fine-tuned (ie, trained) on recorded interactions from real-world student and patient actor interactions during real-world lab exercises. This avatar training was performed using a transfer learning technique using real-world student and standardized patient text files that were collected from transcribed recordings. GPT-2 uses word vectors and input, producing estimates for the probability of the next word as outputs. It is auto-regressive in nature: each token in the sentence has the context of the previous words. Virtual avatar actions (behaviors) were generated in text form by GPT-2 then linked to appropriate animations (movements), allowing them to respond to user requests (eg, drawing pictures when asked to do so during the SLUMS module).

Figure 1.
Screenshot of History Taking module.

5. METHODS

5.1. Experimental Design, Recruitment and Ethics

This investigation was a mixed, cross-sectional, nonrandomized controlled trial, involving two groups of participants, each comprised of first year occupational therapy (OT) students from the same class. All 125 OT students were invited and eligible to participate. This investigation was approved by the Research Ethics Office of Research and Innovation, University of Alberta, Canada. After inspection, this investigation was deemed ineligible to record participant sex variables, due to required de-identification of students to ensure their privacy.

5.2. Experimental Process

VR was open-access to all students and self serve. This investigation utilized class email announcements to offer scheduled VR session appointments. Those who accepted the offer were designated as YesVR participants, with scheduled VR sessions taking place three-days before the OSCE. After the VR sessions were complete, a class email announcement was sent out to invite all students to complete online surveys, measuring student state anxiety and trait test anxiety levels. Students who reported to have not used the VR simulation, yet chose to complete the surveys, were designated as the NoVR group. Semi-structured focus groups and interviews were scheduled after the students completed their OSCE, within a one-week timeframe.

5.3. The Anxiety Surveys

The State-Trait Anxiety Inventory (STAI) is divided into two forms: Y-1 (S-Anxiety) scale, which this investigation used to measure each participant's level of anxiety at a specific moment in time. The STAI also contains the Y-2 (T-Anxiety) scale, which is used to measure trait anxiety, yet this form was substituted for the Test Anxiety Inventory (TAI) as this instrument measures trait test anxiety levels in academic contexts. Each form is comprised of 20 items, with final scores ranging from 20 to 80, with higher scores representing greater levels of their respective anxiety types (Spielberger et al., 2015).

5.4. Interviews and Focus Groups

Questions focused on how student overall experiences, expectations, difficulties, stressors and VR influenced their performance in the OT program. Interviews took up to 45-minutes in duration while focus groups lasted 60-minutes. Interview and focus group data were summarized using an interpretative thematic analysis, based on an approach developed by Burnard (1991) (Burnard, 1991), interview process guide by Kvale (2007) and general approach by Maykut and Morehouse (1994).

5.5. Statistical Analysis

Statistical significance was evaluated at α=.05, and a two-sided P value of .05 or less was considered to be statistically significant. Comparisons between the NoVR and YesVR groups were performed using independent *t* tests, which compared STAI and TAI scores between the groups.

6. RESULTS

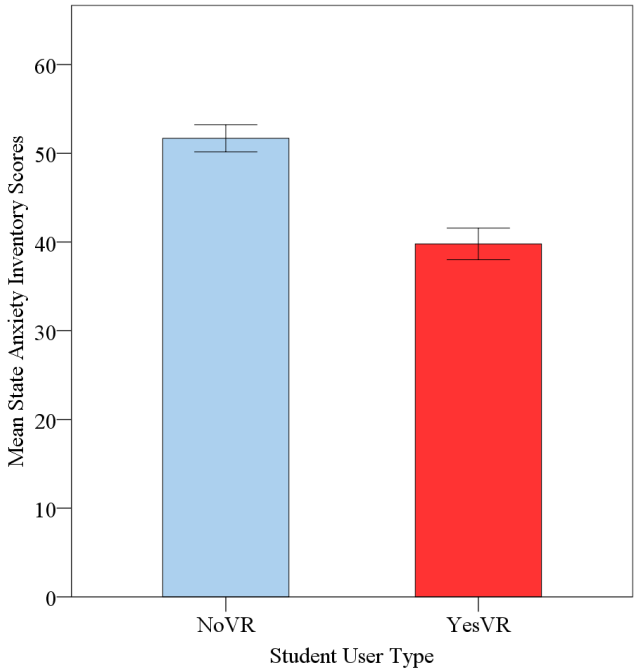
A total of 108 students participated in the quantitative aspects of the study (mean aged 24.53 years, *SD* 2.64): 61 for the NoVR group (mean aged 24.52 years, *SD* 2.42) and 47 for the YesVR group (mean aged 24.54 years, *SD* 2.93). A total of 25 students participated in the interviews and focus groups – 16 from interviews and 9 from focus groups. The majority of YesVR participants utilized the VR simulation for both modules, which typically meant 8-minutes of the History Taking module and an additional 15-minutes with the SLUMS module, in addition to some participants retrying one or both of the modules. The mean VR simulation time spent by the YesVR group resulted in a mean VR simulation time of 24.11 minutes (*SD* 8.00) per participant.

6.1. The Anxiety Scores

Figure 2 shows student state anxiety scores between the NoVR and YesVR groups. There was a significant difference in state anxiety scores between groups, with NoVR showing greater anxiety scores (mean 51.69, *SD* 11.87) than YesVR (mean 39.79, *SD* 12.21)

(t_{106}=5.10, *P*=<.001, Cohen *d* = 0.99). The mean difference was 11.90 units (95% CI 7.28-16.53). There was no significant difference in test anxiety scores between groups, with NoVR showing similar anxiety scores (mean 46.66, *SD* 11.15) to YesVR scores (mean 43.28, *SD* 11.58) (t_{106}=1.53, *P*=.128, Cohen *d* = .29). The mean difference was 3.38 units (95% CI -.985-7.74).

Figure 2.
Student state anxiety between groups; error bars represent standard error. NoVR: subjects not exposed to the virtual reality simulation; YesVR: subjects exposed to the virtual reality simulation.



6.2. Interview and Focus Group Themes

VR was cited as being useful in helping with student orientation of the exam procedure, while allowing students to fail and work through difficulties in a low-stakes environment. The major themes emerging from focus groups and interviews were overall student background, exam feedback, fear of the unknown, self-consciousness, and the exam environment. Refer to Table 1 for the major themes derived from the interviews and focus groups.

Table 1.
Major themes derived from student interviews and focus groups.

Theme	Sample student quotes	Interpretation
Exposure and Background	"The OSCE[a] is quite stressful is because many of us have not done a practical exam like this."	Students claimed those with related clinical exposure may have lesser exam stress.

Exam Feedback	"…to get feedback was not always easy because there is only one instructor to how many students?". "VR[b] made us be more aware to ask simpler questions in the OSCE[a], because it would glitch if talked too much."	The majority of students recommended additional performance feedback be provided, especially for the VR[b] simulation.
Fear of Unknown	"I dreaded the [patient scenario] because you didn't know what you were going to get and the exam was new to me."	Students claimed they felt anxious of the OSCE[a], because they did not know what to expect.
Self-consciousness	"No one wanted to be known as the person who failed the OSCE[a]."	Students claimed they worried about being deemed incompetent by their peers.
Exam Environment	"I found [VR[b]] helpful. [It was] my first VR[b] experience. I got to see what the layout of the room would be like."	Students recommended the VR[b] have exam rooms mimic the actual test environment.

[a]OSCE: Objective Structured Clinical Exam.
[b]VR: Virtual reality.

7. FUTURE RESEARCH DIRECTIONS

New components can enhance the VR simulators for reducing anxiety in health science students. Based on the student feedback provided in this investigation, having the VR simulation provide objective results, based on student performance, would satisfy the most requested feature as recommended by students. To ensure that the system provides only the necessary information for the students to enhance their learning ability, discussion between the designers, professors, and exam evaluators would be necessary for designing the system to provide the relevant feedback. The purpose of the simulation is not for students to exploit it (ie, game the exam), but to serve as a tool that aids in understanding objective parameters of their simulated practice, such as time spent with virtual patients on certain topics, total time taken, and the number of questions asked. Upgrading the GPT to its latest version and training it on real time interactions could improve virtual patient response continuity for specific scenarios in the History Taking module. GPT is also capable of giving the virtual patients personality, increasing a student's sense of imagination. Improvements in realism, including the availability of avatars from different cultures and backgrounds, can enhance the student's perspective of real-world clients. Allowing users to adjust the testing environment could improve the representation of the real OSCE environment, adhering to student preferences.

8. DISCUSSION

This research integrated immersive VR and AI systems to simulate clinical practical exams for health science students. The VR simulation in this research was designed to familiarize the students with the exam format, primarily for environmental settings and patient verbal interactions experienced during a student's actual OSCE. By practicing in a controlled VR environment, the students may have gained a sense of procedural confidence, showing a reduction in state anxiety. However, it remains to be seen whether this reduction in state anxiety persisted throughout the actual OSCE. This study did not capture student

performance metrics, thus it is unknown if the VR simulation enhanced student performance for their actual OSCE.

The relationship between VR simulation, AI and the OSCE is based on enhancing the training of health science students. VR may replicate the conditions of an OSCE, with the VR in this research intended to familiarize the students with the exam format, setting and verbal interactions experienced during the actual OSCE. The interviews in this research identified a familiarity theme, with students admitting that VR was helpful in giving an idea as to what the exam room layout and procedures may entail. Intolerance for uncertainty may cause students to interpret ambiguous exam situations as precarious events, manifesting symptoms of worry, self-doubt and anxiety. However, VR simulation of the OSCE may have provided a sufficient familiarity with the exam environment, thereby positively shaping students' expectations and reducing their state anxiety levels. AI was integrated with the VR simulation to provide dynamic verbal interaction between the students and their virtual patients. AI was demonstrated to drive the behavior of virtual patients, making them respond in a communicative manner reminiscent of a real-world verbal exchange. The interviews in this research identified a theme from the students- their desire for the VR simulation to provide feedback based on their performance. AI has the potential to monitor student questioning in real time, possibly allowing students to review if crucial verbal exchanges took place or not.

To effectively evaluate student performance between VR simulation and the OSCE, it is crucial to develop metrics that apply to both settings. These could include metrics such as communication skills, decision-making abilities, procedural accuracy, and time efficiency. A standardized scenario framework is necessary to ensure that performances in VR and the OSCE are directly comparable. Objective assessment criteria must be consistently applied between both platforms to accurately reflect student proficiency. By ensuring that the VR and OSCE experiences are comparable, evaluators would be able to thoroughly assess how simulation-based performance translates to the OSCE context. Such comparative analysis is crucial for refining educational approaches while identifying specific areas where students may require additional training.

While VR and AI simulation may provide a valuable tool for conditioning students for clinical practical exams, VR differs from the real-world in several ways:

1. Physical Interaction: In a real OSCE, students interact with human patients in a complex manner (eg, physical checkup). Although it is feasible for VR to allow students to physically interact with objects and virtual patients, tactile feedback and nuances of human touch during such physical interactions are difficult to replicate in a VR environment.
2. Sensory Experience: In a real OSCE, the subtleties of smell, touch and sounds in a clinical setting may be difficult to replicate for a virtual setting. Even with enhanced auditory and peripheral senses, VR cannot fully emulate the richness of such real-world stimuli.
3. Emotional Dynamics: In a real OSCE, human patients may display a range of emotional and psychological states (eg, anger, frustration, depression) that can affect the examination process. While an AI simulator can show different emotions and personalities, it is unlikely to capture the full complexity of human emotional expression and how it impacts the patient-practioner interaction.
4. Unpredictability: In a real-world setting, patients may present atypical symptoms or responses (eg, people living with dementia), thus there may be limitations in VR and AI's ability to replicate such unpredictable scenarios.

5. Technical Limitations: VR and AI simulations are seldom an error-free experience. Glitches, system limitations and periodic updates may affect the flow and realism of the simulation. AI may provide immediate and objective feedback in real time, but it is expected to lack the subjective evaluation of a human examiner, which is often invaluable for student learning and professional growth.

However, a VR and AI simulation of a clinical practical exam may not need to be overly complex. The goal of such VR systems is to have students gain familiarity and feedback for an upcoming exam. The students in this research were in their first year of studies— they only needed a basic starting point. If students receive objective feedback on areas for improvement, during basic communication exchanges, they can focus on those areas to better prepare for the real OSCE. Both VR and AI may also check if certain decision-making processes occurred (eg, students scored the SLUMS psychometric correctly) and time spent on each task. AI can provide objective results and feedback on these parameters, which may be invaluable for students to understand their strengths and areas for improvement before they take the actual OSCE. AI enhances the VR simulation by providing a more realistic and interactive experience, which may lead to improved confidence and familiarity for the OSCE. AI has the potential to simulate a wide range of patient scenarios, while tailoring the simulation to the students' learning needs. VR and AI systems may bridge the gap between practice and real-world exams.

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AUTHORS' INFORMATION

Full name: Brendan Concannon
Institutional affiliation: University of Alberta
Institutional address: 2-64A Corbett (E.A.) Hall, 8205 - 114 St NW, Edmonton, AB, Canada, T6G 2G4
Short biographical sketch: Researcher at the University of Alberta, focusing on improving student learning in health sciences through virtual reality (VR) and artificial intelligence (AI). Researched VR simulations with realistic AI interactions, using tools like generative pre-trained transformers (GPT). Goal is to leverage AI and human-machine interfaces for better healthcare, education and independent living.

Full name: Shaniff Esmail
Institutional affiliation: University of Alberta
Institutional address: 2-64C Corbett (E.A.) Hall, 8205 - 114 St NW, Edmonton, AB, Canada, T6G 2G4
Short biographical sketch: Esteemed member of the University of Alberta's Department of Occupational Therapy. Served as Associate Professor, Full Professor and Interim Chair. Has expertise in occupational therapy and human sexuality, particularly in physical, psychosexual, and biomechanical aspects. Professional journey includes significant contributions to distance education, interdisciplinary program development, and research in vocational fields, reflecting commitment to academic excellence and innovative educational approaches.

Chapter #28

THE MELARETE PROJECT TO FOSTER CHILDREN'S ETHICAL DEVELOPMENT: FROM THEORY TO PRACTICE

Luigina Mortari & Federica Valbusa
Department of Human Sciences, University of Verona, Italy

ABSTRACT
The chapter presents the MelArete project, which includes the following components: (a) a theory of ethical education, conceived as education to care and virtues; (b) an educational programme aimed at encouraging primary school children to reflect on ethical concepts and experiences; and (c) a qualitative research to rigorously evaluate the effectiveness of the designed educational activities in fostering the development of children's ethical thinking. In particular, the chapter outlines the theory of ethical education in which the educational programme is grounded, also by comparing it with the main traditions in this field. Then, it presents in detail the educational activities designed for primary school and, in the conclusion, discusses them with reference to research findings.

Keywords: MelArete, ethics education, primary school, care, virtue.

1. INTRODUCTION

Ethical education is at the same time both essential and urgent, since ethics nourishes one's commitment to search for what is necessary to make one's own life and that of others and whole communities something that is good. Nowadays, scarce consideration of others' needs, rights and problems; individualism and egocentricity, which increase indifference towards the common good; disregard for environmental degradation; and widespread political disengagement among young people are elements of an ethical crisis that has at its core a lack of space and time to cultivate the disposition of thinking. Since, as Arendt (2003) highlighted, engaging in thinking is crucial for the development of an ethical consciousness, ethical education should encourage people to think about ethical issues and actions. In order to pursue this educational goal, the Center of Educational and Didactic Research (CRED) at the University of Verona (Italy) developed the MelArete project, which includes the following components: (a) a theory of ethical education, conceived as education to care and virtues; (b) an educational programme aimed at encouraging primary school children to reflect on ethical concepts and experiences; and (c) a qualitative research to rigorously evaluate the effectiveness of the designed educational activities in fostering the development of children's ethical thinking.

2. ETHICAL EDUCATION IN THE LITERATURE

The main traditions in ethical education are traditional character education; the cognitive-developmental approach, or moral development; and the caring approach. Applying Lickona (1989)'s definition of character as consisting of three interrelated components, Howard, Berkowitz, and Schaeffer (2004) individuated the main focus of traditional character education as doing good, that of the cognitive-developmental approach

as knowing good and that of the caring approach as desiring good. To highlight the specificities of these approaches, it is necessary to briefly outline the history of their development (McClellan, 1999; Howard et al., 2004; Althof & Berkowitz, 2006; Graham, Haidt, & Rimm-Kaufman, 2008). Traditional character education developed in the United States at the end of the nineteenth century and was characterised by the indoctrinative purpose to instil traditional values and inculcate desirable habits in young people, starting from the belief that ethical education can rely on a list of virtues assumed to be universal. This tradition was criticised by the cognitive-developmental approach, which developed from the Kohlbergian studies on the stages of moral development (Kohlberg, 1975; Kohlberg & Hersh, 1977) and, contrasting the conception of ethical education as the inculcation of a predetermined set (or 'bag') of virtues, was interested in fostering students' moral reasoning through discussions of moral dilemmas. Kohlberg's theoretical proposal was criticised by feminist theorists, and the dominance of the cognitive-developmental approach decreased in the late 1980s and 1990s. In particular, Gilligan (1982) revealed the gender bias within Kohlbergian research, highlighting that the original sample had been completely constituted by male participants, and on the basis of new empirical data, suggested that two ethical perspectives exist, the 'voice of justice' and the 'voice of care'. The caring approach to ethics education highlights the importance of cultivating caring and empathic relationships and emphasises the role of moral sentiments (Noddings, 2002; Slote, 2010). Nowadays, it is common in the literature to find the expression 'character education', referring not to a specific approach but to the entire field of ethical education and including a wide range of pedagogical strategies and educational practices (Althof & Berkowitz, 2006; Berkowitz & Bier, 2005). Character education sometimes even seems to refer to education as a whole, for example, when it is considered able to promote students' social, moral and emotional development as well as academic achievement (Berkowitz & Bier, 2004).

Comparing the approach to ethics education proposed by MelArete with the other three specific approaches mentioned above would require an in-depth discussion, but put briefly, it can be said that like traditional character education, MelArete emphasises the importance of virtue education, but without it resulting in inculcation or indoctrination. In fact, MelArete shares with the cognitive-developmental approach the idea that ethical education should not result in the direct teaching of a priori established values but rather encourage students to engage in moral reasoning and discussion. Like the caring approach, MelArete emphasises the concept of care as paradigmatic in ethical discourse, highlights the importance of constructing caring learning context and recognises the role of moral sentiments in ethical decisions. However, it conceives feeling as always being interrelated to thinking, as taught by the cognitive conception of emotions (Oatley, 1992; Nussbaum, 2001).

3. A THEORY OF ETHICAL EDUCATION AS EDUCATION TO CARE AND TO VIRTUES

'MelArete' combines the ancient Greek terms *meléte*, meaning 'care', and *areté*, meaning 'virtue', which are the main conceptual cornerstones of the theory in which the educational programme is rooted. This theory argues the thesis according to which (a) ethics must be congruent with the essence of life; (b) the essence of life is care, and consequently, the ethics of care has ontological primacy; (c) the vital nucleus of care is ethical in its essence because the practice of care is carried out through ways of being that can be defined as virtues; and (d) ethical education should be conceived as education to

care and, since the ethical core of care consists of virtues, it can take the form of education to virtues.

The human condition is essentially characterised by ontological weakness and fragility. Human beings are called to find their most proper form without having any sovereignty on their own becoming. We are seeds of possibilities called to look for what it is that allows us to flourish. This task can be defined as ontogenetic, as it consists of giving shape to our being. In searching for a form that better realises our existential possibilities, we discover we are not sufficient unto ourselves, since we intimately need the other. The answer to one's own neediness and to the neediness of the other is care. The ontologically evident datum that everybody needs care makes it a necessity for everyone to care for others. That care is fundamental in life is the assumption that we first encountered in Plato's dialogues, where Socrates highlights the importance of caring for the soul and urges his interlocutors to do so, and which, after having been neglected for much time by Western culture, was revived in the last century by several scholars (Heidegger, 1927/2010; Noddings, 1984; Mayeroff, 1990; Tronto, 1993; Kittay, 1999; Held, 2006; Mortari, 2022).

To care for oneself and for others is not only a possible ideal of being but the prime and original necessity of the condition of being (Heidegger, 1927/2010). If educational action must be considered with regard to what has a primary value in life, and if care is of primary importance, then education can only be education to care through care. According to theoretical and empirical research (Mortari, 2022; Mortari & Saiani, 2014), the essential core of care is made by ways of being that can be defined as virtues. Indeed, as the basis for the practice of care, it is generally possible to find virtuous dispositions, such as sense of responsibility, generosity, respect, courage and rightness. Therefore, assuming that the educational action consistent with the ontological quality of the human condition is an action of care aimed at urging people to care for themselves and for others, and assuming that the ethical core of care consists of virtues, how is it possible to educate people to be virtuous? This is the central question that forms the basis of our proposal for ethical education.

In *Protagoras* (320b) and *Meno* (96c-d), Socrates doubts that virtues can be taught and, formulated in this way, this thesis can be supported because educating is not the same as teaching or instruction. Indeed, education should not be conceived as the didactic transmission of predefined content and concepts; consistently, Socrates points out that he never promised to teach anything and has not done so (*Apology*, 33b). Indeed, his *paideia* is an educational, not an instructional, practice, and it is aimed at cultivating the ability of thinking among his interlocutors. In this educational perspective, Socrates suggests a way to educate people to virtues, saying: 'It is the greatest good for a man to discuss virtue every day' (*Apology* 38a). This is what he does with his interlocutors, guiding them into reasoning about virtues to understand their essence. The Aristotelian proposal is different. According to Aristotle, ethics has a practical purpose, namely, to act well (*Nicomachean Ethics*, I, 1102 b; VI, 1144 b), and virtues are learned by putting them in action. Accordingly, he states: 'We become just by doing just actions, temperate by doing temperate actions, brave by doing brave actions' (Aristotle, *Nicomachean Ethics*, II 1103b).

The recovery of these educational suggestions from ancient Greek philosophy is the basis for the educational proposal of MelArete, which combines both the Socratic and Aristotelian perspectives in designing instruments that encourage children into reasoning about the essence of ethical concepts and reflecting on their ethical actions. The first educational aim follows the Socratic suggestion, whereas the second one embraces the Aristotelian suggestion without directly prescribing children to act in a specific way, since doing so would mean to interpret ethical education as a way of shaping children's

behaviour from outside, and that is not the purpose of an authentic caring educational practice. Instead, in the MelArete programme, the Aristotelian suggestion to focus on virtuous actions is translated into activities that require children to reflect on their own and others' ways to act virtuously.

4. EDUCATIVE RESEARCH FOR CHILDREN

MelArete can be defined as an educative, not merely educational, research, since it does not only conduct research on the phenomenon of education but it also carries out, more specifically, research that involves the participants in experiences aimed at fostering their ethical flourishing. Indeed, MelArete pursues both an educational programme for children and a qualitative research aimed at evaluating the effectiveness of its implementation. Educative research is ethically grounded if it (a) seeks the benefit of the participants and (b) characterises the researcher's way of being with ethical postures. Consistently, MelArete is a research 'for' children, not merely 'on' them, because it aims to offer them positive and significant experiences. To embody an ethical profile, the researcher should not only follow ethical codes, which are necessary but not sufficient, but s/he should also develop ethical relational postures, beginning with the capability of authentically listen to participants as well as with the ability to give time to them, also remembering that if they feel they are in a good relationship, participants will generally take part in the research in a more active way.

5. THE EDUCATIONAL PROGRAMME IN PRIMARY SCHOOL

The MelArete programme for primary school is structured in 12 meetings focusing on the ethical concepts of good, care and virtues and on the specific virtues of courage, generosity, respect and justice. The activities are designed along with a narrative framework that serves as an integrative backdrop, namely a 'Wood of virtues' inhabited by animals with names taken from Platonic dialogues or Greek literature.

Since 'educative research' is designed to have both an educational and a heuristic purpose, every activity in the programme is aimed both at fostering the development of children's ethical thinking and collecting data for research that are needed to rigorously evaluate the effectiveness of the educational experience. Activities are implemented in class by the researcher in the presence of teachers, and before the beginning of the programme, signed informed consent is provided by parents regarding the purposes and methods of the research. In particular, parents are invited to agree that all the meetings will be audio recorded and that all the data will be transcribed verbatim in anonymous form.

Meeting 1: the initial activity

The 'Story of Puc and Pec' is told; in it, the little jaguar Puc is sad because he will have to stay for a few days far from home, and Pec gives him some caring thoughts that will help relieve Puc's homesickness. After the story is told, a Socratic conversation, in the form of a dialogue about the essential meaning of a concept without predefined answers, is carried out in the class, starting with the researcher asking the children what comes to their minds when they hear the words 'good' and 'care'.

Meeting 2: first explorative activity

The children take part in a game named 'The basket of virtues', during which cards are handed out with names of different 'things' (jobs, games and virtues). The students are

asked to group the cards into three baskets and to give a name to each basket. The words 'courage', 'generosity', 'respect' and 'justice' are then extracted from the 'basket of virtues', and every child is required to define them in writing.

Meeting 3: second explorative activity

The researcher reads to the children 'The story of Alcibiades', in which the donkey Alcibiades brings water to a thirsty cow, Chloe, who, in thanks, gives Alcibiades a bucket of milk. The donkey then shares the gift from Chloe with the other animals in the wood. During the dialogue between the animals, the following two questions arise, which the children are invited to answer individually in written form: what are virtues, and how can virtues be learned?

Meetings 4 and 5: activities about courage

In the fourth meeting, a story is told to encourage the children to reflect on a courageous gesture. Two story options are proposed to enable the teachers to choose which is more suitable for the educational needs of their classroom. In the first story, entitled 'The grass lawn', Alcibiades, looking for a green pasture where he can find fresh grass for breakfast, is bothered by a group of wild boars, who will not let him pass. Although he is small, the squirrel Theaetetus finds the courage to defend his donkey friend. In the second story, entitled 'Xanthippe and the edelweiss', the marmot Xanthippe sees that the ibex Laches is trampling some beautiful and precious edelweiss flowers with his hooves. Xanthippe finds the courage to turn to Laches and point out to him what he is doing.

After the reading of the story that has been chosen, the children answer the following questions. What is the virtuous gesture of Theaetetus/Xanthippe? According to you, which thought was in his/her mind that has guided him/her? Which effects has produced his/her gesture? After having acted, what has he/she felt inside him/her? The children initially answer the questions individually in writing, and then share their answers with the class, dialoguing together.

In the fifth meeting, the ludic activity 'The pathway in the wood of courage' is used to deepen the children's understanding of courage. During the game, the children roll a die twice; the first time, they move a token along a pathway representing places of the wood, and the second time, they move the token along a pathway representing animals. Each child then writes a story set in the place and with the animals assigned through the two die rolls.

As an alternative to the game, an activity consisting of vignettes can be chosen that represents a stimulus to reason on an ethical problematic situation. Three different actions are presented to students as pictures, each representing a different way in which one can react to a scene in which a child argues with another and gives her a push. The activity is divided into the following four tasks given to the children: individually writing a description of the three situations; individually choosing which situation demonstrates courage and writing down why; discussing their ideas together; and individually drawing a situation involving courage.

Meetings 6 and 7: activities about generosity

In the sixth meeting, a story is used to encourage the children to reflect on a generous gesture. Again, two story options are proposed. In the first story, entitled 'The hibernation of Xanthippe', Laches offers half of his supplies to Xanthippe, who has not accumulated enough for hibernation. In the second story, entitled 'The fall of the owl Socrates', Theaetetus gives up a picnic to devote time to the owl Socrates, who has been injured in a flying accident.

After the chosen story has been read, the children answer the following questions. What is the virtuous gesture of Laches/Theaetetus? According to you, which thought was in his mind that has guided him? Which effects has produced his gesture? After having acted, what has he felt inside him? The children initially answer the questions individually in writing, and then share their answers with the class, dialoguing together.

In the seventh meeting, a game or vignettes can be chosen. The game is organised as follows: a poster containing a crossword puzzle, which is to be completed by the children, is brought into the classroom. Once completed, the word 'generosity' appears highlighted. The researcher then explains that this virtue can be realised by 'giving something to someone else', 'giving time to someone else' or 'doing something for someone else'. The children are then asked to write individual stories about generosity, choosing one of the three meanings presented.

In the vignettes, three different options representing different ways of responding to a classmate's need for a pen are presented to the children as pictures. The children are then invited to do the following: individually describe in writing the three situations; individually choose which situation demonstrates generosity and explain in writing why; discuss their ideas together; and individually draw a situation involving generosity.

Meetings 8 and 9: activities about respect

In the eighth meeting, one of two stories about respect is used to encourage children to reflect on a respectful gesture. In the first story, entitled 'The plucked duck', the otter Eurydice welcomes into the woods the duck Andromache, who has been rejected by the other animals because they consider her ugly and dirty. In the second story, entitled 'The dance of Alcibiades', Alcibiades pays attention to the flowers planted by Xanthippe, taking care not to step on them.

After the chosen story has been read, the children answer the following questions. What is the virtuous gesture of Eurydice/Alcibiades? According to you, which thought was in her/his mind that has guided her/him? Which effects has produced her/his gesture? After having acted, what has s/he felt inside her/him? The children initially answer the questions individually in writing, and then share their answers with the class, dialoguing together.

As for the other virtues, the activities about respect continue in the ninth meeting with a game or vignettes. The game is entitled 'Puzzles and the scale of respect' and is structured as follows. The children are presented with ten different scenes showing acts of respect (e.g. raising a hand to ask to speak in class, shaking hands with an opponent at the end of a game) and disrespect (e.g. pulling a cat's tail, throwing litter onto the ground), cut out into puzzle-like pieces. After the children have reassembled the puzzles (individually, in pairs or in groups), they are asked to describe verbally the actions represented in them. Then, during a classroom conversation, they assign an ethical order to the different scenes, placing them on a scale ranging from -5 (maximum degree of disrespect) to +5 (maximum degree of respect).

The vignettes about respect represent three different ways of welcoming into the classroom a new child who arrives in a 'strange' outfit. As for the other virtues, the activity continues with individual descriptions of the three scenes, individual choice of the one showing respect and argumentation, a class discussion and an individual drawing of a respectful situation.

Meetings 10 and 11: activities about justice

In the tenth meeting, a story is used to encourage children to reflect on a just gesture. Again, two options are provided. In the first story, entitled 'Supplies for the winter',

Alcibiades and Socrates propose two different ways of distributing hay to Chloe, Laches and Xanthippe. In the second story, entitled 'The raspberry binge', the blackbird Timaeus finds the best way to repair the harm that he and other friends have unintentionally committed, which was to have eaten all the raspberries picked by Xanthippe.

Again, the children are invited to answer questions concerning the quality of the virtuous gesture (for the first story, this question is formulated as: 'According to you, who is right between Alcibiades and Socrates?'), the thought underlying it, the effects produced by it, and the emotions felt by its author. The children initially answer the questions individually in writing, and then share their answers with the class, dialoguing together.

Since one of the justice concepts the children can be invited to reflect on is that of rights, in the eleventh meeting, they contribute to the creation of a 'Memory of rights'. They are presented with eight drawings on which people of different ages are represented. Each drawing constitutes the first piece of the memory game. The children are then asked to make the second piece, on which they draw or write the rights of the person represented in the first. The activity can be carried out individually or in groups.

As an alternative, vignettes on justice can be proposed. In the activity, three different ways of distributing gifts to three children in different situations are presented to the students as pictures. The students are invited to describe the three options, choose which is the just one and explain the reasons for their choice, discuss this in class and draw a scene representing justice.

Meeting 12: final activities

A story narrating the end-of-school celebration of the animals in the 'Wood of virtues' is presented to the students. Starting from the story, each child is again invited to define in writing the virtues of courage, generosity, respect and justice, and to answer the following questions. What are virtues? How can virtues be learned?

By comparing the data collected at the beginning and at the end of the programme, the researchers will gain an understanding of if and how the children's thoughts have developed over the course of the educational experience.

The 'diary of virtues': a reflective writing activity

Over the course of the educational experience, after the third meeting and until the end of the programme, the children are invited, at least once a week, to write down in a reflective journal the courageous, generous, respectful and just actions they have carried out or seen carried out by others. The time and space devoted to the activity are decided by the teachers, since this activity is managed by them under the guidance of the researchers.

6. CONCLUSIONS FROM RESEARCH FINDINGS

In literature, it is frequent to find references to programmes of ethical education, but not always are the underlying theoretical sources well explained and the practices described in detail. Clarifying the purposes of a programme in terms of children's development, as is generally done, is important but not enough. Indeed, it is also essential to make clear the horizon of thinking that gives form to the educational goals as well as to describe how each goal is translated into an educational activity. Consistently, in this chapter we decided to present MelArete by focusing on two elements, those being its theory and practice. However, there is another element that we do not have the space to deepen in this context, but which is equally important, namely the research carried out on the realised educational activities. Since it is the research alone that allows the researchers to rigorously identify the

effectiveness of a programme, we would like to conclude this chapter by discussing the activities of MelArete on the basis of some of the findings that emerged from a qualitative analysis of the data collected during the first implementation of the programme in some Italian primary schools. In particular, the programme involved 106 8-10 years old children, attending 6 fourth grade classes of 4 primary schools located in the North and Centre of Italy. The collected data – i.e., audio-recorded conversations with and among children, children's written answers about the presented stories and vignettes, children's entries in their diaries of virtues – were faithfully transcribed, and the data concerning each single activity were then analysed through a methodological crossbreeding (Mortari & Silva, 2018) between the phenomenological method (Mortari, 2008; Giorgi, 1985; Moustakas, 1994) and the grounded-theory (Glaser & Strauss, 1967; Charmaz, 2006). Consistently with phenomenology (Husserl, 2012), the analysis was carried out by engaging in the practice of *epochè*, which recommends to bracket any pre-given theory, belief and assumption which could affect the heuristic process. Consistently with the grounded-theory, the analysis implied the heuristic actions of labelling and categorizing. The purpose of the research was to evaluate the effectiveness of the realized educational activities in fostering children's ethical thinking, and to understand the children's idea about the ethical concepts of good, care, virtue, courage, generosity, respect and justice, as well as the essence of their ethical experience. Socratic conversations were analysed not only in terms of content, but also by focusing on the discursive practices, which characterized the dialogical exchanges among children.

Briefly summarizing the research findings, the Socratic conversation promoted in the first activity was shown to be effective in fostering the co-construction of children's thinking in a respectful dialogical environment in which each child listened to the other and enriched, changed or better clarified their own perspective thanks to those of their classmates. Concerning the stories about virtues, it is important to specify that they do not have classical morals, meaning that they are not constructed to convey the children's thinking in a precise direction; instead, different ethical positions, through dialogue among animals, are presented, so that the children can reflect on them, starting with open endings. The research findings that emerged from an analysis of the children's answers following the presentation of the stories revealed the children's capacity to see both the complexity of the virtuous action—indeed, they sometimes referred to more than one virtue in describing the gesture of the protagonist—and its difficulty—they appeared aware that choosing what is good is not always the simpler solution. Also, the vignettes activity is structured in such a way as not to suggest to the children a precise solution but to give them the opportunity to think. In this case, the research data confirmed the importance of asking children to describe the scenes before choosing the virtuous one, since the interpretation of a scene conditions the choice and its argumentation. Furthermore, an interesting datum emerged, that the children were able to identify the ethical dilemmas that we normally included among two of the three options, and in making their choice, some of them considered both dilemmatic options as virtuous, arguing for the two choices with different reasoning. The children appreciated the play activities, not only because they were fun but also because they provided an opportunity for reflection. Furthermore, the research experience revealed the importance of structuring the final activities with the same questions as the explorative activities, since this allowed the researcher to compare data from the beginning and end of the programme, so as to explore if and how children's ethical thinking had developed. Finally, much was revealed by the research data collected through the diaries of virtues; in particular, writing proved to be an essential tool for facilitating reflection on ethical experiences.

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AUTHORS' INFORMATION

Full name: Luigina Mortari
Institutional affiliation: Department of Human Sciences, University of Verona, Italy
Institutional address: Lungadige Porta Vittoria 17, 37129, Verona, Italy
Biographical sketch: Ph.D. in Education, is a full professor at the University of Verona. She teaches Philosophy of education at the Department of Human Sciences and Epistemology of qualitative research at the School of Medicine. She founded the Center of Educational and Didactic Research (CRED) and she is the Director of the Melete-Center of Ethics for Care of the same University. Her research interests include philosophy and politics of care, and qualitative methods in educational and healthcare research.

Full name: Federica Valbusa
Institutional affiliation: Department of Human Sciences, University of Verona, Italy
Institutional address: Lungadige Porta Vittoria 17, 37129, Verona, Italy
Biographical sketch: Ph.D. in Education, is Research Assistant at the Department of Human Sciences of the University of Verona, where she teaches Educational research at the Combined Bachelor's and Master's degree in Primary teacher education. She is a member of the Center of Educational and Didactic Research (CRED) of the same University. Her research interests include phenomenology and educational research, ethical education and social-emotional learning.

Chapter #29

ORAL READING FLUENCY MEASURES FOR EDUCATIONAL MONITORING

Maíra Anelli Martins[1], Noemi Del Bianco[2], Ilària D'Angelo[2], Catia Giaconi[2], & Simone Aparecida Capellini[1]
[1]Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University "Júlio de Mesquita Filho" (UNESP), Brazil
[2]Dipartimento di Scienze della Formazione, dei Beni Culturali e del Turismo, Università degli Studi di Macerata (UNIMC), Italia

ABSTRACT
This study assessed oral reading fluency development in students from the 2nd to the 5th grade of Elementary School I over a school year. The research involved 400 students, aged 7 to 10 years, from a municipal public school in São Paulo. The Performance Assessment in Reading Fluency was employed, and students were evaluated in March, July, and November using three texts of similar complexity. The analysis considered the number of words read correctly and incorrectly per minute, with statistical analysis conducted using SPSS 22.0. The results revealed significant improvements in reading fluency over time. The Wilcoxon Signed Rank Test indicated a statistically significant difference between the third and first assessment moments, with increased words read correctly and decreased errors. The Mann-Whitney Test further supported these findings, indicating that the first assessment had fewer words read correctly per minute compared to the second and third assessments, along with fewer misspelt words. In conclusion, this study provides a simple, reliable, and valid method for monitoring and tracking the progressive development of oral reading fluency in students from the 2nd to the 5th grade of Elementary School I.

Keywords: oral reading fluency, measurement reading, screening, progress monitoring, assessment reading.

1. INTRODUCTION

Oral reading fluency is a multifaceted construct encompassing three key dimensions: automaticity, accuracy, and prosody (Kim, Quinn, & Petscher, 2021). Proficiency in these areas not only signifies a student's ability to decode words effortlessly but also signifies the liberation of cognitive resources for higher-order reading functions (Rasinski et al., 2017). Consequently, both the assessment and intervention of reading fluency have garnered significant attention from researchers (Bigozzi, Tarchi, Vagnoli, Valente, & Pinto, 2017; Kostewicz, Kubina, Selfridge, & Gallagher, 2016; Makebo, Bachore, & Ayele, 2022).

The evaluation of oral reading fluency has evolved in several ways, as highlighted in the literature (Hasbrouck & Tindal, 2006; 2017). It serves a dual purpose; the first (complicated by the small number of studies with Brazilian students who bring regulations to the population of other regions of the country; in addition to the lack of appropriate material), it would be based on the performance levels of the students, that is, based on short evaluations, comparing them with each other, thus obtaining a screening measure, an assessment focused on predicting the development and growth of reading skills (Alves et al., 2021; Pereira, Alves, Martins-Reis, & Celeste, 2021), which could determine whether a

student would need support in reading (extra help or alternative forms of instruction), which would contribute to the early identification of students at risk of reading difficulties (Arnesen et al., 2017). The second way to carry out the work with the students would be to observe the development of reading fluency with themselves over time and compare it to the class group. This second way of using oral reading fluency has been called a performance monitoring measure (Furey & Loftus-Rattan, 2022). Monitoring measures can be collected three times in the school year; they are short, individually administered assessments (typically 1 to 3 minutes in duration) that provide information on students' ongoing performance in reading fluency.

Thus, studies that assess reading fluency at the beginning of the school year and its growth throughout this year are critical. As few studies on oral reading fluency have been adapted as a screening and monitoring method in Brazil, this research is highly urgent. Furthermore, the need for psychometric validation of the screening measures concerns other researchers who are experts in reading fluency. While examining student progress over time is crucial, progress monitoring needs to be integrated into national reading assessments or broader reading tests.

2. BACKGROUND

Reading fluency has been demonstrated to be a valid and safe measure to monitor progress and can be used as a predictive skill. Fluency measures should be regularly presented to monitor student development. This progress monitoring data can be graphed, providing visual feedback to educators about student progress in an academic skill area such as reading, more specifically, oral reading fluency. Thus, to assess a student's progress, reading fluency data is plotted on a graph in the form of a time series. The horizontal axis of the graph represents time (i.e., the date on which each reading was performed) and the vertical axis represents the words read correctly in one minute (PCPM) during the administration of the so-called Curriculum-based measurement (CBM) (Deno, 1985). The method known as CBM is a curriculum-based monitoring method to measure growth in specific areas of knowledge and basic skills, and evaluate the effects of instructional programs (the response to intervention). Curriculum-based assessment has become popular in the field of education proposing that the basis of assessment of learning is what has been taught. Thus, the CBM assessment method is a procedure described as curriculum-based as it is used within the context of the school curriculum, assessing basic reading, spelling, writing and expression skills.

Based on the CBM assessment method, the identification of students with reading difficulties and at risk for difficulties can be carried out through reference norms in oral reading fluency (FLO), which allows for the analysis of 1 minute of reading (for example, scores of the number of words read correctly per minute - PCPM). This FLO assessment focuses on two of the three components of fluency (rate and accuracy) and requires the student to read for one minute from a text appropriate to their grade level and unpublished, meaning that they have not encountered the text before. At the end of one minute, errors are subtracted from the total words read to calculate the PCPM score (Hasbrouck & Tindal, 2006).

The method was developed to create procedures for measuring the progressive development in a simple, reliable, and fast way, allowing teachers to frequently and repeatedly measure students' growth. However, despite the widespread use of progress monitoring in schools in developed countries, it is noted that in Brazil, few studies have focused on the topic, and there is no culture of tracking or monitoring in classrooms.

In a recent study, researchers investigated whether reading fluency could be used as an indicator of competence throughout the school year for Brazilian students in grades 3 to 5 of Elementary School I, based on assessments of reading speed, accuracy, and reading comprehension at two assessment points, with a five-month interval. The results indicated that in the intergroup comparison, the control group statistically outperformed the group of interest (students with special education needs) in both variables and all measures, while in the intragroup comparison, statistically significant improvement was observed only in the group of interest. Additionally, based on the Progression Coefficient, the results showed improvement in reading fluency measures for both groups. Thus, reading fluency also appears to be an indicator of reading competence for Special Education, for students with specific functional disorders such as dyslexia, dysorthographia, dysgraphia, dyscalculia, and attention deficit hyperactivity disorder, according to local resolution (Pereira et al., 2021).

The use of progress monitoring measures is closely related to Response to Intervention (RTI) programs. Therefore, oral reading fluency could be used as a tracking system to select children for RTI tier 2 programs, for example, as it is sensitive to changes over the course of the year. Shapiro, Zigmond, Wallace, and Marston (2011) noted that in conjunction with the RTI system, monitoring FLO also helps make decisions about the effectiveness of tiered instruction. Educators can administer a universal screening assessment to identify students at risk of low performance and also monitor the progress of intervention target students (Nese et al., 2012).

To assess reading fluency, scores for the number of words read correctly per minute (PCPM) and the number of words read incorrectly per minute (PIPM) must be measured with three texts of the same difficulty level, and then the median is calculated. Thus, the PCPM measure can be used for screening to identify academically at-risk students, placement in remedial and special education programs, monitoring student progress, improving teaching programs, and predicting performance in high-stakes assessments (Martins & Capellini, 2021). Researchers suggest that the best way to use the PCPM measure would be to calculate the average PCPM performance of students across three passages, meaning that PCPM and PIPM are calculated for each passage, and then the average of the three passages read is calculated. Alternatively, other methods used include the median of three passages, the average of the second and third passage, or the score from the third passage (Petscher & Kim, 2011).

Recommendations for using FLO as a CBM method have been reviewed by Ardoin, Christ, Morena, Cormier, and Klingbeil (2013) in the context of RTI (for making decisions). Since there are two types of analyses that can be done with collected FLO data, Ardoin et al. (2013) explain that, based on previous research, a cutoff rule or a decision rule from a trendline can be used. Both rules require a comparison between the observed growth rate and a goal rate (desired rate). The goal line is a straight line connecting the student's initial performance level to the desired performance level at the end of the intervention period. For the cutoff rule, it is observed whether the student's PCPM rate over time is above or below the established goal line. A commonly used guideline is that 3 to 5 consecutive data points below the goal line indicate ineffective intervention, requiring intensification of the intervention to produce greater changes (e.g., increased frequency, longer duration, or more individualized instruction) or even complete changes to better address the deficit. Similarly, 3 to 5 consecutive data points above the goal line indicate that the student may achieve greater gains than initially expected, and therefore, the goal should be increased. When the last 3 to 5 data points are above and below the goal line, the intervention is maintained, as the data suggest that the intervention is ongoing (Stecker, Fuchs, & Fuchs, 2008; Shapiro & Clemens, 2009).

3. OBJECTIVES

This study aimed to monitor the development of oral reading fluency in students from the 2nd to the 5th grade of Elementary School I during the school year.

4. METHODS

4.1. Participants

This study was approved by the home institution's research ethics committee (09575419.0.0000.5406). The study included 400 students from the 2nd to the 5th grade of Elementary School I from a municipal public school (in a medium- and a small-sized Brazilian city, Southeast Region of Brazil) in the interior of the State of São Paulo, aged from 7 years to 10 years and 11 months. The schools were selected through convenience sampling (simple convenience sample). The students participating in the studies did not have a history of repeating grades; they were monolinguals and native speakers of Brazilian Portuguese.

The inclusion criteria for the sample selection were as follows: informed consent form signed by the parents or guardians for the students; students with no history of neurological or psychiatric illnesses, uncorrected auditory and visual impairments, and cognitive performance within normal, according to the description at the school records and teachers' reports. The exclusion criteria for the sample selection were the presence of genetic or neurological syndromes in the students and students who did not present a satisfactory reading domain level for observing the variable proposed in the study.

4.2. Materials and Procedures

The Performance Assessment in Reading Fluency was applied (Martins & Capellini, 2018). This procedure assessed reading fluency based on the number of words read correctly per minute. The instrument presents 70 passages (narrative and expository), with the word count, presented progressively per line to facilitate the evaluation, with passages that contain 64 to 194 words.

Initially, the passages were designed for students from the 1st to the 4th grade. However, a readjustment was necessary since most Brazilian students are not readers in the 1st year. The collection was restructured to be used as an assessment from the 2nd to the 5th grade when the first cycle of education in Brazil ends.

A study of the complexity of the passages was conducted and based on the fluency of oral reading; they were sequenced from the easiest to the more difficult passages since there is a range of criticisms for research that only uses readability formulas for selecting equivalent level probes (Ardoin, Suldo, Witt, Aldrich, & McDonald, 2005; Begeny & Greene, 2014). After this classification, a statistical analysis was conducted to categorise the passages by quartile to group the most similar texts. The averages of the passages were analyzed by quartile distribution and categorized into: low (< first quartile – Q1), regular (between the first and third - Q1 and third quartile - Q3), and high (> than the third quartile Q3). The normal distribution was verified using the Shapiro-Wilk test with Lillifor correction. Comparison between performance categories was performed using ANOVA for repeated measures and post hoc comparisons using the Bonferroni test. The significance level adopted was 5%. Data were analyzed using SPSS software, version 19.0 for Windows. Thus, sets of three passages were selected for each time of the year (beginning, middle and end) for each grade.

Reading fluency measures were performed by collecting oral readings of three passages with the closest possible textual complexity in March, July and November. For the analysis of each passage, the analysis parameters of the errors made during reading were used, referring to words read correctly and incorrectly per minute.

In this approach, the types of errors that are marked as WIPM are mispronounced words, words substituted with others, words omitted, words read out of order, addition or omission of word endings, and hesitation (words on which the student paused more than 3 seconds, after which they are told the word, and it is marked as incorrect. If necessary, the student is said to continue with the following word (Martins & Capellini, 2018). The following items indicate all situations that are marked as WCPM: words pronounced correctly, self-corrections, words decoded slowly but ultimately read correctly, repeated words, words mispronounced due to dialect or regional differences, and words inserted. To quantify errors, scoring rules are also proposed for certain situations: lines or multiple words omitted; when one or more lines are not read (four or more omitted words in sequence), they are not considered errors, although those words are excluded from the WCPM (such that this rule is applied whenever a student skips four or more words within a sentence). If the student skips one, two, or three consecutive words, each word should be counted as an error (WIPM) (Martins & Capellini, 2018).

The Mann-Whitney Test was applied to verify possible differences between the three times of the year – March (beginning), July (middle) and November (end) for the WCPM and WIPM variables in each grade. After applying the Mann-Whitney Test, as statistical differences were found, the Wilcoxon Signed Rank Test was applied to identify which time of year variables (beginning, middle and end) differ when comparing two to two. The results were statistically analyzed using the Statistical Package for Social Sciences, version 22.0, with a significance level of 5% (0.050).

5. RESULTS

With the application of the Mann-Whitney Test, it was possible to verify that there was a statistically significant difference, indicating that the groups had a lower number of words read correctly per minute (WCPM) in the first reading measure compared to the second and third measures (see Table 1). This finding was also found in words read incorrectly per minute (WIPM), indicating that the number of errors decreased throughout the school year (see Table 2).

Table 1.
Comparison of WCPM measures in 3 moments of the school year.

	WCPM	n	Average	SD	Min	Max	Percentile 25	Percentile 50	Percentile 75	Sig. (p)
2nd grade	beginning of the year	100	16.89	4.13	7.00	30.00	14.00	17.00	20.00	< 0.001*
	middle of the year		23.38	4.94	9.00	32.00	21.00	24.00	27.00	
	end of year		27.14	5.91	10.00	37.00	24.00	28.00	31.00	

3rd grade	beginning of the year	100	44.01	7.45	34.00	68.00	39.00	42.00	48.00	< 0.001*
	middle of the year		49.75	7.39	36.00	73.00	44.25	49.00	55.00	
	end of year		54.29	6.80	36.00	69.00	49.25	55.00	59.00	
4th grade	beginning of the year	100	58.04	3.04	50.00	68.00	56.00	58.50	60.00	< 0.001*
	middle of the year		62.57	3.89	53.00	70.00	60.00	62.50	65.00	
	end of year		66.04	3.97	53.00	72.00	62.25	67.50	69.00	
5th grade	beginning of the year	100	62.34	4.74	54.00	71.00	58.25	62.00	67.00	< 0.001*
	middle of the year		64.30	4.60	56.00	72.00	60.00	64.00	68.75	
	end of year		71.02	5.08	58.00	79.00	68.00	71.00	75.00	

***** Statistically significant difference

Table 2.
Text Comparison of WIPM measures in 3 moments of the school year.

	WIPM	n	Average	SD	Min	Max	Percentile 25	Percentile 50	Percentile 75	Sig. (p)
2nd grade	beginning of the year	100	5.57	2.20	2.00	10.00	4.00	5.00	7.00	< 0.001*
	middle of the year		3.45	2.07	0.00	9.00	2.00	3.00	4.75	
	end of year		2.64	2.04	0.00	10.00	1.00	2.00	4.00	
3rd grade	beginning of the year	100	1.07	1.51	0.00	7.00	0.00	1.00	1.75	0.005*
	middle of the year		0.84	1.26	0.00	8.00	0.00	0.50	1.00	
	end of year		0.62	0.91	0.00	5.00	0.00	0.00	1.00	
4th grade	beginning of the year	100	0.71	1.31	0.00	5.00	0.00	0.00	1.00	< 0.001*
	middle of the year		0.29	0.62	0.00	3.00	0.00	0.00	0.00	
	end of year		0.07	0.26	0.00	1.00	0.00	0.00	0.00	

5th grade	beginning of the year	100	0.21	0.48	0.00	2.00	0.00	0.00	0.00	< 0.001*
	middle of the year		0.08	0.27	0.00	1.00	0.00	0.00	0.00	
	end of year		0.00	0.00	0.00	0.00	0.00	0.00	0.00	

***** Statistically significant difference

With the application of the Wilcoxon Signed Rank Test, it was possible to verify that there was a statistically significant difference in the groups of this study both for the total number of words read correctly in one minute and the total number of words read incorrectly between the third moment of the fluency measure in comparison with the first moment when compared to peers, as can be seen in Table 3.

Table 3.
Comparison between pairs of reading measures at three times of the school year.

		2nd grade	3rd grade	4th grade	5th grade
WCPM and WIPM	Time of year	Sig. (p)	Sig. (p)	Sig. (p)	Sig. (p)
WCPM	middle X beginning	< 0.001*	< 0.001*	< 0.001*	< 0.001*
	end X beginning	< 0.001*	< 0.001*	< 0.001*	< 0.001*
	end X middle	< 0.001*	< 0.001*	< 0.001*	< 0.001*
WIPM	middle X beginning	< 0.001*	0.033	< 0.001*	0.009*
	end X beginning	< 0.001*	0.001	< 0.001*	< 0.001*
	end X middle	< 0.001*	0.009	0.001*	0.005*

***** Statistically significant difference

6. FUTURE RESEARCH DIRECTIONS

Many limitations can be observed in this current research; therefore, the results must be interpreted cautiously. First, the study includes students from only one region of the country. Since Brazil is a country of continental dimensions, with significant cultural differences and even speech rates, research must expand to other areas and increase the sample size, schools, years and grades to assess the external validity of these findings.

However, this small study is also an impetus for discussions about methods, procedures and instrumentation to continue to be evaluated and developed, which may reach the context of supporting RTI models in Brazilian schools.

Based on the data presented in this chapter, experimental studies will be conducted to evaluate the effects of different teaching strategies to promote oral reading fluency.

7. DISCUSSION AND CONCLUSIONS

Data collection in three periods of the year, with a median of three passages with elementary school students, is an unprecedented form of monitoring in Brazil since we have yet to find scientific articles that used the WCPM measurement in this monitoring format. Moreover, this is just the first step to start disseminating this type of assessment among

teachers, and discussions about how to use these measures need to be the second step. This is because it is necessary that students are identified for their reading difficulties and also as at risk for future problems. When WCPM measures are collected systematically throughout the school year, they can be monitored to ensure that interventions are offered as identified (Deno, 1985; Nese, 2022; Stecker et al., 2008).

Progress monitoring data has been much discussed in the literature in the context of producing estimates of growth that are sufficiently reliable for educators to make meaningful inferences about a student's response to the intervention. WCPM data can be graphed over time and compared to a trend line of student performance against an established goal. These assessments are quick and consistent, ensuring that they can be administered uniformly across various time points. This consistency is critical for generating reliable data that can be used to drive instructional decisions. (Fuchs, Fuchs, Hosp, & Jenkins, 2001).

Monitoring carried out throughout the school year with students from 2nd to 5th grade revealed differences that are early evidence that measures of oral reading fluency can be used to monitor student progress over an entire year, and that brings several advantages discussed for educators, mainly making it possible to identify students at risk, monitor student learning outcomes, assess intervention effectiveness, and develop benchmarks for Brazilian students.

In conclusion, the adoption of WCPM measurements at multiple intervals throughout the school year in Brazil represents a promising step towards enhancing literacy education. As further research is conducted and discussions evolve on how to effectively utilize these measures, the potential benefits for students and educators alike are considerable.

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AUTHORS' INFORMATION

Full name: Maíra Anelli Martins
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA),
Institutional address: Department of Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Short biographical sketch: Speech therapist. PhD in Education from São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.

Full name: Noemi Del Bianco
Institutional affiliation: Dipartimento di Scienze della Formazione, dei Beni Culturali e del Turismo, Università degli Studi di Macerata (UNIMC),Italy.
Institutional address: Università degli Studi di Macerata (UNIMC), (Italia).
Biographical sketch: Professor in Didactics and Special Pedagogy, University of Macerata.

Full name: Ilària D'Angelo
Institutional affiliation: Dipartimento di Scienze della Formazione, dei Beni Culturali e del Turismo, Università degli Studi di Macerata (UNIMC), (Italia).
Institutional address: Università degli Studi di Macerata (UNIMC), (Italia).
Short biographical sketch: Professor in Didactics and Special Pedagogy, University of Macerata.

Full name: Catia Giaconi
Institutional affiliation: Dipartimento di Scienze della Formazione, dei Beni Culturali e del Turismo, Università degli Studi di Macerata (UNIMC), (Italia).
Institutional address: Università degli Studi di Macerata (UNIMC), (Italia).
Short biographical sketch: Full professor in Didactics and Special Pedagogy, University of Macerata.

Full name: Simone Aparecida Capellini
Institutional affiliation: Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Institutional address: São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.
Short biographical sketch: Full Professor at Speech and Hearing Sciences Department, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil.

Chapter #30

AUDITORY AND LANGUAGE PROCESSING DISORDER: A CASE STUDY

Fabio Corsi & Ivan Traina
Department of Human Sciences – University of Verona, Italy

ABSTRACT
This chapter describes a psychoeducational intervention for supporting language learning. It concerns a child that lost about 80% of hearing functioning at 11 months age, caused by an occlusive otitis. Despite successful surgery, the child didn't learn to talk. Chapter objective consists of presenting the psychoeducational intervention adopted. This was based on inclusive practices aimed to develop language skills and carried out by an interdisciplinary team in collaboration with primary school teachers. The methodology used for describing the intervention consisted of a naturalistic observation that allowed collecting information on changes as result of the intervention. This permitted the analysis of the insights generated through practical experiences, and to find evidence in research on language learning. Also, the results emerged through the observation of this intervention provided useful elements for encouraging the exploration of intervention's potentiality and inspire future trajectories of research.

Keywords: case study, auditory processing disorder, psychoeducational intervention, language learning, inclusive practices.

1. INTRODUCTION

Language has unique characteristics that distinguish it from other forms of communication. It is *creative*, and like vision it is not a simple set of images or sensations, it is the product of a transformative process of physical stimuli operated by brain. We learn to speak understanding the necessary rules for creating meaningful expressions, and not simply repeating memorized phrases. Also, language has a *form*, composed by a limited number of sounds that follow a predictable order. All languages in the world use a limited number of sounds respect to the potentially available range. Sounds are represented by the "phonemes", the smallest part that form language. Finally, language has *content*, distinct in *morphology* (combination of different phonemes to form words), and *grammar* (combination of several words to form sentences). Unlike communication systems based on signs, in which meaning is strictly connected to specific situations, vocal language consists of depicting and communicating abstract ideas. Moreover, it has an *emotional content*, often amplified by different linguistic expressions, such as gestures, voice tone, facial expressions and posture. These elements allow language to be the main tool of social communication and interactions. Through language we can organize our sensory experiences and express thoughts, feelings and expectations (Mayeux, 1991). Based on such premises, this chapter presents the case of a child who became temporarily deaf due to an occlusive otitis that caused the loss of about 80% of hearing functioning. It happened from 11 months to 2nd year of age, an important phase for language development. Initially, the family noted many differences in relationship and behavior if compared to his twin brother. In fact, this child developed closures and stereotypies that compromised his relational and cognitive development. After some surgical

interventions, the follow-up tests (such as immittance testing, auditory evoked potentials, cortical magnetic resonance, etc.) confirmed a normal typical structure. Despite this, at the age of 3 years the child did not speak, had no eye contact, demonstrated mannerisms and motor stereotypes, as well as developed marked hyperacusis, screams and cries. In addition, he usually played alone (as stereotypical behavior), did not respond to verbal stimuli, was attracted by distant noises rather than the nearby ones, and did not produce any words (only stereotyped vowel sounds). At the age of 40 months, the family requested the support of an interdisciplinary team composed of neuropsychiatrist, psychomotor therapist, speech therapist, music therapist, psychologist, and pedagogist. The request focused on motor and sensory rehabilitation as well as support the inclusion in the school environment, because the child was often isolated from the peer group, and not even the teachers knew how to approach him effectively.

1.1. Language Development

Speech recognition requires high performance of auditory system, since sounds are produced by high-frequency vibrations of the vocal cords, which evoke resonant effects in the vocal tract, due to mouth and tongue effects. Such vibrations have frequencies about 10 Hz, that means these are below the audible spectrum. Nevertheless, if such vibrations are correctly modulated the ear can decode them. In fact, the selective tuning of receptors and fibers of the acoustic nerve allow the auditory system to function as a *frequency analyzer*. In this way the formative elements of language, including the peaks of the frequencies that characterize the sounds produced by the different vowels, are represented in the individual nerve fibers, below form of action potentials bursts having characteristic properties (Kelly, 1991). Some pathological processes interfere mostly with one or more of these characteristics. For instance, the form of language can be altered by lesions of central or cortical structures. There are regular and universally widespread stages in language learning. Children start from babbling to single words speech, then two words speech syntactically joined and finally they arrive to complex form of language. Some children advance through these stages more quickly than others, but the age of these stages is the same in every culture. These observations suggest that there is a sort of critical period during the development, in which language is learned effortlessly (both verbal and sign language). Nowadays, there is no evidence linking language learning with maturation of specific brain areas, and only few research focuses on the conceptualization at cognitive level for investigating how human forms linguistic constructs starting from world experience (Shapiro, 2011). Neither research that attest what styles, uses and characteristics of the learned language help to further develop some functions and areas of brain (Kuhl, 2007). Despite the lack of sound evidence-based research, linguists and psychologists believe that the mechanisms related to universal aspects of language are determined by the structure of the human brain. According to this hypothesis, the human brain is prepared to learn and use language like it would follow a predeterminate development program. While the type of spoken language, dialects and inflections depend by social environment. Currently, linguists are debating whether linguistic universals derive from nervous structures specifically related to language learning itself or from more general cognitive universals (Mayeux, 1991). In both cases, an explanation able to justify how the type of language learned (as in the case of the bi- and multilingualism), characteristics (iconic, musical, philosophical, mathematical, etc.), can influence the definition of life path of individuals is still missing.

Negri emphasizes that the “embodiment” perspective rejects the metaphors used by classical cognitive science to represent the mind. In particular, the sandwich and computer models (Negri et al., 2022). The first model views perception, cognition, and action as three

events that occur in linear sequency, as separate processes representing the input and output of the cognitive system (Gallistel, 1980; Hurley, 2001; MacKay, 1987). In the computer model, the mind is considered as a computational system that transforms inputs into abstract a-modal symbols representing the external world as outputs (Pfeifer & Scheier, 2001; Thompson, 2007; Bickle, 2020).

According to several authors (Leitan & Chaffey, 2014), these models have some limitations. For example, the sandwich model (perception-cognition-action) is not dynamic enough to cope with the need of taking immediate actions as required by the complex scenarios of everyday life (Burr, 2017; Hurley, 1998; Cisek, 2007; Cisek & Kalaska, 2010; Levy & Glimcher, 2012; Padoa-Schioppa, 2011). On the other hand, the computer model does not consider the importance of connections between body, sensory process and cognition (Thompson, 2007).

Decades of research attest how much the study of language development and the ability to communicate are extremely complex. Therefore, this chapter intends to provide a sound contribution in investigating the role of a psychoeducational intervention to face the interference of a pathological event in one of the crucial stages of a child language development.

2. BACKGROUND

The child was born in September 2016 and accessed our service in the summer of 2020 after the first year of kindergarten, attended with a support teacher and an assistance operator. In the initial request to our service, family reported the difficulties experienced by child in creating relation with peers due to his strong language delay. At four years of age he still didn't speak, and he had tendencies towards isolation and didn't play with other children, except with his twin brother. He had stereotyped behaviors that didn't fit properly with peer relationships, because of the absence of verbal communication. From the anamnestic interview emerged that the child was born at 36 weeks + 6 days with planned twin births without perinatal consequences. Breastfeeding was artificial with effective suction. Weaning took place without problems around 6 months. They didn't report chewing and/or swallowing difficulties. The child was able to eat with cutlery and chewing occurs in a rotational fashion. Deictic gestures emerged after 2,5 years. While babbling was initially productive, a later regression led to the first diagnostic investigations. The first "words" seemed emerge around the age of 3 years, with a limited lexicon (Italian was the language the child learned). First steps emerged at 13 months. Sphincter control and autonomy was achieved even during the night. He had a quite regular sleep. The child attended school (kindergarten) since the age of eleven months. In November 2018 the child started to be cared by the local Child Neuropsychiatry Service and the first diagnosis was "delay in linguistic and psychomotor development". A diagnostic hospitalization was carried out in January 2019 and analysis conducted through the Auditory Brainstem Response with sedation showed a conductive deafness due to a complete bilateral endo-tympanic catarrhal block. Wave V was found to be replicable on the right up to 40 db nHL and on the left up to 60dB nHL. Later, it was scheduled an adenoidectomy and tonsillar reduction which took place at 2 years and 7 months of age due to an aggravation of the hearing impairment. It was estimated that conductive deafness developed around the age of 10 - 11 months (preverbal period) and that the child remained hearing impaired for about a year and 8 months. It was reported that since this period the child tried to use more the visual channel, consequently worsening the interaction with others. He didn't turn around if called by name and there was fear of loud noises and non-constant reactions to environmental noises. After the adenoidectomy and tonsillar

reduction operation, hearing improved. In December 2019 a diagnosis of neuro-psychomotor developmental delay impacting on communicative and relational aspects was provided. Therefore, the initial diagnosis (based on DSM V) changed in "previous hearing loss between submissive impairment syndrome (H90), impairment of psychological development (F84.1), cognitive development delay of medium degree (F71). The first approach to psychoeducational intervention took place at the beginning of summer 2021. The availability of outdoor space allowed the child to enter and easily explore the park of our structure. He didn't interact with adults and peers, but runed around the perimeter to examinate the new environment. After the first impact with the new context, he noted a jar of flowers and started to play with soil. This activity was carried out with repetitive actions, consisting in selecting soil containing small stones and recovering some magnolia leaves. During this activity that lasted half hour, he experienced heights and different positions from which to let filter the soil, with extreme attention to the produced sound. The support team tried to create a relation through such game, but child didn't respond when called with his name and had no eye contact. During brakes he was sometimes attracted by weak auditory stimuli. He was distracted from playing with soil and looked at something in distance, accommodating the position of the head, almost tuning to a distant sound. Therefore, the team hypothesizes a hypersensitivity auditory compensation for the previous hearing loss, a kind of compensatory hyperacusis since he spent several months with an estimated hearing impairment of 80%. Despite the impairment once the occlusion solved auditory hypersensitivity remained. In literature, hyperacusis and its effects on speech is widely documented. In particular, the difficulties to isolate and distinguish vowel from ambient sounds. As consequence, the child was not able to isolate, imitate, and use sounds to develop language. Grandin describes his own hyperacusis as "have a hearing aid set on maximum volume" (Bogdashina, 2016, p. 77) and compares his ears to a microphone that collects and amplifies sounds. Hyperacusis subjects may be able to hear some frequencies that are normally heard only by animals. Often, these subjects have a light sleeping, they are frightened by sudden and unexpected sound, hate storms and the crowd, are terrified of cutting hair. They often cover their ears when the noise is painful, even if others have no perception of disturbing or alarming sound. Sometimes they produce spontaneously repetitive noises as "bloke-out" annoying sounds (Bogdashina, 2016). The clinical diaries highlighted behaviors and stereotypies that the child performed with frequency are:

- banging the head on the ground or against the wall,
- jumping like a frog,
- drumming and flickering with the hands,
- deviations of the head and eyes,
- verbal stereotypies,
- continuous need for tactile and sound sensory stimulation.

Also, the frustration resistance and ability to wait were very low, while angry manifested with crying, yelling, kicking, as well as throwing chairs and objects around the room. All conditions that limit inclusion with peers and in the school environment.

3. THE PSYCHOEDUCATIONAL INTERVENTION

3.1. Objectives and Design of the Intervention

The objectives of the psychoeducational intervention consisted of creating an inclusive environment for rehabilitation and facilitating the development of communication and expressive skills. Therefore, the intervention was designed for beginning with a music therapist, who proposed eight E.V.P. (electronic voice phenomenon, also called psychophony) sessions for the re-education in sounds' recognition. At the end of sessions, the child correctly imitated single sounds and rhythmic sequences. Also, the music therapist suggested using the Tomatis Auditory Stimulation Method©, which is performed by listening to music (Mozart and Gregorian Chants), mother's voice recording and other voices through an active vocal work, processed and filtered through an electronic device. Once the music therapist's intervention was concluded, different games were planned and implemented at home, to further develop the relationship with his brother and family members and reduce the situations of isolation and stereotypy behaviors. The home intervention lasted two months, once a week. From clinical observations emerged that he interacted with his brother using eye contact, contextual smiles and consistent behavioral responses. In the domestic environment, he looked for games of movement (somersaults, being lifted high), or structured games such as exchanging toy cars, pushing the train. After this intervention, the Picture Exchange Communication System (PECS) was introduced at home and school, to allow the child to express his needs and choices. Concurrently, stereotypies and undesired behaviors significantly reduced, eye contacts increased, and the intentional use of communication appeared through the utilization of pictograms and the deictic gestures.

3.2. Method Applied

The method applied to observe and analyze the intervention was based on the naturalistic observation (Furlong, 2013) and NDM (Naturalistic Decision Making) framework. Naturalistic Observation allowed to collect information on changes as result of the intervention (Furlong, 2010; Morgan et al., 2017). The adoption of this methodology permitted to analyze the insights generated through practical experiences and find evidence in study and research on the topic of language learning. MDTs framework (including recognition of decisions, coping with uncertainty, team decision making, as well as decision errors) helped to identify important areas of intervention previously not considered (Bartolo et al., 2001). Also, an action-research approach was used for defining a functioning profile for understanding child's Auditory Processing Disorder (APD), and how the brain processes auditory information. Through the application of the psychoeducational intervention a diagnosis of APD was defined – a neurodevelopmental disorder involving the processing of auditory information by the brain that occurs even if individuals with APD don't have impairments at outer, middle, and inner level of ear structure and function. The method used for the observation showed how sensory processing disorders lead to stereotypes and behavioral dysfunction that can benefit from an inclusive approach aimed to improve communication and social skills, as well as provide sensory rehabilitation.

3.3. Results

The elements gathered through the analysis of this intervention and the evidence emerged through the literature review on this theme, led to define the strengths of the psychoeducational approach when applied to address difficulties due to language learning. The data available through the anamnesis and naturalistic observation allowed to formulate

two hypotheses: language and neurodevelopmental delay (difficult in communication) could depend by previous pathology, occurred in critical stages of language development. Another hypothesis was that "something" (congenital) reduced ability to develop language capability. After confrontations, the team initially agreed with a hypothesis of Central Auditory Processing Disorder. A neurodevelopmental disorder involving the brain auditory information processing, in the absence (o after resolution) of the outer, middle, or inner ear pathologies. Following the definition of the American Academy of Audiology (2010) *"Auditory processing disorder, rarely known as King-Kopetzky syndrome or auditory disability with normal hearing, is a neurodevelopmental disorder affecting the way the brain processes auditory information". Individuals with APD usually have normal structure and function of the outer, middle, and inner ear. However, they cannot process the information they hear in the same way as others, which leads to difficulties in recognizing and interpreting sounds, especially sounds composing speech. It is thought that these difficulties arise from dysfunction in the central nervous system. It is highly prevalent in individuals with other neurodevelopmental disorders, such as attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), Dyslexia, and Sensory Processing Disorder*. Also, comorbidity with others unknown neurodevelopment disorders was possible. After some naturalistic observations, the support team decided to adopt auditory discrimination strategies to discover and focus on other symptoms, as well as how to approach the child.

For these reasons, with supervision of a music therapist specialized in Tomatis Method© eight sessions of E.V.P. and re-education in sounds recognition were planned. The room where sessions were carried out was isolated, but not soundproofed, and family members were present beyond the door for increasing child's sense of safety. The activity was conducted on a carpet, and it lasted one month with two sessions per week. In Table 1 are reported the description of the 8 sessions and the results obtained for each session.

Table 1.
Description of activities proposed, and results achieved.

Session	Activity proposed	Results achieved
1st	Electronic piano: proposal of sounds (initially the A at 440Hz) and tones within the same octave. Therapist plays and sings.	Interruption of stereotypies in response to the sound stimulus. Attention maintained up to 5 minutes. Exploration of instruments and keyboard. No vocalization produced.
2nd	With electronic piano: proposal of pure sounds (initially the A at 440Hz) and tones within the same octave. Therapist sings the sound with his voice and invite to imitate.	Initial game activity with episodic attention maintained for at least 10 minutes. He started to explore other instruments (e.g., Orff and boom whackers) and produced selective attentional response to therapist's voice.
3rd	With boom whackers and maracas, rhythmic movement, and sound experience.	At the end of session, the child started to imitate therapist's movement, and a "sound dialogue" begun.
4th	Electronic piano: pure tones and major fourth and fifth chords, with therapist's voice imitation.	First vocalizations produced on a fifth chord with a basic tone, with correct repetition of intonation and rhythm.

5th	Electronic piano: pure tones and major fourth and fifth chords, with therapist's voice imitation.	The child rejected the piano, while using boom whackers and maracas he come up with a beat. No vocalization produced, and attention was maintained for about 25 minutes.
6th	Choice of instruments: piano, boom whackers and Orff instruments Use of different kind of sounds.	The therapist singed a song the child listened in previous session. Repeated for several times, attention was maintained. The therapist invited a colleague to sing the same song with different vocal timbre, and the child has maintained attention to both voices.
7th	Repetition of song singed during previous session with a colleague and using guitar. Electronic piano: major fourth and fifth harmonics.	The child listened with interest both the alternation and overlapping of two vocal timbres. Produced intentional vocalizations imitating sounds of fourth and/or fifth vocally, producing two vocal sounds in sequence.
8th	Children's song, use of guitar and electronic piano.	The child maintained his attention for almost the entire session (45 min). While singing, he emitted impromptu vocalizations and correctly imitates two sounds in sequence.

Once the music therapy intervention was concluded, game activities at home were implemented to further develop the relationship with sibling and family member, and to limit his isolation and stereotypies. The intervention at home took place once a week for two months. The relationship with twin brother and peers improved. Then he improved the interaction and physical games with his brother. The child demonstrated to acquire the capability to manage functional relationship (eye contact, coherent interaction), even if for a limited duration, and only with people who interacted with him in a non-invasive way. In this case, he accepted to leave solitary game for starting with a relationship in a reciprocal dimension, with eye contact, smiles and active participation for 20-30 minutes. After three months of intervention, the child learned to express a form of intentional communication. Consequently, he started to perceive difficulties in communicating. This caused anger crisis with various behavioral problems that were interpreted as a manner to show his needs. Therefore, the team decided to introduce the use of the Alternative Augmentative Communication (AAC) as additional speech therapy for promoting reciprocity in the communication with peers and adults, as well as acquisition of complex communication structures. Through AAC the child started using basic symbols. The first symbol represented the meaning "again". This symbol allowed the child to express and generalize his own preference (for example about games, activities, and food). The second symbol learnt was "enough", used to express the willingness to end an activity or action. Other symbols used represented bathroom, ball, bubbles, crackers, biscuits, water. Initially the child had some difficulties in indicating the symbols chosen. This difficulty was reduced when the team suggested to limit the choice of symbols using a binary choice (two pictograms) and provide physical gestures for helping his choice. Following the intervention, the child learnt to

express different words with a well-defined vocalization as “water”, “mom”, “dad”. Also, vocalizations started to be composed of sounds he imitated when expressed by adults. In addition, he started to use deictic gestures for making requests (e.g., open hand), and sporadically expressed the “hello”. Concerning the interactions with others, he started to accept the relationship with peers, teachers, and parents, including his twin brother. Moreover, he started to accept teacher’s proposals of different activities, such as coloring within borders, decoding, and coupling of images, manipulation activities with objects (e.g., Lego). Finally, he started to move in a functional way, respecting the spaces of others and accepting the presence of peers (e.g., on the same worktable), sharing materials and exploring autonomously the school building, identifying places through Picture Exchange Communication System (PECS) as classroom, gym, and bathroom.

4. FUTURE RESEARCH DIRECTIONS

Future research could explore the effects of the intervention in other countries (this intervention was developed in Italy), since the topography of language skills for mastering communication can vary across cultures and locations. Therefore, it could be useful to further study the features of the psychoeducational approach that allowed the child to build the abilities for intentional communication with peers and adults. In particular, the combined effects of Tomatis Method© (Gilmor, 1989; Kurkowsky, 2013) and speech therapy, that need to be further observed and investigated because there is a paucity of qualitative studies on this issue (Kuhl, 2007).

5. CONCLUSION

After three months of intervention, the child started to express a form of intentional communication and consequently perceived his difficulties in communicating. This caused anger crisis with behavior problems. These behaviors were interpreted as a manner to show his needs. Therefore, the team decided to introduce as speech therapy the use of the Alternative Augmentative Communication (AAC), for promoting reciprocity in the communication with peers and adults, as well as complex communication structures. Through AAC the child started using basic symbols. The first symbol represented the meaning “again”. This symbol allowed the child to express and generalize his own preference (for example about games, activities and foods). The second symbol learnt was “enough”, used to express the willingness to end an activity or action. Other symbols used represented bathroom, ball, bubbles, crackers, biscuits, water. Initially the child had some difficulties in indicating the symbols chosen. This difficulty was reduced when the team suggested limiting the choice of symbols to two pictograms (binary choice) and providing physical gestures for helping his choice. The strengths of evidence of the intervention consisted of allowing child to learn how to express different words with a specific vocalization such as “water”, “mom”, “dad”. Also, vocalizations started to be composed of sounds he imitated when expressed by adults, to use deictic gestures for making requests (e.g., open hand), and sporadically expressing the “hello”. Another strength concerned the interactions with others, as he started to accept the relationship with peers, teachers, parents, family members including his twin brother. And to accept teacher's proposals of different activities, such as coloring within borders, decoding and coupling of images, manipulation activities with objects (e.g., Lego). Moreover, he started to move in a functional way, respecting the spaces of others and accepting the presence of peers (e.g., on the same worktable), sharing materials and exploring autonomously the school building, identifying places through PECS as classroom, gym,

bathroom. Other important strengths of the intervention for improving communication abilities had consisted of using specific methods such as music-therapy, psychomotor games and augmentative alternative communication, demonstrating also their effectiveness (Lorah, Holyfield, Miller, Griffen, & Lindbloom, 2022). Lastly, the adoption of the psychoeducational approach allowed the interdisciplinary team to focus on the functioning profile rather than the diagnosis. The profile was elaborated using the International Classification of Functioning (ICF) model. This provided the opportunity to highlight needs, define educational objectives, involve different persons (such as peers, teachers and family members) as well to analyze the context in terms of barriers and facilitators. The profile was used also to settle a personalized learning environment, both at home and at school. When the child started to attend primary school a new education program was designed, including new education objectives and competences to be acquired, in order to improve his communication abilities. The activities proposed consisted of E.V.P. using the Tomatis Method©, speech therapy and AAC (Tatum, Oelfke, & McCauley, 2004; Corbett, Shickman, & Ferrer, 2008; Brbić & Tomić, 2020). These activities allowed the identification of new communication needs and stereotypes to be addressed. Also, the first attempts to use language allowed the development of relationships with teachers and peers.

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AUTHORS' INFORMATION

Full name: Fabio Corsi
Institutional affiliation: University of Verona - Department of Human Sciences
Institutional address: Lungadige Porta Vittoria n. 17 – 37129, Verona (Italy)
Short biographical sketch: Fabio Corsi is a PhD Research Fellow at the University of Verona, Department of Human Science. Freelancer in special education since 2001, he worked with blind people and children with learning disabilities. He obtain his PhD in 2008 with a research about mathematics education for blindness. He was headmaster of a special school. His interests of research include inclusion of vulnerable children, intellectual disability, training for special teacher.

Full name: Ivan Traina
Institutional affiliation: University of Verona - Department of Human Sciences
Institutional address: Lungadige Porta Vittoria n. 17 – 37129, Verona (Italy)
Biographical sketch: Ivan Traina is a PhD Researcher at the University of Verona, Department of Human Sciences. He obtained a post-doc Marie-Curie fellowship in 2017 with the research project "Empowerment of youth with Intellectual Disabilities through Educational and training curricula for Acquiring employment Skills (E-IDEAS)". Also, he was employed as Research Manager at the University of Bologna, where he obtained his PhD in Special Education in 2014 at the Department of Education Sciences. His interests of research include inclusion of vulnerable groups, intellectual disability, transition programs, language learning, curriculum development and assistive technologies.

Chapter #31

ECO-POLITICAL RULE AWARENESS IN CHILDHOOD

Gudrun Marci-Boehncke[1], Matthias O. Rath[2], & Madeleine Rusch[2]
[1]*Institute for Diversity Studies, TU Dortmund University, Germany*
[2]*Institute for Philosophy, Ludwigsburg University of Education, Germany*

ABSTRACT
Do preschool and primary school children already have a "political consciousness"? Furthermore, how is this expressed? A focused study examines ecological awareness in the context of the interdisciplinary research project "PoJoMeC", funded by the Federal Agency for Civic Education in Germany. The theoretical basis of the research presented here is Bronfenbrenner's (1979) ecological model of human development. However, we understand this development as shaped by a process of medial orientation (cf. Johnson, & Puplampu, 2008). Our study concretizes the question of political consciousness to the socioecological rule awareness of nine students from upper primary school classes (grade 4). Methodologically, we focus on the children's explicit knowledge, subjective theories, media sources of information, and their concepts of rule-guided action.

Keywords: political thinking, early education research, ecological theory of human development, eco-political awareness.

1. INTRODUCTION

Climate change, peace, sustainable development, and inclusive participation of different groups in our society are just some of the tasks that UNESCO (2019, 2021) has summarized in the *17 Sustainable Development Goals*. They deal with protecting the environment, keeping people healthy and social diversity. This diversity is to realize human rights. Such goals require acceptance by society if they are to be realized. Active participation in social reality depends on the political understanding of citizens. However, this requires knowledge and general political awareness, which is already conveyed and acquired in childhood (Paulus, & Schmidt, 2018).

We understand "politics" as communicating and acting to establish and enforce generally binding regulations and decisions within and between people. Creating an awareness of what this responsibility means and what role everyone should play in it is a central educational goal. We have described the theoretical framework within which civic education must be conceptualized (Marci-Boehncke, Rath, Goll, & Steinbrecher, 2022). This civic education must begin early because political attitudes, beliefs, and stereotypes also develop in early childhood and are challenging to change throughout life (Smetana et al., 2012; Smetana, Jambon, & Ball, 2018).

For modern society, moreover, media play a central role in conveying and further developing a worldview and thus also in safeguarding democracy (Milner, 2002; Marci-Boehncke, Rath, Delere, & Höfer, 2022). Language is just as important as images, films, and other forms of communication. Thus, we advocate a broad concept of media that goes beyond a purely technical perspective. The world, and thus potentially every citizen, is internationally networked. Global citizenship education in the digital age depends on knowledge of the initial conditions of political thought. Formally, these points seem

researchable regarding developmental psychology (Wegemer & Vandell, 2020). Knowledge about what children understand by politics and whether or what political competencies they bring to preschool and primary school and develop when they move on to secondary school is still limited. Empirical research seems particularly difficult in this age group. Given the children's rudimentary writing and reading skills, studying larger cohorts seems impossible (cf. van Deth, Abendschön, Rathke, & Vollmer, 2007). In contrast, higher school age is already well researched (cf. Hunter, & Rack, 2016; Rowe, 2005; Flanagan, 2013).

The heterogeneities of the research, the target group, the scientific questions, and the wide-ranging object field initially suggest a multimethod approach. Based on earlier studies (Marci-Boehncke, & Rath, 2013), we could draw on experience in child-oriented questioning (interviews) and with playful approaches. Recently, we extended this range of methods by picturizing strategy (Tkotzyk & Marci-Boehncke, 2022; Tkotzyk, Lategahn, & Marci-Boehncke, 2022). Symbolic picture cards are used in this process (cf. van Deth et al., 2007, pp. 119-160). In our study presented here, in addition to the environmental policy topics that children choose, they are also an entry point for discussing the social and media frame of reference of policy rules.

Therefore, this study is to be understood as a pretest, primarily intended to validate the methodological side of our overall project. The group studied is homogeneous in terms of age and type of school. The specific age is relatively high compared to the cohorts of our target group. This point is to ensure that the media orientation of the children focused on in our study, especially television as the medium most used, is developed. Current studies show that in Germany the lower target group age (4-5 years), TV is used for around 26 minutes a day (Kieninger, Feierabend, Rathgeb, Kheredmand, & Glöckler, 2021, pp. 14-15), while the upper age segment (6-9 years) watches 68 minutes (Feierabend, Rathgeb, Kheredmand, & Glöckler, 2023, pp. 37-74). Therefore, we chose the homogeneous age group of 9-year-olds as the starting point for the project to be described here.

2. SOCIAL FRAME OF REFERENCE AND MEDIAL MEDIATION

With a social frame of reference, we emphasize the different social systems people open up for themselves during their development. These frames of reference expand in the context of ontogenetic development. Uri Bronfenbrenner (1979) has differentiated five systems, beginning with the *microsystem* directly surrounding the child through the *mesosystem*, *exosystem*, *macrosystem*, and *chronosystem*. The macrosystem and exosystem include, among other things, the state political organization and the related ideological attitudes and beliefs that determine a policy. The mesosystem provides the institutional bridge between the micro- and macrosystems and determines the institutional framework of the microsystem and its actors.

In our study, we restrict ourselves to the three main systems micro-, meso- and macrosystem. The microsystem is the closest social framework that extends directly beyond the individual, such as the family with parents. That is followed by the mesosystem, which includes the first educational institutions such as kindergarten, school, and later peers. Finally, the macrosystem is a system of general social order in which general laws apply that we represent in our study through Germany. These systems, conceived concentrically by Bronfenbrenner, provide the material, each of varying complexity, for developing a child's political consciousness. However, the politically relevant aspects, the increasing social integration of the child into existing social structures and their regularity, remain strictly separated in the systems. Vélez-Agosto, Soto-Crespo, Vizcarrondo-Oppenheimer, Vega-Molina, and García Coll (2017) have developed a more open model of human

development. Here, culture, with language and communication in its various manifestations, has a comprehensive function in the expanding structure of social relations. The extension of Bronfenbrenner's system model by Johnson and Puplampu (2008) is in the same direction. They add to the innermost circle of the microsystem a "techno-subsystem" of medial communication that encircles the individual and shapes interactions with the world and others. This medial subsystem symbolizes medial presence from early childhood (Marci-Boehncke & Rath, 2013). In the media-influenced microsystem, technological symbolization becomes the central mediator of regularity (cf. Navarro & Tudge, 2023).

To capture the political awareness of rules, we focused on the topic repeatedly discussed in families, educational institutions, and the public in the wake of the *17 Sustainable Development Goals*: the protection of the environment. We focused on Capra's (2012) "ecological awareness" or "ecological consciousness" (O'Sullivan & Taylor 2004) of children. With Capra (2012), we argue that "ecological literacy" is a critical educational goal in the school mesosystem and that "ecological awareness" is a good conversation starter to capture children's political awareness. Many studies on sustainability education over the last 15 years also point to the political importance of this topic (cf. Güler Yıldız et al., 2021).

3. METHODS

In this qualitative study, nine students (five male, four female) were interviewed individually. For reasons of comparability, children of the same age (9 years old) and grade 4 elementary school ("fourth grade" in German "Grundschule") were interviewed.

In preparation, various picture cards were spread out on a table. To start the interview, the topic of the interview and the three levels, based on Bronfenbrenner's "Ecological Model of Human Development" (1979), were addressed. Three larger maps depicting a family, a school, and Germany (symbolically in the form of a map of Germany, in the colors of the country's flag) represented the three environmental systems selected for the study: microsystem, mesosystem, and macrosystem. In addition, a series of picture cards were available to the students as possible conversation starters, all related to the theme of "environmental protection and conservation". The children could choose between illustrated rules, such as waste separation, and between the causes and effects of climate change due to progressive environmental pollution. During the interview, the respondents were motivated to select picture cards and discuss them intuitively. The learners' explicit knowledge, which is relevant in education for sustainable development, should become apparent. A total of eleven topic areas were visualized: (1) Buying regionally and seasonally, (2) Eating consciously and sustainably, (3) Renewable energy sources, (4) Saving resources, (5) Minimizing CO_2 consumption, (6) Protecting and preserving forests, (7) Protecting animals and preserving biodiversity, (8) Avoiding environmental and marine pollution, (9) Avoiding (plastic) waste, (10) Recycling, and (11) Separating waste.

The children decided which topics were addressed in the respective interviews by selecting a picture card. With defined guiding questions, the children were encouraged to explain which of the rules and consequences they already knew and to whom they applied. In the further course of the survey, by assigning the picture cards to the respective system levels, it was checked whether the children already had an awareness of rules about environmental topics. The goal was to design the dialog so the subjects were encouraged to reflect on the rules by asking questions.

Within the evaluation framework, however, the respondents' statements were not sharply evaluated concerning the individual. We interpret the respondents as representatives of a specific group, characterized by a certain homogeneity (age, school class) and thus

comparability (cf. Hennink & Kaiser, 2022). Given the small number of respondents, we are not interested in the individuals but in the number and content of statements we can assign to ecological-political awareness. Therefore, we analyze the responses regardless of the individual source. In what follows, we name the interviewees for ease of reference, but they are irrelevant as individuals. Therefore, the pool from which we draw our analyses does not include nine sources (the interviewees) but a total of 364 thematically and systematically relevant text segments. The following Table 1 differentiates the number of clearly attributable segments by system level.

Table 1.
Number of segments in the social reference systems micro-, meso-, macrosystem.

	microsystem	*mesosystem*	*macrosystem*
Which rules are known?	12	1	56
Who makes the rules?	1	2	22
Rule makers: institutions (family, school, political institutions)	1	2	4
Who told the children about the rules?	2	1	12
Source: media	2	0	3

4. FINDINGS

The following section presents the children's responses at various social levels. The children's statements were translated directly since the interviews were conducted in German. The transcripts are numbered. An "M" before the number means it is a transcript of an interview with a girl, and a "J" means an interview with a boy. The evaluated interview segments are also numbered and abbreviated with "seg.".

4.1. Rule Awareness in the Microsystem

The twelve statements ("segments") in the microsystem listed in Table 1 are distributed among nine interviewees. They thus use such rules, which were familiar to them from their families, as a starting point for conversation. Two interviewees each referred to the topics "Conscious, sustainable nutrition", "Saving resources", "Minimizing CO_2 emissions", or "Recycling". In one interview each, the topics "(plastic) waste avoidance" and "waste separation" were central components of the rules in the children's families. The other areas still needed to be addressed.

When asked what rules the children knew from home, interviewee M2 answered, for example, "(...) that living vegan is healthier, for the environment and also for oneself" (M2, seg. 12). It is thus clear from the transcript of the interview with M2 that she assigns a conscious or sustainable diet to the micro level. J3 also refers to this topic at the beginning of his interview (J3, seg. 8). Overall, 16.7% of the evaluated segments on the rules at the micro level refer to a vegan or sustainable diet.

In each case, 16.7% of the coded segments are also distributed among the topics of "saving resources", "minimizing CO_2 consumption", "avoiding the environment and marine pollution", and "recycling". "During the week, we are not allowed to use a tablet so often because it also consumes electricity" (J3, seg. 127). Here, the interviewee, like his classmate M4, expresses that they know the rule of "saving resources" in the form of keeping electricity and water consumption low from home: "So, that when you take a shower, for example, you do not take a shower for so long because that uses water" (M4, seg. 96).

Only in one of the nine interviews was it discussed who made the rules at the family level. J1 stated that his parents made the rules at home (J1, seg. 113). The source to which the interviewees attributed their rule knowledge at the microsystem was also only outlined in one of the nine interviews. M2 stated that she generated her information regarding a healthy and sustainable diet as well as the topics "recycling", "waste separation", and "waste avoidance" from the media, which in her case consisted of television and radio (see M2, seg. 18; 32).

4.2. Rule Awareness in the Mesosystem

Remarkably, only one interview mentioned rules in the mesosystem, such as school and peers. That will be discussed separately in chapter 6. In the evaluated interviews, only J1 mentions public transport as a relevant environmental protection measure connected to the mesosystem "school". He believes that the school bus is a more environmentally friendly transport option than "would any mother or father now drive every child extra" (J1, seg. 72-74). He assumes this "uses a lot more fuel". The remaining eight respondents did not mention any environmental issues relevant to them at the mesosystem. When asked who makes the rules at school, J1 named his "teacher" (J1, seg. 117) and "the principal" (J1, seg. 124). These rules were recorded as a poster of class rules (see J1, seg. 137).

4.3. Rule Awareness in the Macrosystem

Rules and topics relevant to environmental protection at the macrosystem, i.e., those that apply to all people (or here, considering the children's reference to their living environment, to people in Germany), were mentioned several times in all interviews. In the following, the topics that were covered are presented.

The goal of minimizing CO_2 emissions was the most frequently mentioned rule related to environmental protection measures at the macrosystem, accounting for 17.5% of the coded segments. For example, J5 notes in his interview "that there is quite a lot of CO_2 in our world" (J5, seg. 32). Therefore, "maybe you shouldn't drive your car so much or ride your bike or something", M4 also thinks (M4, seg. 72). J3 also thinks, "There are things everywhere where gas comes out, gas comes out here, nuclear power plants are that" (J3, seg. 80). These exhaust gases and the environmentally harmful substances in them "(...) pollute the air" (J13, seg. 64), the children agree. The rule assigned second most often in the interviews to the macrosystem, with a seg. share of 15.8%, is to avoid environmental and marine pollution. That primarily includes (plastic) waste disposed of in the environment (see J1, seg. 27; J5, seg. 16), especially in the sea (see J1, seg. 148; M2, seg. 38; J3, seg. 112; M4, seg. 25; J5, seg. 38; J13, seg. 22).

With a frequency of 14.0%, statements that concern the measure "protect and preserve forests" follow. Both J1 and four other children state "that you don't put out fires and you don't just leave glass in the forest" (J1, seg. 28-29; J3, seg. 52; M4, seg. 16; M9, seg. 54; J11, seg. 14) and that you "have to take care of the forests" (M2, seg. 56). J3 also believes that "it is also very important not to cut everything down in the forests" (J3, seg. 122). Thus, forest fires, deforestation, and the general threat to the world's forest areas and the need to preserve them is also an essential topic for the learners, given the interviews they have already evaluated.

12.3% of the aspects mentioned at the macrosystem also refer to renewable energy sources. The statements on this topic are often closely related to switching to an electric car (see J3, seg. 38) or producing electricity or energy. The children suggest a change or the use of electric cars as well as a sustainable production of electricity as a solution. "If the sun shines on it, then there is internet, and internet is also needed in the world" (J1, seg. 35-36).

For J3 and J13, solar power plants also belong to renewable and thus environmentally friendly energy sources (see J3, seg. 38, 42, 70 and J13, seg. 50). J13 also mentions wind power plants. According to M9, coal-fired power plants harm the environment (see M9, seg. 28).

"Animal welfare" was mentioned with a frequency of 10.5% as a rule everyone (in Germany) should follow. According to J1, M2, J3, M4, and M9, animals are particularly endangered by improper disposal of waste in their habitats "because the animals then eat that and then die from it" (J1, seg. 29-30; see also M2, seg. 40; J3, seg. 54; M4, seg. 31; M9, seg. 38).

The topics of "sustainable use of resources", "recycling", and "waste separation" are covered equally frequently in the nine interviews, at 8.8% each. According to M4 (see seg. 108), M9 (see seg. 44), M12 (see seg. 42), and J3 (see seg. 106), resources to be used sparingly include water, while M9 also point out that "you should turn off the lights to save electricity" (M9, seg. 16).

"Turn old into new" is known to respondents J3 (see seg. 137), M9 (see seg. 42), J11 (see seg. 20), M12 (see seg. 48), and J13 (see seg. 36). Four children also mention waste separation as a rule that should be followed at the macrosystem. J1 explains: "So, for example, organic waste like apples, pears or bananas or something goes in the organic waste. Plastic goes in the plastic garbage like everything that is made of plastic. Paper, all things that are made of paper, we should throw in the paper garbage" (J1, seg. 158-161). The opinion is also shared by J3 (see seg. 56), M9 (see seg. 38), and J11 (see seg.s 22 and 58). Instead of proper disposal, the general avoidance of (plastic) waste came up with 3.5% only during the interviews with M2 (see M2, seg. 26) and J3. J3 justifies as follows: "So plastic, it can't degrade on its own" (J3, seg. 62).

"Conscious/sustainable nutrition" was not addressed at the macrosystem. Moreover, as was already the case at the micro- and mesosystem, seasonal and regional food shopping was again not a relevant topic of discussion for the students.

Each of the nine interviewees attempted to explain who makes the rules in Germany and who is involved in legislation and compliance with the laws. Thereby, "Olaf Scholz and Angela Merkel" (J1, seg. 176-177), representing the position of Federal Chancellor, were, for each of the interviewees, without doubt, the authoritative persons responsible for the determination of the rules on the macrosystem (see M2, seg. 66; J3, seg. 92; M4, seg. 84; J5, seg. 66; M9, seg. 92; M12, seg. 80; J11, seg. 64; J13, seg. 74). 44.44% also knew that the Bundesrat as well as the Bundestag, i.e., the two chambers of the German parliament, were also involved (see M2, seg. 64; J3, seg. 98; M12, seg. 86; J13, seg. 84).

One-third of the respondents suspected that the police played a role in this (see J1, seg. 193; J11, seg. 74; M12, seg. 90). Two respondents each believed that politicians in general and courts play this role (see J1, seg. 198; M2, seg. 64; J11, seg. 62; M12, seg. 88). J5 believes "the whole state" (J5, seg. 70) is responsible for the rules for people in Germany.

Overall, seven out of nine interviewees talked about the origin of their macrosystem rule knowledge. In four interviews, laws were stated as the basis for the respective rule knowledge at the macrosystem. Two interviewees each stated that they had obtained information regarding the environmental protection rules that everyone in Germany should adhere to from the media or because of their school education. J13 and J5 stated they did not know how they knew a rule (see J13, seg. 28, 40; J5, seg. 54).

The macrosystem segments assigned to impacts on nature and the environment were the most represented, with a frequency of 38.8%. For example, J1 stated that not following the rules at the macrosystem "is not so good for the environment" (J1, seg. 97). Reasons given include dumping trash in the ocean (see M2, seg. 76), melting glaciers (see J3, seg. 131),

drying up bodies of water (see J3, seg. 102), degrading air quality (see J3, seg. 86), and damaging our atmosphere (see J3, seg. 82). The occurrence of forest fires (see M4, seg. 17) and natural disasters such as floods (see J11, seg. 44) were also cited. These aspects all appeared several times and in different interview sequences.

With a share of 22.5% of the assigned statements, the impact on animals follows. 18 statements of the students deal with the reduced welfare of the animals and their extinction if not everyone would follow the rules (see M9, seg. 61).

Consequences for humans were mentioned with a frequency of 17.5%. Topics such as injustice (see M2, seg. 74), lack of resources (see J3, seg. 133), illness (see J3, seg. 50), and reduced quality of life (see J3, seg. 122). The reduction of living space (see J11, seg. 56) played a central role. Climate change and global warming were addressed in 10% of the statements. Interviewee J3 knows, for example: "The earth is getting warmer, and there are more and more exhaust gases in the air" (J3, seg. 84). M4 also directly links the melting of the polar ice caps to climate change: "There's a polar bear on an ice floe because that's also climate change because now it's melting because it's getting so warm" (M4, seg. 46). In 8.8% of the statements, however, it is evident that the students are partially unaware of the consequences of (not) acting ecologically responsibly (see M4, seg. 52).

5. DISCUSSION

Overall, there was an exciting asymmetry in terms of the breadth of rule awareness and the idea of the origin of the rules. The children were given picture cards and a lead-in to the interview that focused on rules related to environmental protection issues. Eleven themes were presented to the children and visualized through picture cards. According to Bronfenbrenner, these eleven topics were also specified on three social reference levels and introduced again in each case: microsystem "family", mesosystem "school", and macrosystem "Germany". That is, the eleven topics were offered a total of 33 times. In addition, key questions were asked to record the children's awareness of rules at each system level. These questions were answered as follows (see Table 2):

Table 2.
Key questions on the reference levels.

key questions	*level*	*given answers*
who makes the rules?	microsystem	parents / children / all together
	mesosystem	school principal / teacher
	macrosystem	the society / parliament / politicians / court / police / German Chancellor / unknown
rule origin	microsystem	parents / idols / role models / media / unknown
	mesosystem	classroom rules / media / education system
	macrosystem	education system / media / laws / unknown
consequences from rules	for all three system levels	effects on the interviewee himself / on animals / on all humans / on nature / climate change and global warming

Children participate in public discourse on political issues and political responsibility at a very young age (cf. Berton, & Schäfer, 2005). They show awareness of numerous ecological issues and can reproduce relevant lines of argument. They understand a healthy environment as a community concern and emphasize the need for mindful use of resources. They are familiar with rules as a framework for orientation in social contexts. They believe such political rules should be binding and that rule violations can also be punished. They still need to clearly distinguish between the legislative, executive, and judicial branches of government and tend to associate specific individuals rather than offices with responsibilities.

6. CONCLUSION

Two aspects, in particular, are interesting for our study: The response sequences reflect the broad medial "techno-subsystem" (Johnson, & Puplampu, 2008). At all three ecological systems, media (newspapers, television, radio, Internet) are named as sources for rule knowledge, but not books. That shows that media not only determine childhood today as a matter of course but that in the various systems, these media are also explicitly introduced by the social mediating instances as a justification instance and a source of information. On the mesosystem, on the other hand, no media appear as sources at all since the originators of the rules that apply here are solely institutionalized persons, namely the school principal and the teachers. They have the license of rule definition due to their social position in the system. An additional source of rule knowledge is unnecessary.

The second relevant aspect is the conspicuous lack of argumentative responses in the mesosystem. The children indeed possess detailed information about overall social reasoning (as also shown by naming the originators of rules). We also assume that the familial rules are experienced as valid as a matter of course and can be named. The school mesosystem, on the other hand, is left out. The school cannot be neglected as a mediating instance of rules (especially since education is explicitly mentioned several times). However, in contrast to the immediate experience of the family, the macrosystem of society is only present to the students in a mediated way. This mediating function is assumed by the family and the media insofar as they are received and discussed in the family, and above all, by the school in the context of ecological education. However, the school needs to integrate these general rules of the macrosystem into its own rules. The statements of the children interviewed indicate that the school, unlike the family, does not operationalize these rules as a mesosystem. With Buchanan-Barrow and Barrett (1998), we assume this is due to a particular structure of the school mesosystem. Where the school provides information beyond the rules that apply to it, as a mesosystem, and that our school rules in the narrow sense, it does refer to rule validity, rule origin, and rule actors in the macrosystem. However, the school does not come into view as its own rule instance in relation to these rules of the macrosystem. It mediates without offering an operational realization in its institution for the children (cf. Thornberg, 2008).

An example would be the demand on the part of the school for waste separation in the classroom. That would practice a macrosystemic orientation mesosystemically. It will be an essential aspect of our further research to further analyze this mediating function of the mesosystem, especially regarding a school-based thematization of the medial regular offers.

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AUTHORS' INFORMATION

Full name: Gudrun Marci-Boehncke
Institutional affiliation: Institute für Diversity Studies, TU Dortmund University
Institutional address: Emil-Figge-Str. 50, 44227 Dortmund, Germany
Email address: gudrun.marci@tu-dortmund.de
Biographical sketch: Dr. Marci-Boehncke is Professor for German Literature and Applied Studies at TU Dortmund University. She is head of Research Center Youth – Media – Education in Dortmund and leading part of the PoJoMeC research team. Further research interests are Media Studies and Media Education, Digital Literacy in early years and youth as well as Diversity Studies and Intersectionality.

Full name: Matthias O. Rath
Institutional affiliation: Institute of Philosophy, Ludwigsburg University of Education
Institutional address: Reuteallee 46, 71634 Ludwigsburg, Germany
Email address: rath@ph-ludwigsburg.de
Biographical sketch: Dr. Matthias O. Rath is Professor for Philosophy at the Ludwigsburg University of Education. He is head of Research Center Youth – Media – Education in Ludwigsburg. Further research interests are Media Studies, Media Education, Media Ethics.

Full name: Madeleine Rusch
Institutional affiliation: Ludwigsburg University of Education
Institutional address: Reuteallee 46, 71634 Ludwigsburg, Germany
Email address: madeleine.rusch@seminar-sindelfingen.de
Biographical sketch: Madeleine Rusch has a master's degree in teaching at the primary school level and is working on a dissertation on children's environmental awareness.

Section 4
Organizational Issues

Chapter #32

BULLYING AS DRIVER OF LOW MATHEMATICS AND SCIENCE ACHIEVEMENT IN SOUTH AFRICAN SCHOOLS IN A CHALLENGED CONTEXT

Marien Alet Graham
Department of Science, Mathematics and Technology Education, University of Pretoria, South Africa

ABSTRACT
All children deserve safe, decent schooling; but school bullying dominates South African news. We used Bronfenbrenner's ecological theory to examine bullying and Grade 9 math and science achievement in public schools without tuition. We used a quantitative positivist approach using TIMSS 2019 data to develop multi-level models, each with 20 predictors and maths and science achievement as the outcomes. Unsurprisingly, learners who were refused to talk to, had their family insulted, forced to do things they didn't want to do, shared nasty or hurtful messages or embarrassing photos about them online and were physically hurt, performed significantly worse. Principals' views on learner intimidation and verbal abuse were significant predictors. Surprisingly, learners who reported being stolen from significantly outperformed those who reported being stolen from less or not at all. This seems counterintuitive, but we offer some explanations. In the maths model only, learners who had mean things said about their physical appearance outperformed those who had this happen less often, and in the science model only, learners who had lies spread about them significantly outperformed those who did not (again, we provide suggestions for these counterintuitive results). Recommendations are provided for future research.

Keywords: bullying, mathematics achievement, science achievement, TIMSS, socio-economic status, challenged context.

1. INTRODUCTION

Bullying in childhood and adolescence, whether as bullies, victims, or spectators, has long-term effects, including negative behaviour, mental health disorders, financial concerns, low psychological well-being, low social adjustment, coping difficulties, psychological distress, and suicide risk (Xue, Hu, Chai, Han, & Sun, 2022; Yosep, Hikmat, Mardhiyah, Hazmi, & Hernawaty, 2022) and poor academic achievement (Dias-Viana, Noronha, & Valentini, 2023; Tiauzon & Malquisto, 2019). We link traditional and cyberbullying to mathematics achievement (MA) and science achievement (SA), as the Trends in International Mathematics and Science Study (TIMSS) 2019 results indicated poor results for these important subjects for South African learners. TIMSS studies are undertaken at the fourth and eighth-grade levels, but due to poor performance, South Africa conducted it at fifth and ninth-grade levels (Reddy et al., 2015); this study considers the latter. At Grade 9 level, 39 countries participated, and South Africa was second to last in MA and last in SA (Reddy et al., 2021). These results are alarming, and we investigated how bullying is associated with MA and SA and discussed implications for researchers, such as suggestions for future bullying intervention programs.

2. RATIONALE

The 2022 UNICEF "Disrupting Harm Study" found that 70% of South African children engage in risky online behaviour, such as cyberbullying, without parental consent. Bullying has been linked to learner MA and SA, but few studies have considered the hierarchical levels of an educational setting, such as the learner-level and the school-level (Woltman, Feldstain, MacKay, & Rocchi, 2012), and, to the best of our knowledge, no such study has been done on South African learners in disadvantaged communities. Low-SES learners were chosen because South African education literature shows that they are bullied more often (Johansson, Myrberg, & Toropova, 2022). It is hypothesised that South African learners in poor communities in less-researched environments (Global South) who are bullied in traditional or online means perform worse in math and science. We also considered bullying interventions, because of the uniqueness of South African no-fee-paying schools in poor communities, instead of simply employing generic bullying interventions, targeted interventions must be used to address specific problem areas. Thus, the current study contributes to the literature on resilience, bullying, and school interventions for underserved youth by recommending targeted interventions to improve MA and SA in low-SES South African schools.

3. LITERATURE AND FRAMEWORK

3.1. Literature Review

Bullying and its impact on learners' academic achievement has been the subject of extensive global research conducted in numerous countries and diverse educational settings over many years. Tiauzon and Malquisto (2019) conducted a study in the Philippines using 1,000 Grade 7 learners and found a negative association between achievement and bullying. Djunaid, Puluhulawa, and Yusuf (2019) conducted a study in Indonesia using data from 68 learners and found that bullying and achievement were significantly associated. Samara Da Silva Nascimento, El-Asam, Hammuda, and Khattab (2021) conducted a systematic review and a meta-analysis to address the question "How can bullying victimization lead to lower academic achievement?" (p. 1) using literature between January 2000 and January 2020 by considering mediating factors between bullying and academic achievement. They specifically focused on cognitive-motivational factors (e.g., self-concept and self-esteem) and found that bullying victimisation was negatively related to cognitive-motivational factors which, in turn, was associated with poorer academic achievement. In the next year, Laith and Vaillancourt (2022) published a review paper on the literature on relationships between bullying victimisation, academic achievement and school attendance, with a specific focus on longitudinal studies, and concluded that far more longitudinal studies need to be conducted to fully understand the complex patterns of associations between these three factors, but that, overall, bullying victimization can function as both antecedent and consequence of poor academic achievement and engagement. More recently, Dias-Viana et al. (2023) used data from 428 Brazilian learners and found a direct significant effect between being bullied and performance. The further mediation analysis revealed that the influence of being bullied on MA was entirely mediated by positive emotions experienced at school. Graham (2023) conducted a secondary study of South African Grade 9 TIMSS 2019 data to test for a significant association between bullying and MA. The multi-level analysis revealed that certain bullying behaviours, such as learners refusing to engage in conversation with other learners, insulting their families, coercing them into activities against their will, sending

hurtful messages or sharing embarrassing photos of them online, inflicting physical harm, making derogatory comments about their physical appearance and causing physical harm to other learners, were all significantly associated with MA.

Many studies focus on reducing or eliminating bullying in schools altogether; however, many of the recommended interventions are expensive and unrealistic to implement for schools in economically disadvantaged areas. It may be argued that the government can pay for these interventions; however, government funding is limited, and for some of these interventions, it's not as simple as reimbursing, say, a specialist for their time spent on presenting a workshop as some interventions include the printing of material and the need to purchase specialised gear (e.g., karate clothes). Examples of interventions where materials must be printed are, for example, the social cognitive theory (SCT)-based intervention (Salimi et al., 2019) which involves providing education about bullying. This study was conducted in elementary schools in deprived and semi-deprived areas of Kermanshah City, west of Iran, and was based on socio-cultural characteristics that focused on the SCT theory to reduce and potentially eliminate bullying in schools. Salimi et al. (2019) carried out four training sessions over six weeks with learners, four 20-minute sessions and one 90-minute session with school personnel and parents, and materials, which included "a booklet, two posters, texts and messages for speech, and five scenarios of role- playing" (Salimi et al., 2019, p. 3) had to be created and printed. Another example of where there are printing costs are problematic is the study by Scott, Wang and Cheong (2023), who focused on low-SES Latinx learners, where an intervention was employed using bibliotherapy as a means to enhance learners' capacity to recognise instances of bullying, interpret such situations as emergencies, and cultivate greater empathy towards the victims, thus fostering a greater willingness to intervene. Examples of interventions where specialised gear must be purchased include sports-based mental health interventions using karate (Greco, Fischetti, Cataldi, & Latino, 2019) and martial arts, meditation, breathing exercises and stretching activities (Moore, Woodcock, & Dudley, 2019); all activities that have shown to increase resilience and self-efficacy. Greco et al. (2019) held a 12-week karate-based intervention in Italy that consisted of 25 learners doing karate for one hour once per week. Moore et al. (2019) conducted a study in Australia where 282 participants participated in ten 50-minute sessions once per week for 10 weeks, that involved martial arts, meditation, breathing exercises and stretching activities. Although both studies had successful outcomes, it should be noted that Greco et al. (2019) conducted their study with learners whose SES is reported as high average, and the SES for the participants in Moore et al.'s (2019) study were low to low-average (45.1%) and high-average to high (54.9%); thus, the majority being from the higher SES side.

As mentioned above, bullying leads to poor academic performance, and many bullying prevention interventions are expensive and may not be feasible for South African no-fee-paying schools in disadvantaged areas, which cannot collect fees or raise funds (Dass & Rinquest, 2017).

3.2. Theoretical Framework

The systems of Bronfenbrenner's (1977) ecological theory are: the "microsystem" (the learner), the "mesosystem" (the connection between the learner's microsystem, e.g., the learner and their friends), the "exosystem" (formal institutions, such as the parents' work and school environments), and the "macrosystem" (the learners' societal culture, e.g., SES and ethnicity). Multi-level models are considered ideal for analysing school data due to the nested structure inherent in educational settings where students are nested within classrooms, classrooms within schools, etc. Accordingly, multi-level modeling was used in this study

with learner-level and school-level variables, with the learner-level variables speaking to Bronfenbrenner's micro- and mesosystems (e.g., the learner and relationships between learners), and the school-level variables speaking to the exo- and macrosystems (e.g., the school environment, which of course, is tied to learners' societal culture as the latter encompasses the shared values, beliefs, norms, and practices of a society, and these elements significantly influence the educational system). In essence, this study recognises the holistic nature of Bronfenbrenner's ecological theory, emphasising that all its systems - microsystem, mesosystem, exosystem, and macrosystem - should be duly considered to comprehensively address the research question at hand.

4. METHOD

4.1. Research Design and Participants

A quantitative, secondary data analysis using TIMSS 2019 data was utilised, and only the data from non-fee-paying schools were used. The South African school funding model has five Quintiles (Q) 1–5 schools. These Q's determine government school funding. Top- Q's (Q4-Q5) charge tuition, while bottom-Q's (Q1-Q3) are free. Q1 are in the poorest neighbourhoods, whereas Q5 are in the wealthiest. No-fee schools receive all their money from the government and cannot charge fees. However, fee-paying institutions can raise funds and regulate operating revenue (Dass & Rinquest, 2017). The TIMSS 2019 learner questionnaire, which learners answered, was used at learner-level/level-1/L1), and the principal and teacher questionnaires, which principals and teachers answered, were used at school-level/level-2/L2.

4.2. Data Collection and Quality Assurance

South Africa's TIMSS 2019 data collection occurred in September 2018 (Cotter, Centurino, & Mullis, 2020). We recommend readers to Cotter et al. (2020) and LaRoche, Joncas and Foy (2020) for information regarding the rigour (e.g., reliability and validity) with which the TIMSS 2019 developers developed the TIMSS 2019 instruments.

4.3. Data Analysis

SPSSv.28.0 was used to replace missing values using multiple imputation (recommendation: Van Ginkel, Linting, Rippe, & Van der Voort, 2020), and HLMv.7 was used for multi-level analysis. The dependent variable is achievement (MA for the mathematics model and SA for the science model); the HLM software uses all five plausible achievement values. The predictors used at L1 were 14 bullying items: those in boldface in Tables 3 and 4 plus "Shared my secrets with others", "Threatened me", "Excluded me from their group (e.g., parties, messaging)", and "Damaged something of mine on purpose" TIMSS (2018a, p. 12). At L2, the principals had to indicate the severity of the problems: "Intimidation or verbal abuse among students (including texting, emailing, etc.)" and "Physical injury to other students" (TIMSS, 2018b, p. 7). Teachers had to indicate their level of agreement: "This school has clear rules about student conduct" and "This school's rules are enforced in a fair and consistent manner" (TIMSS, 2018c, p. 3).

As in many studies, gender and SES were controlled for in the L1 model (Graham, 2022; Xue et al., 2022). SES was controlled for since, though the focus of this study is on schools in a challenged context, there are substantive financial differences between the quintiles in terms of the funding they receive from the government, as Q1 (poorest) receives the highest allocation per learner, Q2 receives less and Q3 even less. All the predictors are

ordinal (except the control variables, gender (binary) and home educational resources (continuous)) and were treated as continuous variables (Robitzsch, 2020). For continuous variables, it is typical to use group centring at L1 and grand centring at L2 (Raudenbush & Bryk, 2002), and this is what we have done. Variable weighting was done as per the recommendations of Stancel-Piątak et al. (2013).

5. RESULTS

The null models without any variables were created to show the variance (var) between the schools (Table 1). The var at L2 is significantly different from zero ($p<0.001$) for both models, indicating significant achievement variation between schools.

Table 1.
Null models.

		var	*df*	χ^2	*p*
Mathematics	L2, intercept	733.83	279	3,801.13	<0.001
	L1, slope	3,061.58			
Statistics	L2, intercept	1,414.91	279	4,208.85	<0.001
	L1, slope	5,481.14			

After creating the null models, full models were created where all the predictors, control variables and achievement scores were entered. The final models were created by removing all insignificant predictors one at a time from the full model until only significant predictors remained (Table 2).

Table 2.
Final models.

		var	*df*	χ^2	*p*
Mathematics	L2, intercept	716.80	278	4,201.35	<0.001
	L1, slope	2,770.60			
Statistics	L2, intercept	1,369.99	278	4,945.16	<0.001
	L1, slope	4,589.78			

Table 2 reveals that L2 significantly differs from zero ($p<0.001$) for both models, indicating significant achievement variation between schools. By comparing the var components of the final models to those of the null model, the percentage reduction in the var at L1 was 9.5%, for L2 was 2.3% for the maths model and 16.3% (L1) and 3.2% (L2) for the science model. Tables 3 and 4 provide information on the significant predictors for MA and SA.

Table 3.
Significant predictors of MA.

Variable description	Response options	Coefficient	Standard Error	*t*	p
Intercept		357.70	2.41	148.62	<0.001*
	L1				
"Are you a girl or a boy?" TIMSS (2018a, p. 3)	1="Girl" 2="Boy"	1.38	1.32	1.03	0.312
"Home educational resources" Yin and Fishbein (2020, p. 16.168)	<8.4 "few resources" 8.4–12.2 "some resources" >12.2 "many resources"	0.34	0.44	0.78	0.444
"Said mean things about my physical appearance (e.g., my hair, my size)"	1="At least once a week" 2="Once or twice a month" 3="A few times a year" 4="Never"	-1.58	0.50	-3.16	0.003*
"Refused to talk to me"		1.73	0.49	3.49	0.001*
"Insulted a member of my family"		4.10	0.52	7.86	<0.001*
"Stole something from me"		-7.01	0.51	-13.63	<0.001*
"Made me do things I didn't want to do"		2.67	0.76	3.49	0.004*
"Sent me nasty or hurtful messages online"		1.61	0.65	2.52	0.014*
"Shared nasty or hurtful things about me online"		4.53	0.75	6.04	<0.001*
"Shared embarrassing photos of me online"		7.25	0.92	7.82	<0.001*
"Physically hurt me" TIMSS (2018a, p. 12)		3.59	0.78	4.62	0.001*
	L2				
"Intimidation or verbal abuse among students (including texting, emailing, etc.)" (TIMSS, 2018b, p. 7)	1="Not a problem" 2="Minor problem" 3="Moderate problem" 4="Serious problem"	7.09	1.76	4.02	<0.001*

*$p<0.05$

Unsurprising results:

L1: For learners who "refused to talk to me", "insulted a member of my family", "made me do things I didn't want to do", "sent me nasty or hurtful messages online", "shared nasty or hurtful things about me online", "shared embarrassing photos of my online" and "physically hurt me", since all ß's positive and all $p<0.05$, those where these things happened to less frequently achieved higher scores than learners where these things happen more frequently.

Surprising results:

L1: The relationship between "said mean things about my physical appearance (e.g., my hair, my size)" and MA was significant (ß=-1.58, $p=0.003$), indicating for every unit increase in the predictor, with an increase indicating mean things being said happens less frequently, MA decreased on average by 1.58.

L1: The relationship between "stole something from me" and MA was significant (ß=- 7.01, $p<0.001$), indicating for every unit increase in this predictor, with an increase indicating it is happening less frequently, MA decreased on average by 7.01.

L2: The relationship between "Intimidation or verbal abuse among students (including texting, emailing, etc.)" and MA was significant (ß=7.09, $p<0.001$) indicating for every unit increase in this predictor, with an increase indicating the beliefs of the principals that the level of severity of the problem is a serious one, MA increased on average by 7.09.

Table 4.
Significant predictors of SA.

Variable description	Response options	Coefficient	Standard Error	*t*	*p*
Intercept		323.37	3.87	83.66	<0.001*
	L1				
"Are you a girl or a boy?" TIMSS (2018a, p. 3)	1="Girl" 2="Boy"	-0.21	1.72	-0.12	0.902
"Home educational resources" Yin and Fishbein (2020, p. 16.168)	<8.4 "few resources" 8.4–12.2 "some resources" >12.2 "many resources"	1.72	0.71	2.40	0.022*
"Spread lies about me"	1="At least once a week" 2="Once or twice a month" 3="A few times a year" 4="Never"	-2.58	0.77	-3.35	0.001*
"Refused to talk to me"		4.12	1.12	3.69	0.004*
"Insulted a member of my family"		6.56	0.90	7.29	<0.001*
"Stole something from me"		-9.69	0.86	-11.28	<0.001*
"Made me do things I didn't want to do"		4.73	1.13	4.21	<0.001*
"Sent me nasty or hurtful messages online"		3.63	1.16	3.12	0.003*
"Shared nasty or hurtful things about me online"		8.96	1.09	8.19	<0.001*
"Shared embarrassing photos of me online"		12.39	1.11	11.17	<0.001*
"Physically hurt me" TIMSS (2018a, p. 12)		4.86	1.05	4.59	<0.001*
	L2				
"Intimidation or verbal abuse among students (including texting, emailing, etc.)" (TIMSS, 2018b, p. 7)	1="Not a problem" 2="Minor problem" 3="Moderate problem" 4="Serious problem"	11.50	4.36	2.64	0.009*

*p<0.05

Unsurprising results:

L1: For learners who "refused to talk to me", "insulted a member of my family", "made me do things I didn't want to do", "sent me nasty or hurtful messages online", "shared nasty or hurtful things about me online", "shared embarrassing photos of my online" and "physically hurt me" happened less frequently achieved higher SA than learners where these things happen more frequently (since all ß's positive and all p<0.05).

Surprising results:

L1: The relationship between "spread lies about me", and SA was significant (ß=- 2.58, p=0.001), indicating for every unit increase in lying, with an increase in this variable indicating it is happening less frequently, SA decreased on average by 2.58.

L1: The relationship between "stole something from me" and maths achievement was significant (ß=-9.69, p<0.001), indicating for every unit increase in stealing, with an increase in this variable indicating it is happening less frequently, SA decreased on average by 9.69.

L2: The relationship between "Intimidation or verbal abuse among students (including texting, emailing, etc.)" and SA was significant (ß=11.50, p=0.009), indicating for every unit increase in intimidation/verbal abuse, with an increase in this variable indicating the beliefs of the principals that the level of severity of the problem is a serious one, SA increased on average by 11.50.

6. DISCUSSION

At L1, which links to Bronfenbrenner's micro- and mesosystem, refusing to talk to learners, insulting their families, forcing them to do things they didn't want to do, sharing nasty or hurtful messages or embarrassing photos of them online, physically hurting them, saying mean things about their physical appearance, and stealing from them were significant predictors of Grade 9 MA and SA. Unexpectedly, the mathematics model revealed that learners who heard negative remarks about their physical appearance less frequently had much lower grades than those who heard such remarks more frequently. This surprising result could be attributed to the normalisation of obesity in South African schools, especially in economically disadvantaged areas as recent studies, for example, Verduci, Di Profio, Fiore, and Zuccotti (2022) pointed out that the prevalence of obesity in South African girls aged 10 to 19 years who eat lunch outside the home (typically at the school), is 60.2%. Many South African schools in economically disadvantaged areas provide lunch for learners (Ismail, Mda, & Mashiyi, 2022). Other recent studies on obesity in South African low-SES schools also emphasise the rising levels of obesity (Long et al., 2022; Seabi et al., 2021) and being obese has even been described as "normalised" among South Africa's urban poor (Day, Gray, Padayachee, & Cois, 2020, p. 252). This predictor is about physical appearance, including size; therefore, the exponential increase in obese South African youngsters may have distorted the results. For science, it was unexpected to find that learners who have had lies spread about them less frequently had significantly worse grades than those where lies spread more frequently. This result may be attributed to the resilient nature of South African learners in challenged contexts (Bandeira, Graham, & Ebersöhn, 2023; Theron, Ungar, & Höltge, 2022).

For both models, another surprising result was that learners who reported being stolen from less frequently had considerably worse achievement than their counterparts. This startling conclusion could be explained by the fact that "stole something from me" can be construed in numerous ways. Some learners may have believed that a missing pencil or eraser constitutes theft, while others may have considered it primarily referring to larger objects such as calculators or textbooks. In the following cycle of TIMSS, it is suggested that the question's wording be changed to "stole anything of value from me". This suggestion is made, as researchers have noted that theft in South African schools is common (Obadire & Sinthumule, 2021) and that theft of small items, such as another child's lunch, is not uncommon (Mahabeer, 2020).

At L2, for both models, school environment in the form of intimidation or verbal abuse among learners being a problem is a significant predictor for MA and SA, which links to the exosystem of Bronfenbrenner's framework. The results showed that for learners in schools where principals felt that the severity of the problem was serious, both MA and SA increased. This surprising conclusion may be attributed to South African learners' resilience in challenging situations, according to Theron et al. (2022). We would not have found these startling results if we had employed the TIMSS bullying scale by averaging the bullying items. It's also of interest to note that some of the items in the bullying scale of TIMSS 2019 were not found to be significant predictors ("Said mean things about my physical appearance (e.g., my hair, my size)" (SA only), "Spread lies about me" (MA only), "Shared my secrets with others" (MA and SA), "Threatened me" (MA and SA), "Excluded me from their group (e.g., parties, messaging)" (MA and SA), "Damaged something of mine on purpose" (MA and SA). Simply using the TIMSS bullying scale, we would have missed these findings.

7. LIMITATIONS

TIMSS is an International Large-Scale Assessment (ILSA), and Klemenčič and Mirazchiyski (2018) have pointed out the following limitations of ILSAs: "(1) ranking is relative to the other participating educational systems; (2) significant differences between the ranked systems are often insufficient; (3) the role of contextual factors related to student achievement is disregarded; (4) single number estimates are not representative of the whole spectrum of the distribution; and (5) non-cognitive (personality, psychological) aspects are ignored" (p. 321). Also, as TIMSS studies are cross-sectional, causation can't be proven. Furthermore, although some recommendations for interventions are provided, the study served as a foundational exploration, paving the way for subsequent research that focuses explicitly on effective anti-bullying interventions in the South African context and is not meant to offer solid solutions to eliminate bullying altogether, but rather, guidelines as to get there.

8. CONCLUSIONS AND RECOMMENDATIONS

The first recommendation is that the TIMSS team consider rephrasing the item phrased "stole something from me" to "stole anything of value from me", as the results showed unexpected results for this item. From the results, it is evident that predictors of both traditional and cyberbullying were significant predictors of academic achievement in low-SES schools. Evangelio, Rodríguez-González, Fernández-Río, and Gonzalez-Villora (2022) found that only two of 43 articles on cyberbullying from 2016 to 2020 focused on South African schoolchildren, highlighting the need for further research in South African schools. It should be acknowledged that their study only focused on the ages children start using mobile phones and social media and not on all schoolchildren. More studies on bullying in low-SES South African schools are needed, as literature on South African education has shown that learners from lower-SES schools reported being bullied more often than learners in higher-SES schools (Johansson et al., 2022). Regarding bullying interventions, we recommend that focused interventions be used with a focus on the predictors significantly negatively associated with achievement. Thus, directed workshops could be developed with an emphasis on teaching learners to respect each other's property and families, not to send (or share) nasty or hurtful messages or embarrassing photos online, not to hurt another learner physically, and that something that may appear harmless ("refused to talk to me") is considered bullying and is unacceptable. Learners must be informed that bullying policies have clear penalties. Due to COVID-19, e-Learning has risen dramatically in the previous two years. All learner-teacher training should include cyber-safety and cyber-protection measures. The study's conclusions affect more than South Africa's education system. Suppose bullying victimisation severely hurts learner academic performance. In that circumstance, widespread bullying may slow human capital growth and hurt students and South Africa's economic growth. This is why studies like these carry weight, and the recommendations should be taken seriously by the relevant stakeholders.

ETHICAL CONSIDERATIONS

No authorisation was required to analyse the TIMSS 2019 data, as it is publicly accessible online (Fishbein, Foy, & Yin, 2021).

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AUTHOR INFORMATION

Full name: Marien Alet Graham
Institutional affiliation: Department of Science, Mathematics and Technology Education, University of Pretoria, South Africa
Institutional address: Faculty of Education, University of Pretoria, Groenkloof Campus, Natural Sciences Building Room 3-2, Corner of George Storrar Drive and Leyds Street, Groenkloof, Pretoria, 0002
Short biographical sketch: From the start of her career, Prof. Graham focused on developing new statistical techniques, specifically in the research area of statistical quality control. In the last few years, she has deepened that focus to generate a more detailed understanding of how learning and assessment opportunities for students at all levels of the formal education system (early learning, primary, secondary and tertiary) and their overall mental health and well-being can be improved. She uses sophisticated, novel statistical techniques to inform that understanding. She has contributed to many fields, including education, healthcare, and social issues. She holds a doctoral degree in mathematical statistics and is a Y1-rated researcher with the National Research Foundation (NRF), South Africa. She serves on the editorial advisory board of Scientific Studies and Research, Series Mathematics and Informatics, has published over 100 articles in peer-reviewed journals and regularly presents her findings at national and international conferences.

Chapter #33

THE EFFECT OF ENTREPRENEURIAL LEADERSHIP ON TEACHER JOB SATISFACTION: THE MEDIATING EFFECT OF PROFESSIONAL DEVELOPMENT, TEACHER-STUDENT RELATIONS AND TEAMWORK

Devorah Eden[1] & Ido Liberman[2]
[1]*Department of Education, Western Galilee College, Israel*
[2]*Department of Sociology and Anthropology, Western Galilee College, Israel*

ABSTRACT
Privatization and decentralization policies in Israel's educational system have spawned entrepreneurial leadership among school principals. We define entrepreneurial leadership as the combination of principals' proactiveness (seeking opportunities for innovations), and school innovativeness (actual innovations). Principals as entrepreneurs must ensure that teachers overcome their resistance to the frequent changes and willingly participate in their implementation. We suggest that this depends on their job satisfaction. The literature indicates that job satisfaction is related to teachers' professional development, good teacher-student interaction, and teamwork. Data were collected from 410 Israeli teachers who completed a questionnaire evaluating their principal and his/her effect on them. We hypothesize that (a) proactiveness and innovativeness will have a positive effect on teachers' job satisfaction; (b) the relationship will be mediated by teachers' professional development, teacher-student relations, and teamwork. The results partially supported our mediation model. We concluded that teachers follow their principal willingly and actively when provided with opportunities for growth and satisfaction.

Keywords: entrepreneurial leadership, professional development, teamwork, teacher-student relations, quantitative research.

1. INTRODUCTION

Privatization and decentralization have brought about increasing competition among schools for recruiting students and made outside funding available to schools (Man, 2010). These have resulted in pressure on school principals to become entrepreneurial leaders (Harel Ben Shahar, 2018) and implement frequent and large-scale innovations.

Entrepreneurship in education consists of finding outside resources for educational activities in the school. It requires traits such as risk-taking, networking abilities, vision, principals' proactivity and school innovation. In this study, we refer only to proactivity and innovation, which are the two main dimensions of entrepreneurship (Eyal & Inbar, 2003). Proactivity means the principal's willingness to initiate new programs in school by introducing opportunities into the institution's organization (Eyal & Inbar, 2003), having teachers discuss and express their opinions, and being able to get the staff to work together (Gupta, MacMillan, & Surie, 2004). Innovation refers to activities actually implemented in the school (Eyal & Inbar, 2003).

Most of the literature on entrepreneurial leadership in education focuses on the aspects of the leadership external to the school. As principals respond to the decentralization and privatization of the schools, it becomes incumbent on them to take on

the role of entrepreneurial leaders and implement new initiatives. As reported in the literature, this situation requires that the principals overcome the teachers' resistance to change (Masry-Herzalah & Dor-Haim, 2021), especially veteran teachers (Snyder, 2017), and gain their motivation and cooperation. The literature goes on to report that this can be achieved by enhancing the teachers' satisfaction with their jobs.

Job satisfaction is both a cognitive (Herzberg, Mausner, & Snydermann, 1959) and affective (Weiss & Cropanzano, 1996) construct. It is both the judgment and the emotion that people have towards their work. It is determined by organizational factors one of which is supportive leadership (Bogler, 2001). Job satisfaction consists of intrinsic rewards such as self-development, quality of relations with students, and interaction with colleagues (Bogler, 2001), as well as extrinsic rewards such as promotion, improved work conditions. The macro dimension is that of outside school factors such as policies that can be either satisfiers or dissatisfiers (Dinham & Scott, 1997).

Thus, we examined the relationship between principals' entrepreneurial leadership and teachers' job satisfaction, mediated by the intrinsic organizational dimension of teachers' professional development, teacher-student relations, and teamwork.

2. THE THEORETICAL MODEL

2.1. Dependent Variable: Job Satisfaction

Theories of job satisfaction consist of cognitive and affective approaches. The cognitive aspect of job satisfaction refers to peoples' evaluation of their work as satisfactory when comparing with their own objectives or with other jobs (Dugguh & Ayaga, 2014) and the content of their job satisfaction (Herzberg et al., 1959). The second approach addresses the affective experience at work and analyzes job satisfaction in terms of emotions (Weiss, 2002). Based on the affective approach, Skaalvik and Skaalvik (2010, 2011), and Aldridge and Fraser (2016) defined teachers' satisfaction as enjoyment of their work. Enjoyment refers to work in general, or to parts of the job that produce job satisfaction (Skaalvik & Skaalvik, 2009). Job satisfaction predicts the decision to continue working in one's current position (Bogler, 2001).

Organizational determinants of job satisfaction include satisfaction with job itself and supervision, role, school type, and different types of rewards. These include extrinsic rewards such as salary, opportunities for advancement, and working conditions, or intrinsic rewards that include three elements: teacher own growth, relationship with students, and interaction with colleagues. Self-growth through professional development that consists of an active learning of new teaching materials, and also opportunities for doing collaborative research (Taylor, Yates, Meyer, & Kinsella, 2011; Wang, Luo, & Zhang, 2019). The quality of interaction with students is the most important determinant of teachers' job satisfaction (Skaalvik & Skaalvik, 2014); this includes classroom discipline, student behavior or misbehavior, and scholastic achievement. Staff collaboration through sharing information (Duyar, Gumus, & Sukru Bellibas, 2013; Skaalvik & Skaalvik, 2015). This relationship was also found among manufacturing workers when given autonomy (Griffin, Patterson, & West, 2001). One of the most studied relationships regarding job satisfaction is the interaction between employees and their supervisors (Bhal & Ansari, 1996). Leadership that is regarded as transformational affects job satisfaction (Braun, Peus, Weisweiler, & Frey, 2013), as does support from principals (Aldridge & Fraser, 2016). These relationships are cross-cultural, and are evident in Israel (Bogler, 2001), Greece (Koutouzis & Malliara, 2017), and Indonesia (Eliyana, Ma'arif, & Muzakki, 2019).

2.2. Independent Variable: Entrepreneurial Leadership

Decentralization and privatization have made private funding available to schools (Man, 2010). As a result, principals have to act as entrepreneurs and bring innovation and change to their schools (Man, 2010; Pihie, Asimiran, & Bagheri, 2014). The literature on entrepreneurial leadership presents two approaches to this concept. The first argues that entrepreneurial leadership is similar to transformational leadership (Eyal & Kark, 2004), or includes elements of it, such as charisma (Nwachukwu, Chladkova, & Zufan, &, 2017). The second maintains that entrepreneurial leadership is a phenomenon distinct from other leadership styles (Chen, 2007; Pihie et al., 2014). It is a hybrid of a leader's ability to combine the skills of communicating and networking with outside agencies in order to build support for their vision (Borasi & Finnigan, 2010) with the skills used inside the school to mobilize teachers' cooperation (Pashiardis & Savvides, 2011). Thus, Pashiardis and Brauckmann-Sajkiewicz (2018) defined a new emerging leadership style that they termed "edupreneurial," which links entrepreneurship with pedagogy to bring innovation. Innovations may range from small-scale innovations (Ensley, Pearce, & Hmieleski, 2006) to radical changes (Eyal & Inbar, 2003; Leffler, 2009), and include programs for teachers, new pedagogical projects for students, new subject matter, and new administrative structures.

Entrepreneurial leadership requires competencies, skills and behaviours (Harrison & Burnard, 2016). These include communication and networking with outside agencies (Borasi & Finnigan, 2010); recognizing and exploiting opportunities, being passionate, flexible, creative (Renko, El Tarabishy, Carsrud, & Brännback, 2015), praising workers, encouraging them, taking risks (Bagheri & Harrison, 2020), implementing innovation and being proactive (De Jong, Parker, Wennekers, &Wu, 2015; Eyal & Inbar, 2003). We follow Eyal and Inbar's (2003) definition of school entrepreneurship as the combination of principals' proactiveness and school innovativeness to test entrepreneurial leadership. Proactiveness means the degree and frequency of principal's active search for new opportunities and sharing it with teachers; innovativeness is defined as the degree and frequency of actual implementation of these opportunities in school.

Studies have established a relationship between entrepreneurial leadership and school-level variables. For example, González-Romá and Hernández (2016) reported that in banks, the number of innovations implemented had a direct positive effect on team performance and job satisfaction. Kongjinda, Niyamabha, Wichitpatcharaporn, Sakulthanasakdi Moore, and Koedsuwan, (2020) examined the relationship between entrepreneurial leadership and school effectiveness in private schools in Thailand and found relationship through the mediation of school culture and teacher OCB which were initiated by the principal. Wibowo and Saptono (2018) indicated that in Malaysia, entrepreneurial leadership affects teachers' innovativeness and creativity (Pihie et al., 2014).

2.3. Mediating Variables

2.3.1. Professional Development

Professional development refers to opportunities and programs to improve teachers' instructional competencies, deal with complex knowledge (Archibald, Coggshall, Croft, & Goe, 2011), and improve collegial collaboration leading to changes in teachers' practices and improvements in student learning (Darling-Hammond, Hyler, & Gardner, 2017). There are numerous models for professional development: in-service teacher training, school-university partnerships, conferences and workshops, teachers' informal exchanges

of knowledge by visiting each other's classrooms, short courses, tutorials, and mentoring (Archibald et al., 2011).

Professional development is a leading method for supporting reforms and increases teachers' use of new technologies (Donnely, McGarr, & O'Reilly, 2011), and promotes innovative behavior (Thurlings, Evers, & Vermeulen, 2015). It also creates a positive climate and is effective, mainly when principals practiced shared leadership styles (Urick & Bowers, 2014). These practices are effective in that they allow teachers to influence, control, and direct their own development (Rose, 2020).

2.3.2. Teacher-Student Relations

E. Skinner and Belmont (1993) described teacher-student relations as encompassing teachers' affection for their students, their willingness to devote their resources (help, time, and energy) to them, dependability and involvement, structure, and support for autonomy. Havik and Westergård (2020) documented that teachers' emotional support affected students' engagement, making the latter work harder in class.

Several factors affect the relations between teachers and students. One factor is student behavior. Hamre and Pianta (2001) reported that teachers' perceptions about student behavior affect three important areas of teacher-student relations: conflict, closeness, and dependency. Closeness indicates a positive relationship with students. It motivates teachers to spend extra time and energy to promote children's success. Student dependency also prompts teachers to exert extra effort, particularly with boys. In contrast, conflict leads to teachers' attempts to exclude disruptive children from the classroom (Pianta, 1994). These relations occur more with students who have difficulty learning (Hamre & Pianta, 2001). Additional factors involve gender, with teachers exhibiting closer relationships with girls than boys. Furthermore, high school students reported feeling closer to their homeroom teachers than to their subject teachers (Roorda, Jorgensen, & Koomen, 2019).

Positive teacher-student interactions and teachers' perceived ability to modify their students' attitudes and behavior are significant factors in their job satisfaction (Dinham & Scott, 1997; Skaalvik & Skaalvik, 2009, 2015; Veldman, van Tartwijk, Brekelmans, & Wubbels, 2013). Slaughter-Defoe and Carlson (1996) noted that teacher-student relations are the most important dimension of a school's climate. Barile et al. (2012) indicated that teacher-student relations play an important role in their sense of belonging in school, and Vieno, Perkins, Smith, and Santinello (2005) found that student sense of community in school was related to the degree of their participation in activities and sense of teacher fairness. Such students are less likely to get into trouble (Hopson & Lee, 2011), which ultimately increases teachers' satisfaction. Thus, teacher-student relations have an impact on teachers' job satisfaction.

Teamwork: Cohen and Bailey (1997) defined a team as "a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity" (p. 241). Teams develop in stages (Tuckman, 1965), during which they become creative and effective in diffusing change (Benoliel & Schechter, 2018). Skilled leaders promote teamwork. For example, Nielsen, Yarker, Randall, and Fehmidah (2009) found that transformational leaders improved the efficacy of nursing teams, leading to increases in their job satisfaction (Beverborg, Sleegers, & van Veen, 2015). Such leaders also shaped teams by maintaining their work environment (Benoliel, 2016). Studies in schools have determined that meetings with the principal were effective in sharing his/her vision with team coordinators (Eden,

2001). The cooperation aspect of teamwork is also related to enjoyment, learning, and job satisfaction (Skaalvik & Skaalvik, 2015).

According to Fitzgerald and Theilheimer (2013), teamwork is related to professional development, as it enables staff members to learn together and build peer relationships and feelings (Slaughter-Defoe & Carlson, 1996). These factors are especially important for novice teachers who learn from veteran teachers (Egodawatte, McDougall, & Stoilescu, 2011).

Wang et al. (2019) found that professional development, autonomy in instruction, teacher-student relations, and teacher cooperation predict teachers' job satisfaction.

2.4. Hypotheses

Based the literature on relationship between research variables, we hypothesize the following:

H1: The principal's entrepreneurial leadership, measured as the degree of proactiveness and innovativeness, will have a positive relationship with teachers' job satisfaction.

H2: There will be positive relationship between the principal's entrepreneurial leadership, measured as the degree of his or her proactiveness and innovativeness, and 1) the teachers' professional development, 2) teacher-student relations, and 3) teamwork.

H3: Teachers' professional development, teacher-student relations, and teamwork will mediate the relationship between the principal's entrepreneurial leadership and teachers' job satisfaction

3. METHOD

3.1. Sample

The participants were 410 teachers from different elementary, junior and senior high schools in Israel. We chose only teachers who had worked for more than two years with the same principal because the questionnaire on entrepreneurial leadership measured the principals' proactiveness and innovativeness in the last two years.

All of the teachers worked in public schools. Of the 410 respondents, 85.4% were Jewish. Of them, 65.6% served in secular schools and 19.8% in religious schools. The remaining 14.6% were Arab teachers. Israel's Central Bureau of Statistics ranks the SES of every community on a scale of 1, the lowest, to 10, the highest. The average SES index of these schools was 6.88, S.D =1.69 (YNet, 2018). Significant differences were found on all research variables between Jews and Arabs where Arabs were higher. However, the results indicated the same model for the two populations.

In accordance with Skaalvik and Skaalvik (2010), we approached all of the teachers present in the school at a particular time and distributed the questionnaires.

3.2. Research Instrument

The 33-item questionnaire was taken from two sources. Items about entrepreneurial leadership came from Eyal and Inbar (2003), who measured entrepreneurship as the degree and frequency of school innovativeness and principals' proactiveness. Items about job satisfaction and the mediating variables of professional development, teacher-student relations, and teamwork came from a 2019 survey created by the National Authority for Measuring and Evaluation (NAME), a division that is adjunct to the Ministry of Education. The survey measures school climate and students' scholastic achievement in all schools in

Israel. It contains questions on numerous aspects of school life, such as teacher-student relations, teamwork, professional development, and teachers' job satisfaction. The survey is distributed to students, teachers, and principals. Using the survey enabled us to study phenomena that are important locally, yet are congruent with international studies. The survey, which tests teachers' perceptions of the research variables, consists of Yes/No questions, which we modified into 6-point Likert scale questions ranging from 1-not at all, to 6- very much. We calculated all of the scores by averaging the responses to the items on that scale. We then calculated the score on the entire scale as the average of the items on that scale.

3.2.1. Job Satisfaction

We used two items from the NAME questionnaire that referred to general job satisfaction as enjoyment and accomplishment. Respectively, the items were: "The school makes sure that teachers feel that it is pleasant to be there" and "The school makes sure to enable teachers to succeed." Internal reliability was α =.92.

3.2.2. Entrepreneurial Leadership

The entrepreneurial leadership questionnaire was based on Eyal and Inbar's (2003) two dimensions: degree and frequency of principals' proactiveness and school innovativeness. The nine items included three items on principals' proactiveness and six items on school innovativeness. An example of the former is "Our school principal exhibits great initiative qualities" (Internal reliability was α= 0.75). An example of the latter is: "The innovations implemented in the last two years have radically changed the school" (Internal reliability was α =0.92).

3.2.3. Professional Development

The seven items on this scale referred to activities related to planning and sharing knowledge between colleagues that enable growth. An example of the items is: "We make sure to share the knowledge that teachers learn in in-service with other teachers." Internal reliability was α= 0.79.

3.2.4. Teacher-Student Relations

The nine items on this scale referred to the dedication of time and energy to students. For example, "In our school we hold personal meetings with students" and "Our school enables each student to advance according to their ability." Internal reliability was α =0.87.

3.2.5. Teamwork.

The four items on this scale referred to teachers' collaboration on pedagogical and emotional dimensions. For example, "The teachers help each other through difficulties" and "Teachers on the professional team plan the teaching aides they develop together." Internal reliability was α=0.82.

4. RESULTS

4.1. Descriptive Statistics

Table 1 presents the means, standard deviations, and correlations for all of the variables. The results show positive, strong and significant relationships between all of them.

Table 1.
Descriptive statistics and Pearson's Correlation Coefficient among research variables.

		Satisfaction	Teamwork	Teacher-student relations	Professional development	innovativeness
Proactiveness	M=4.89 S.d=.79	.441**	.623**	.786**	.746**	.859**
Innovativeness	M=4.55 S.d=.91	.377**	.595**	.728**	.699**	
Professional development	M=4.47 S.d=.85	.567**	.839**	.824**		
Teacher-student relations	M=4.79 S.d=.71	.561**	.742**			
Teamwork	M=4.61 S.d=.92	.528**				
Satisfaction	M=4.68 S.d=.98					

* $p < .05$. ** $p < .01$. *** $p < .001$

4.2. The Regression Model

Next, we conducted a linear hierarchical regression to test the suggested mediating model in accordance with Kenny, Kashy, and Bolger's (1998) mediation model. The results are shown in Table 2.

Step I indicates that both proactiveness and innovativeness are correlated with job satisfaction (β= 0.43***, 0.16*** respectively), supporting H1. Step II tests the relationship between the independent variable and the mediating variables. It indicates strong and significant correlations between entrepreneurial leadership (proactiveness and innovativeness) and two of the mediators: professional development: β = 0.27*** for proactiveness, and 0.47*** for innovativeness, and teacher-student relations: β=0.19*** for proactiveness and β=0.45*** for innovativeness, but not teamwork. Thus, H2 was partially supported.

Steps III and IV test the effect of the mediating variables on the independent variable. The results indicate that only professional development and teacher-student relations predict job satisfaction, not teamwork. They also indicate that the presence of all variables does not diminish the effect of the initial variable on the outcome variable of job satisfaction. Thus, H3 was partially supported. Considering the results, we concluded that the mediation model was partially supported as it does not fulfil all of Kenny et al.'s (1998) requirements for a mediating model.

Table 2.
Summary of the mediation model.

	Job Satisfaction			
	B	SE B	B	t
Step I: JS				
Pro	0.54	0.05	0.43	10.27 ***
Inno	0.18	0.05	0.16	3.84 ***
R^2				.32
F				185.35 ***
Step II: PD				
Pro	0.26	0.04	0.27	6.95 ***
Inno	0.44	0.04	0.41	10.46 ***
R^2				.41
F				274.22 ***
Step III: TSR				
Pro	0.15	0.03	0.19	4.71 ***
Inno	0.41	0.04	0.45	10.94 ***
R^2				.36
F				225.79 ***
Step IV: TW				
Pro	0.13	0.05	0.13	2.86 *
Inno	0.40	0.05	0.34	7.51 ***
R^2				.45
F				99.84 ***
Step III+ IV: JS				
Pro	.195	.051	.195	4.74 ***
Inno	.033	.042	.033	.86
PD	.276	.050	.276	6.41 ***
TSR	.230	.052	.230	6.11 ***
TW	.067	.037	.067	1.91
R^2				.46
F				135.49 ***

* $p < .05$ ** $p < .01$ ***$p < .001$

JS= job satisfaction; PD = professional development; TSR = teacher-student relations; TW=teamwork; Pro =proactiveness; Inno=innovativeness

5. DISCUSSION

We examined the relationship between principals' entrepreneurial leadership and teachers' job satisfaction due to the need of school principals to lead to frequent innovations due to competition between schools as a result of privatization and decentralization. The results confirmed our initial claim that the principal's ability to be proactive and implement innovations affects teachers' job satisfaction. These results are consistent with those of previous studies on other leadership styles. For instance, that distributed leadership has a significant effect on job satisfaction (Samancioglu, Baglibel, & Erwin, 2020), that transformational leadership affects teachers' satisfaction (Bogler, 2001; Koutouzis & Malliara, 2017), and that this relationship increases employees' happiness (Geijsel, Sleegers, Stoel, & Krüger, 2009).

However, while the results indicate that proactiveness and innovativeness are related to each other and go together, they affect job satisfaction in different ways. According to our findings, proactiveness predicts job satisfaction through the mediation of professional development and teacher-student relations, whereas innovation predicts job satisfaction directly, and proactiveness predicts job satisfaction more than does innovativeness. Thus, our claim regarding the mediation was partially confirmed. Our findings of the mediation concur with Garcia Torres (2018), who found that distributed leadership affects professional development, work satisfaction, and job satisfaction.

Our study also demonstrates that professional development and good teacher-student relations mediate between entrepreneurial leadership and teacher job satisfaction (Thurlings et al, 2015). When teachers are provided with intrinsic rewards, such as professional development and conditions for good relations with students – both being high-order needs of interest, challenge, and autonomy – teachers are satisfied with their work. Professional development answers the teachers' need for self-direction (Rose, 2020), which gives them interest and meaning that ultimately lead to job satisfaction (Graham, 2018; Keyhani & Kim, 2021). These rewards are satisfiers and motivators (Herzberg et al, 1959), and bring enjoyment to teachers (Skaakvik & Skaalvik, 2015). They encourage teacher experimentation and entrepreneurship (Brauckmann-Sajkiewicz & Pashiardis, 2020), and create a culture in which innovation is welcome (Weckström, Karlsson, Pöllänen, & Lastikka, 2021). Teacher-student relations also predict job satisfaction as it defines teachers' and students' sense of belonging (Vieno et al, 2005) and thus contributes to teachers' job satisfaction (Dinham & Scott, 1997). Although proactiveness and innovativeness are correlated with teamwork, teamwork does not mediate for either of them. A potential explanation may be that teachers respond positively to changes that result from professional collaboration and collegiality and from having the principal share new ideas with them, not necessarily from teaming up (Garcia Torres, 2019).

These results confirm our initial claim that organizational factors are essential for successful innovations. Indeed, these relationships between entrepreneurial leadership and teacher outcomes have been observed in other countries, including Malaysia (Wibowo & Saptono, 2018) and Thailand (Kongjinda et al, 2020).

6. SUMMARY AND CONCLUSIONS

The findings are useful for schools seeking to implement frequent changes. They also provide guidelines for helping principals overcome teachers' overt or covert resistance to innovative programs and ensuring that the innovations continue rather than fade away.

Entrepreneurial leadership can turn the dissatisfaction into satisfaction by strengthening the teachers' intrinsic rewards that are most important to them, thereby enhancing their motivation, sense of belonging and power over their work to face the uncertainty, and the resultant willingness to engage in innovations.

Principals who are entrepreneurial leaders are known to inspire teachers to participate actively in these endeavors (Gupta et al., 2004). They create the confidence in teachers that "On the organizational trapeze, individuals will take the entrepreneurial leap only if they believe there will be a strong and supportive pair of hands at the other end to catch them" (Ghoshal & Bartlett, 1999, p. 93). Entrepreneurial leadership and orientation, particularly openness to innovation and change, affect educational and organizational outcomes (Man, 2010). A ripple effect is created whereby job satisfaction fosters entrepreneurial behavior in teachers (Amorim Neto, Picanco Rodrigues, & Panzer, 2017), which in turn may lead to the intrinsic rewards so needed by teachers for job satisfaction and maximum performance. Teacher entrepreneurship may consist of developing and writing teaching material for a project, initiating a new project, and mobilizing outside resources (Amorim et al, 2017). Such activity will increase entrepreneurial orientation and the school's ability to face increasing privatization, as well as the market-related competition demands that are being increasingly put on teachers and principals

7. LIMITATIONS OF THE STUDY

This study has two major limitations. The first is method bias. Conway and Lance (2010) argued that the bias in organizational research stems from individuals' self-reports of their principals as leaders. Bogler and Nir (2015) suggested that studies must collect information regarding principals from several sources rather than only from teachers. The second limitation is the context of the study. The teacher sample was homogeneous economically. The vast majority of the schools were of average SES. However, the respondent population was demogrephically hererogenous. All schools studied were treated as one type. It is quite possible that considering the schools by type (religious/secular, elementary/ junior high/senior high, Jewish/Arab) might yield different results. It is also possible that context matters (Freeman & Fields, 2020) and that in other contexts, the results would be different. Thus, future studies should expand the sources of information such as that of the principals and the community, and contexts such as type and size of school, as well as exploring the impact of other organizational phenomena in mediating this relationship

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AUTHORS' INFORMATION

Full name: Devorah Eden, Ph.D.
Institutional affiliation: Western Galilee College
Institutional address: 2 Derech Hamichlala, Acre, Israel
Short biographical sketch: Dr. Devorah Eden is a Senior Lecturer at the Western Galilee College in the Department of Education. She teaches in the master's degree program in education systems management. Her interests are school leadership focusing on gender and organizations, multiculturalism in education, and entrepreneurial leadership. Her publications include articles on school leadership in multicultural schools, the paradox of school leadership and on principals as community leaders; gender equality policy in education, and covert discrimination of women faculty in academic conference; on multicultural education and policy towards work migrants. She teaches courses in educational policies in Israel, school change, organizational aspects of school, and decision-making. She presented papers in international conferences such as AERA. Dr. Eden has served in numerous committees, such as teaching committee of the college and of the master's degree, as well as coordinator of the two-track division in the education department.

Full name: Ido Liberman, Ph.D.
Institutional affiliation: Western Galilee Colleg
Institutional address: 2 Derech Hamichlala, Acre, Israel
Short biographical sketch: Dr. Liberman is a senior lecturer in the Department of Sociology and Anthropology at the Western Galilee College. His research focuses on the effects of postmodern thought on communities in Israel, especially the religious society. He specializes in research methodology in the social sciences. He teaches courses in the field of research methodology, postmodern society, immigration and social demography, entrepreneurship, and evaluation in organizations. He is also involved in applied research in government bodies, and serves as a consultant to several bodies in the social science. Recently, he studied the issue of identity building and lifestyle of religious young people at high school. He served as chair and member of several academic committees in the college such as the research committee, the teaching committee, and the multicultural committee. He is one of the founders of the Galilee Institute for Social Research.

Chapter #34

TRANSFORMATION IN SCHOOL LEADERSHIP: VOICES OF FEMALE LEADERS

Samantha Kriger[1] & Sinobia Kenny[2]
[1]*Faculty of Education, Cape Peninsula University of Technology, South Africa*
[2]*Department of Education Policies, Stellenbosch University, South Africa*

ABSTRACT
Due to an apartheid regime, South Africa was demarcated according to race classifications of 'white', 'coloured', Indian and 'black'. Race classifications determined where one lived, went to school, and the possibilities to pursue higher education. For women of color in South Africa interested in a post-schooling education, the state availed bursaries to pursue teaching (and nursing) to control and limit their careers. The backdrop to separate and segregated living and learning for each racially classified group was to socialise amongst themselves, school themselves and obtain careers deemed sufficiently fit by an apartheid government. The transition from apartheid to a more inclusive and less segregated society has been slow and particularly evident in school leadership. This chapter reports on an empirical case study of the first seven 'coloured' women principals who assumed leadership positions in historically 'white' led schools. The study locates itself in the broader Cape Town area of South Africa two decades into the country's democracy. It has a qualitative research design and uses a case study method for data collection. Following ethics approval, semi-structured interviews served as data collection instruments. Data were analysed thematically, and the findings provided insights into leadership in historically 'white' schools in post-apartheid South Africa.

Keywords: school leadership, intersectionality, women of color principals, transformational change.

1. INTRODUCTION AND BACKGROUND

The apartheid regime in South Africa (1948-1990) legislated race classifications to create political and socioeconomic power following colonisation by the British Empire. Classifications of 'white', 'coloured', 'black' and Indian enforced separation and segregation between racialised groups. Every aspect of daily life was controlled, determining where people lived, went to school, and where students could pursue post-schooling opportunities. The democratic government continued race categorisations to redress the past. However, equity redress is complex as it assumes that the experiences of individuals in a particular race (and gender) category have the same experiences for all in the category (Mare, 2011). Consequently, it overlooks the successes individuals experience in particular race-gender groups. Women of color is not a common phrase used in post-apartheid South Africa. Instead, there are separated race-gender categorisations of 'coloured', 'black African' and Indian that may carry derogatory meanings from the apartheid era (Jansen & Walters, 2020). The article contributes toward filling the theoretical void of women of color principal leaders (living with the marker of 'coloured') in schools in South Africa.

2. CRITICAL RACE FEMINISM

Successes of 'coloured' women are sparsely reported in South Africa (Kenny & Davids, 2022). We wanted to hear about the lived experiences of the first women of color categorised as 'coloured' in leadership positions at historically 'white' primary schools. Much of what has been written about women of color not only portrays them as problematic but, often, these views are written by authors who are either 'white' females or males (Lugones & Spelman, 1983). We drew on the writings of Lugones & Spelman (1983), who argue that women of color need to own their stories and should not be authored by another who knows very little about their daily lives. We wanted to bring to the attention that not all literature about 'coloured' women needs to be slanderous and derogatory and that there are individuals living with the 'coloured' categorisation that have been successful in schools, though under challenging circumstances.

There are few studies about women principals in South Africa (Davids, 2018; Khumalo, 2021; Mestry & Schmidt, 2012). While Davids (2018), for example, focuses on the complexities of the leadership identities of principals and how it manifests in a school environment, Khumalo (2021) turns attention to the challenges women face as school principals. We wanted a better understanding of the strengths the women of color principals brought to the schools. We also wanted to know more about how they navigated and strengthened their leadership in historically advantaged 'white' schools. With this in mind, we found Critical Race Feminism (CRF) in education to be a helpful framework to guide the analysis of our empirical study with the view that their lived experiences become the theory (Wing, 2003). Like Carter (2012: 13), this article dares to challenge "discriminatory power structures" that keep the faces of women of color "at the bottom of the well, and stop to help them to the top".

CRF begins with the assumption that race-gender discrimination exists in the schooling system in South Africa and manifests itself differently in the lives of women of color. CRF also brings to attention that race and gender discrimination rarely function in isolation. Intersectionality is, therefore, at the forefront of our study (Cho, Crenshaw, & McCall, 2013). We imagined this to mean that there is no need for us to justify intersectional discrimination and oppression but to focus on the lived experiences of women of color in their roles as school leaders in South Africa. In agreement with Davids (2018), we also acknowledge that there could be (mis)conceptions of gendered leadership in South African schools. However, our thoughts resonate with Wing (2003) that the experiences that shape women of color (in school leadership) are different from the experiences that shape their male counterparts and 'white' women (and men) in the same spaces.

3. RESEARCH METHODOLOGY

Our study followed on from the research gathered for the book, Who gets in and why? Race, class and aspiration among South Africa's elite schools (Jansen & Kriger, 2020) in the broader area of Cape Town, South Africa. While, Who gets in and why is based on admissions processes into white-majority schools, our study interrogated the lesser available appointments of non-white/coloured female leaders within these white-majority schools. As women authors living with the marker of 'coloured' ourselves, we wanted to know more about 'coloured' women's experiences in their new principalship positions at historically 'white' schools. In this light, we drew attention to the first seven 'coloured' women leaders at the historically 'white' schools. These women were purposefully sampled

since there are so few of them as leaders within white-majority schools. They all started their careers as teachers and had a substantial number of years within the profession before embarking on school leadership. The interviews started with obtaining biographical data from the participants, as the first broad category of interest. We asked about their educational, social, economic backgrounds, their school-based teaching and what circumstances, if any, led to their leadership positions. The second category of interest was the experiences within leadership and what led them to apply for positions of leadership within these white-majority schools. Thirdly we focused on their current experiences within their schools. We were guided by the research questions together with the interview questions. To this end, we engaged in data reduction, coding, and decoding analytic processes to analyse and interpret each of these qualitative data forms (Saldaña, 2021: 8-10). The methods unfolded through concurrent and iterative research processes: data collection, transcription of audio-recorded semi-structured interviews, and data analysis. We applied coding terminology and procedures according to Saldaña (2021: 133-148). All research protocols were adhered to, including confidentiality and anonymity. The data were analysed thematically and, with this conference in mind, leading transformative change is discussed next.

4. LEADING TRANSFORMATIVE CHANGE

4.1. From Managing Shortfalls to Managing Privileges

The consequences of apartheid rule meant that post-apartheid schools that had historically accommodated learners from marginalised communities lacked sufficient teaching staff, educational resources, finance, administrative staff and parental involvement with high teacher-learner ratios (Spaull & Kotze, 2015). According to Bush and Sargsyan (2007: 397), transformation in South African schools "require[d] action at all levels and there [were] limits to what principals c[ould] achieve in the absence of appropriate physical, human, and financial resources". Furthermore, with no official training programme for principals to understand the meaning of transformation in schools, it was left for the principals to work it out on their own (Bush & Glover, 2016). Each of the women in this study was a principal leader at schools that enrolled learners from historically marginalised communities (townships) before they applied for their new principal positions. As Dee pointed out, it was not an easy time because the education department put enormous pressure on principal leaders for schools to become fully functional and how to do so. Although Bush and Sargsyan (2007) describe transformative leadership as redressing the inequities of the past, its meanings in township schools were tested by managing resource, administrative, financial and staff shortages. Through an interpretivist lens, transformative leadership in a township school means compliance with the education department and being innovative about a school's survival.

On the other hand, 'white' schools were historically well-resourced and academically sound. However, there were challenges that the 'coloured' women principals had not experienced in their township schools. At Dee's new school, she found that she had greater autonomy; the education department gave her time to acclimate to the school context and decide how she wished to move the school forward. Although the schools appeared to be fully functional, underneath the surface, there were challenges they were unaccustomed to. For example, Rose stated, "I had to make a lot of financial decisions that had an effect on the school. I had to make financial changes … we were over-staffed". Rose was not accustomed to managing large numbers of School Governing Body (SGB) staff, which

"also impacted the school's financial management," she stated. SGB consist of elected parents, staff and school leadership. The SGB decide on the amount of school fees per learner and staff appointments. SGB staff appointments are not paid from the state's purses but from the learners' school fees. Dee and Rose point out that they were unaware of the number of SGB staff in their new schools as, in township schools, SGB posts were slim. Dee states, "But then I came in here to about 30 plus SGB staff. That is huge! And, I had to manage them as well". The data directs attention to tough financial decisions that had to be made, which affected the employment of some of the predominantly 'white' staff and their reactions to staff redundancies. Therefore, redressing inequities in historically 'white' schools has little to do with managing tangible shortages. Instead, redressing equity in this context meant making financial decisions about re-directing finances in the interests of the schools without the 'interference' of the education department.

4.2. Transformation from within Privileged Schools

Transformation is a common phrase in South Africa, often understood as redressing equity (Mestry & Schmidt, 2012). However, redressing equity through representation does not imply transformation, as issues around equity go much deeper in South Africa, historically and politically. Seemingly, there are missing conversations about what transformation means for staff employed at historically 'white' schools. Bev made the following observation:

> *A lot of assumptions were also made by not understanding things from a different perspective, not maybe taking the time to understand what transformation looks like. When you start unpacking it from what the teacher needs in the classroom, of what the children need, of the type of conversation and spaces that need to be created for people to unpack all of this. I don't think that was given a priority.*

During the early stages of the data collection, it became clear that even though these female leaders were the first principals of color in their schools, what was even more disturbing was that very few schools had any teachers of color in leadership positions. Thus, many of these principals felt isolated with no support from fellow teachers. While the learner cohort of schools displayed transformation, we can deduce that a distinct lack of transformation occurred, especially within the leadership positions at these same schools. To this end, transformation begins with difficult ongoing conversations with staff about understanding that privileges may need to be given up to accommodate the needs of those with less. Anita, for example, addressed some difficult issues with her staff members and found that "it was a hell of a battle for the teachers … they couldn't deal with it". Gail "invited every staff member to come and see me and tell me their story, and I remember there were a few of them who never came". The teachers' absence may imply that face-to-face discussions may work for some and not for others. Gail adds, "You have to strategically plant the seeds if you want things to change" – to be an agent of change. Another strategy was for an external service provider to unpack deeper meanings of transformation with staff, as was the case for Bev. In her view, "if you really want transformation, you need to create the spaces for connections to happen [amongst staff]". Still, Dee affirms, it remained her responsibility as a "coloured' woman principal to lead on transformation as "we cannot transform from the outside in, you need to be inside to transform outwards", leaning towards the determination and resilience required for transformational change.

4.3. Gender Imbalance in the Workplace

Gender imbalance within the workplace is not uncommon. A recent study by Walters, Bam, & Tumubweinee (2022) examines how gender inequalities are sustained within the academy in the Global South. Similar to our study, it emerged that our female leaders felt they needed to work so much harder than their white male predecessors, to 'show their worth' as a leader. Carol's first-hand experience justified this finding: "And I attended meetings because I needed to stay abreast with what is changing and happening, because you're not going to get me on anything, because then it's going to be coloured people". Dee affirmed this as she was appointed into a post where her white male predecessor was implicated in financial irregularities within the school. "Yes, when I got here the second day, I got into the school the Times (a local newspaper) was laying outside. So how do you as new principal, a woman, a person of colour deal with that background and that baggage of the school?" She had to navigate the parents' backlash and the teacher's reaction to this situation, which resulted in added stress to her already tedious job.

5. FUTURE RESEARCH DIRECTIONS

Both race and gender are key indicators of identity (Zulu, 2022) within marginalised communities and coloured female principals are not excluded. In this study evidence suggests, the combined gender and racial identities remain vital catalysts in experiences within the leadership positions that coloured females occupy. The significance of the study is thus two-fold. What has become evident is the lack of transformation within school leadership in previously white schools within South Africa. In addition, this study also makes visible the continued gender inequalities experienced by female school leaders within the workplace. Given the evidence of the imbalance in leadership and the struggles these women face this study clearly has implications for gender and racial equity within school leadership in South Africa. Future research should investigate support for new leaders within diverse contexts. Similar to the recommendation by Zulu (2022) ongoing humanistic, self-development-orientated psychotherapy could be useful within their career progression. A practical application should include conducting ongoing research on best practices within other schools and institutions and applying these principles to newly appointed female leaders within schools. The knowledge gained from this research could be made available for school leaders. This will inform all stakeholders on the improvement of policies, working conditions and general well-being of staff, which can add to a positive school climate.

6. CONCLUSION

This article highlights the leadership experiences of the first seven 'coloured' women, a category of women of color in South Africa, as they began their principalships in historically 'white' primary schools in the broader Cape Town area. Lived experiences revealed that although the women brought a wealth of leadership and management experiences from their historically marginalised schools, they experienced different challenges in their new schools, which they needed to adapt to. While there may have been a plethora of successes and challenges in these schools, we discovered two variables perhaps overlooked when women of color apply for principalship positions in historically 'white' schools. Firstly, the implications of managing the employment of more than necessary staff. Secondly, doing the 'work' of transformation with staff who reaped the

privileges of 'white' spaces. We believe that what is needed in (predominantly 'white') privileged schools is not necessarily transformational leadership in terms of employment equity redress but to employ principal leaders who can lead transformative change in the schools. While we could not identify what constitutes transformative change and managing the processes thereof, we seeded conversations that all principal leaders should have with their staff if they are serious about school transformation.

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AUTHORS' INFORMATION

Full name: Samantha Kriger, Dr.
Institutional affiliation: Cape Peninsula University of Technology
Institutional address: Highbury Road, Mowbray, Cape Town, South Africa
Short biographical sketch: Dr Samantha Kriger completed her undergraduate, Honours and Masters studies in music and education at the University of Cape Town (UCT). After teaching in South African schools for 25 years she completed a PhD in Curriculum Studies at Stellenbosch University. She is a lecturer in the Faculty of Education at the Cape Peninsula University of Technology (CPUT), South Africa, where her focus is on pre-service teacher education. Her research and practice focuses on teacher education from pre-school through to higher education, teaching practice within schools, educational inequality, music education and its impact on language literacy development and integration across the curriculum. She conducts mixed methodological work exploring how music, race, language, and culture impact students learning in diverse classrooms**.**

Full name: Sinobia Kenny, Dr.
Institutional affiliation: Stellenbosch University
Institutional address: GG Cillié Building, Ryneveld Street, Stellenbosch 7600, South Africa
Short biographical sketch: Dr. Sinobia Kenny obtained a BSc in Chemistry and Mathematics, followed by an Honours degree in Chemistry and a Higher Diploma in Education from the University of the Western Cape. Her academic journey continued with postgraduate studies at Edgehill University in the UK, where she pursued a Masters degree. With nearly two decades of experience in teaching and consulting within mathematics education, she embarked on doctoral studies in the Department of Education Policies within the Faculty of Education at Stellenbosch University. Presently, Dr. Kenny serves as the Academic Manager for the schools' enrichment department at the African Institute of Mathematical Sciences (AIMS) in South Africa. Her commitment lies in sharing her teaching fervor with historically marginalized in-service teachers at AIMS, while also nurturing a vision for learners to engage with cutting-edge mathematical sciences. Her research interests encompass higher education, mathematics education, and exploring lived experiences through the lenses of post-colonial feminism, critical race theory, and critical race feminism education, with a particular focus on the impact on women of colour.

Chapter #35

USING THE RESULTS OF PROBLEM-SOLVING SIMULATIONS TO IMPROVE GROUP LEARNING

Alexander Pojarliev
Department Administration and Management, New Bulgarian University, Bulgaria

ABSTRACT
The paper discusses the application of simulations for group problem solving. The aim is to explore trends in group performance, which can enable analysis and discussion of decision-making processes during training sessions. The results of 115 groups with a total number of participants of about 510 people were obtained from 5 different simulations. The average individual and group results, the gain/loss from the group discussion and the resulting synergy were calculated as efficiency measures. The results of the groups in the sample were compared with those of known published abroad studies and the means and standard deviations were calculated to serve as reference values for Bulgarian groups. Expectations of similarity in the performance trends of individuals and groups are confirmed. The hypotheses regarding the increase in the quality of group decisions compared to the averaged individual results (in 83% of cases) and the relatively limited achievement of synergy (only in 30% of cases) are confirmed. Differences are also established between groups based on belonging to a private or state organization and open groups or members of a team/organization. The observations create a basis for in-depth discussions during the training sessions on how the quality of group learning can be improved.

Keywords: group learning, synergistic problem solving, simulations.

1. INTRODUCTION

The decision-making process is of critical importance in all areas of human activity. Some early studies from the 1930s formed the view that groups perform better than individuals due to the effect of accumulated knowledge and experience, which increases the probability of making a better decision (Shaw, 1932). However, it was later stated that the answer to the question is unclear and there is evidence both for and against this proposition (Maier, 1967). Groups can contribute to a better quality of the decisions made, but also impair the performance of the individuals of which they are composed. Branson, Steele and Sung point to a number of studies supporting both the advantages of group work and its disadvantages related to inherent characteristics of the group process leading to a decrease in effectiveness (Branson, Steele, & Sung, 2010: 76). Schmutz, Meier and Manser (2019) investigate the relationship between teamwork and performance and their meta-analysis of 1390 teams from 31 different studies showed that teamwork has a medium sized effect. A recent study applying NASA simulation similar to the used in this research leads to the conclusions that collective decision-making outperforms individual judgment, but not the so called “wisdom of crowds” (Hamada, Nakayama, & Saiki, 2020). Thus, the present study takes as its main research question what are the trends in the performance of learning groups compared to individual performance in practical problem-solving learning situations? The study uses several simulations conducted using a methodology developed by Human Synergistics, one of which has published data from its application with groups

from the US, where it was created. A purpose of the research is to find out to what extent the Human Synergistics methodology leads to similar results in different cultural environment and how it can be used effectively to enhance group learning. Some hypotheses are formulated and tested and then an attempt is made to outline how the obtained results can help to improve group learning.

2. BACKGROUND

2.1. Factors Affecting the Effectiveness of Group Decision Making

Effective group decision-making depends on a number of factors. According to Maier (1967), the forces that influence problem solving are group assets, constraints inherent in the group process, and factors dependent on the skills of the leader. The information and knowledge in the group always exceeds that of any individual and the number of approaches to the problem is greater. Group participation in the decision-making process strengthens acceptance and improves the understanding of the decisions made. On the other hand, restraining forces can be group pressure for conformity, the "valence" of decisions - accumulating a critical mass of positive comments about a decision, after which other decisions have little chance of being considered (Hoffman & Maier, 1964), dominance of individuals and conflicting side goals (eg. power, winning the argument). The manifestation of factors that can be both an asset and a liability of the group will depend on the leader's skills in maintaining constructive disagreement, dealing with conflicting interests, taking risks, managing time and defending constructive proposals regardless of their source (Maier, 1967). However, a number of situational factors should also be taken under consideration. In addition to the skills of the leader, the essence of the problem and the goal to be achieved are also important (high quality solutions or solutions accepted by all; need for innovation, speed, satisfaction of different needs).

Another key factor that can significantly influence the increase in group performance is the style of interaction between its members (Group Styles Inventory etc., 1990). It is addressed in detail in the synergistic problem-solving model developed by the research organization Human Synergistics, Center for Applied Research, founded by Clayton Lafferty. The result of synergistic problem solving is an effective solution. The effectiveness of the group decision, in turn, can be determined based on criteria such as achieving higher quality than all individual decisions (synergy) and acceptance by all members of the group. Referring to the ideas of Maier, the effective solution can be represented in the form of an equation, where it appears as the product of the measure of quality multiplied by the measure of its acceptance by those who will implement it (Maier, 1963).

Human Synergistics pioneered the development of problem-solving simulations measuring and demonstrating the idea of synergy (Subarctic etc., 2007: 27-31). Their mechanism is based on making a judgment and prioritizing a list of items or actions according to their importance to achieve goals such as survival or higher efficiency. Individual and group responses are compared to a norm (based on expert, recommended or research decisions), on the basis of which magnitudes of deviations from it can be obtained. The model is built on the premise that when groups adopt a constructive interaction style and their members approach problems in a rational and supportive manner, the collaborative effort of people working together will have a greater impact than the sum of their independent efforts.

In a study conducted using the simulation developed by Lafferty, Subarctic Survival Situation, the results of 244 teams, including a total of 1228 participants, are presented (Subarctic etc., 2007: 55). The expert decision of the simulation was consulted with the Canadian Rescue Service. According to these data 96% of the teams achieved a better group score than the average individual score. Respectively, only 4% of the groups failed to improve the average individual score. Another study by J. Szumal shows a comparison of the performance patterns of 388 groups that participated in one of six different simulations, including the one listed above. The percentage of groups that improve the average individual score varies between 85-100%, and of those that improve the best individual score and achieve synergy is in the range of 17-50% (Szumal, 2000). Usually less than half of the groups succeed in surpassing the performance of their best participant, i.e., based on the results, it can be concluded that groups do not achieve synergy easily. According to Human Synergistics, the achievement of synergy depends primarily on the quality of interactions between group members, no matter what the type of problem or its context.

2.2. Objectives and Hypotheses of the Study

The objectives of the present study are to evaluate the adaptation of some popular simulations in Bulgarian language and culture and to investigate to what extent groups in the sample make decisions of a higher quality than individuals and achieve synergy. Based on the obtained results, another objective is to establish initial reference values that can serve as criteria for comparison and implementation of activities to improve the work of the Bulgarian learning groups.

Using the known data related to the application of the synergistic model for problem solving, the general hypothesis was formulated that: 1. The trends in the results of the same simulation for US and Bulgarian groups would be similar. This would also mean confirming the hypotheses that: 2. The quality of group decisions would in a comparably high percentage of cases be better than the quality of averaged individual decisions. 3. Synergistic groups would be a significantly lower percentage - less than half of all groups.

It can be assumed also that the quality of interaction in groups is likely to depend on whether the people know each other and have experience working together. A study using similar Human Synergistics' simulations shows consistent improvements in decision-making after students had worked in teams for 4 months (Sibbald, Campbell, Flores-Sandoval & Speechley, 2023). Thus, if groups are compared based on whether or not their members belong to the same organization or team, and based on the presumption that groups with better interaction quality are likely to achieve a higher performance, there is reason to expect that: 4. Groups consisting of members from one organization or team would achieve better results than open groups composed of people who have not worked collaboratively.

In addition, the dynamics of work in the sphere of private business suggest greater pressure for efficiency and results, and a higher need to develop teamwork skills, group decision-making, and higher-quality interactions. Therefore, it is interesting to test the hypothesis that: 5. The groups composed by participants working in private organizations would achieve better results than those composed by participants working in public organizations.

3. METHODS

The study includes the registration of the results of the group problem solving of 115 groups, most of which are 4-6 people, with the exception of several groups consisting of 3 or 7 participants. The total number of participants amounts to over 510 (for several groups the exact number is not noted, therefore the total number cannot be given with absolute precision). The study covers 5 different problem-solving simulations conducted in Bulgarian as part of open or corporate management trainings. Participants in the study are both real teams working in private business organizations and in the public sphere, as well as open groups, including students and managers from the Master's and Professional Management Programs of New Bulgarian University, and participants in other management skills trainings.

Table 1.
Types of group participants.

Types of groups	No
Groups from one organization	**44**
- Private Business (8 organizations)	39
- Public Organizations (2 organizations)	5
Open Groups	**71**
- Private Business (in a wide range of sectors)	36
- Public Sphere (Directors of VE schools)	35

Table 2.
Distribution of groups in simulations.

Types of simulations	No groups
Envisioning a Culture for Quality	60
Subarctic Survival Situation	35
Organizational Change Challenge	10
The Stuck Truck	7
Managing Transitions	3
Total groups:	**115**

These simulations were held between 2009 and 2023. Three of the simulations were developed by Human Synergistics, the first being perhaps their most popular simulation - the Subarctic Survival Situation (Lafferty, 2007). The other two are: Organizational Change Challenge (Szumal, 1998a) and Envisioning a Culture for Quality (Cooke, 2004). The fourth simulation is The Stuck Truck, developed by R. Baker and D. Kolb (Baker & Kolb, 1990), and the fifth is Managing Transitions based on a case published in the W. Bridges book of the same name (Bridges, 2003).

The procedure for conducting simulations follows the Leader's Guides of Human Synergistics (Subarctic etc., 2007; Envisioning etc. 1993; Szumal, 1998b) and lasts an average of about 2 hours. In all simulations, the output of the activity is assigned a sequence number to evaluated items based on their priority. In the procedure for calculating the results of simulations as the main indicators of efficiency are the obtained individual scores (IS), the group score (GS) the best individual score (BIS) in the group, the average individual score (AIS), gain/loss score (comparison between AIS and GS – if the GS is

lower than the AIS, it represents a gain) and the resulting synergy (comparison between GS and BIS - if the GS is lower than the BIS, it represents a synergy). IS and GS are calculated by subtracting them from the best solution (expert or obtained in research) rank for each item and summing the absolute differences (ignoring pluses and minuses) between the participants' ranks and the experts' ranks of the arrangement of the items from the list. The lower the values, the smaller the deviations, i.e., the solution comes close to the best possible solution and therefore has a higher quality. AIS is calculated as the sum of the ISs of the group members is divided into their number and is a measure of the average level of knowledge and resources they bring to the group. It can also be considered as an indicator of the expected level of decision quality if a member of the group is elected randomly to solve the problem. The GS is the consensus result of the group discussion and is a measure of the quality of the decision made by the participants working together as a group. Groups can improve the quality of the solution if they achieve a lesser deviation of the GS than AIS over the best solution. However, this does not yet mean achieving synergy. The calculation of synergy is done by GS being subtracted from the BIS. The positive value obtained indicates that the interaction of people in the group achieves a higher quality than each of the individual decisions, i.e., the synergistic solution is better than the mechanical sum of the individual solutions.

4. RESULTS

According to the study of a sample of 58 groups, the results of the Subarctic Survival Situation in 90% of cases are achieve a better group score than the average individual and in 50% of cases achieve a better score than the best individual score (Szumal, 2000). The results of the same simulation in the present study on 35 Bulgarian groups are slightly lower, but the tendency is similar: 85.7% of the groups achieve an improvement in AIS (30 of 35) and 40% achieve better results than BIS (14 of 35). This gives reason to confirm the first hypothesis of this study. Confirmation of the results can be considered as verification, both of the observations so far and the validity of the Bulgarian adaptation of the simulation.

The results show similar trends, as well as in the cited study by Human Synergistics of the same simulation conducted with 244 teams, where 96% of the groups improve AIS. However, differences are also observed. The comparison of the results in Table 3 shows that US individuals and groups in it generally do better than the Bulgarian groups in the present study which are much closer to the results of the sample of poorly performing US groups including the value of gain which is insignificantly higher.

The best individual scores in the Bulgarian sample are also clearly weaker, i.e., the knowledge, skills and experience to solve the problem are lower. One possible reason for this could be related to cultural characteristics that determine the competence of the participants in both samples. For example, that the experience of the Bulgarians is more inconsistent regarding a survival simulation in North America. However, the amount of gain/ loss in group work is also lower and the share of groups that do not improve is significantly higher (14.3% compared to 4%). This should no longer be relevant to the competence of the participants as to the quality of group interaction in the Bulgarian groups. (Teamwork is often informally reputed to be of a poorer quality than in other cultures.) However, the value of gain is higher than that of the groups performing poorly in the US study.

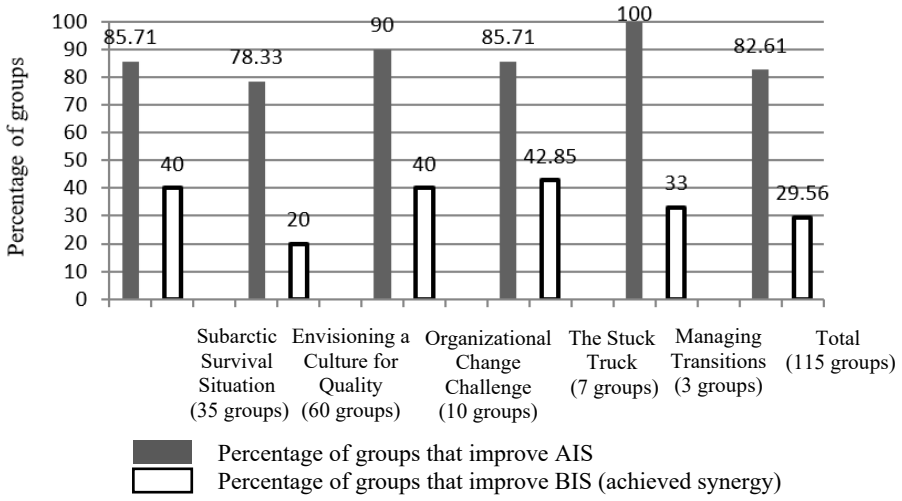
Table 3.
Comparison of the results of the Subarctic Survival Situation in the US and Bulgarian study.

No.	Indicators	Scores of 244 groups (Subarctic etc., 2007: 55)		Scores of 35 BG groups
		Total	Poorly performing	
1.	Average individual score	47.3	50	60.9
2.	Average group score (GS)	29.8	40.9	49.8
3.	Average Gain/ Loss in group work	17.4	9	11.2
4.	Average best individual score (BIS)	32.5	36.4	46.8
5.	Average difference between the BIS and GS	2.7	-4.5	-3.0
6.	Groups that improve the average individual score	96%		85.7%
7.	Groups that do not improve the average individual score	4%		14.3%

It is necessary to interpret the data with a high degree of caution due to the small size of the Bulgarian sample and its disproportionateness relative to the control group, including their placement in distant periods of study. However, they can serve to compare the general trends of the performance of the groups.

The trends in the performance, observed in all 115 groups, participated in one of the five simulations are depicted in Figure 1. The share of groups that improve the average individual score varies between 78.33-100% (85-100% in Szumal), and those who improve the best individual score and achieve synergy is between 20-42.85% (17-50% in Szumal). In total, for all 115 groups, the results are 82.61% (95 groups), respectively, improved AIS and 29.56% (34 groups) that improved BIS.

Figure 1.
Trends in the performance of groups in the five simulations.



The results regarding synergy show that in one of the simulations covering over half of the sample, the ratio is 1 in 5 groups. In three of the simulations, just under half of the groups achieved synergy, close to the results in the cited study of Szumal describing one of them. In general, synergy achieves an average of only 1 in 3 groups, which, despite the use of different simulations, is comparable to that of the Szumal's study (Szumal, 2000) and gives grounds to confirm both the second and the third hypothesis of the present study.

To examine the alleged influence of the established group collaboration on the results, the sample was divided into two parts, based on whether the participants are from one organization, work in one team or at least joint (company groups, n=44), or are enrolled in an open training program, including strangers and colleagues from different organizations (open groups, n=71). The results of the comparison are presented in Figure 2, where the difference in AIS improvement is 9.7%, and in BIS 11.01% in favor of company groups. In general, the data testifies to support the grounds for confirming the expected results formulated as a fourth hypothesis. However, care must be taken with the conclusions, as the two compared groups participated in different simulations and their results may have a cross-influence of factors related to their content. It is likely that differences are due, for example, to differences in the difficulty of simulations and the level of success in each of them.

To check the alleged influence of the different dynamics of work in the private and public area on group interaction skills and the results, the sample was divided into two parts, based on whether the participants are members of public (n=40) or private organizations (n=75). The results of the comparison are presented in Figure 3, where the difference in AIS improvement is 15.5% and in BIS is 7% in favor of private groups. The data testifies to support the conditional acceptance of the fifth hypothesis too.

Figure 2.
Comparison between the performance of company and open groups.

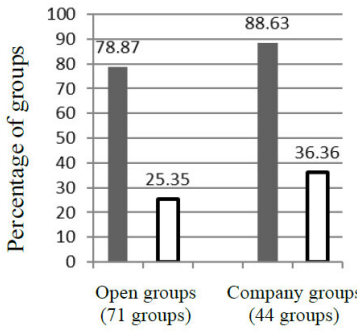
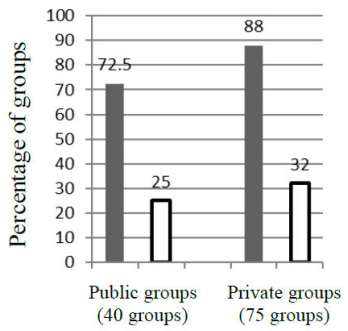
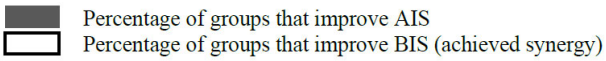


Figure 3. Comparison between the performance of groups in public and private areas





It should be noted that the comparisons made do not have the rigor and accuracy of a statistical analysis. They only show trends in the performance of the groups. However, the expressed trends in the results are indicative and set grounds for more precise future research.

5. USING RESULTS TO IMPROVE GROUP LEARNING

According to the model of Human Synergistics, there are two groups of key factors that contribute to effective decisions. The first group includes the skills and knowledge of the group members and the resources they have in regard to the problem. The second group of factors refers to the quality of the skills for rational thinking and interpersonal interaction of participants, i.e., to the emerging group process in solving the problem. Rational skills relate to analyzing the situation, setting goals, simplifying the problem, considering alternatives and discussing consequences. Interpersonal skills include listening, supporting, participating, constructive confrontation and striving for consensus (Subarctic etc., 2007: 29).

Human Synergistics developed observational forms and manuals to assess these skills and their constituent behaviors in order to offer feedback on the extent to which group participants exhibit them in the process of working together (Cooke, 1992). These include a clearly defined observer tasks, a detailed description of the rational and interpersonal processes, guidelines for conducting the observation, and forms and scales for evaluating behaviors. From a learning perspective, feedback from observers is particularly valuable and developmental, enabling a better understanding of the group process and own behavior. However, this requires the preparation of a resource of suitable observers.

A possible approach to improving the quality of group work is to divide the problem-solving discussion into two stages, with the first stage reflecting on the effectiveness of interpersonal skills and drawing conclusions for improvement to be implemented in the second stage. This can be done with or without the aid of structured observation. A similar approach was used with some groups in the Subarctic Survival simulation in the context of a more extended team building sessions for intact teams. One of them showed the best result in the sample. Before the simulation, team members discussed what they liked and disliked about teamwork, and what the team needed to acquire to be more effective. After the first stage of group work in the simulation, the team discussed how to improve the decision-making process and formulated key behaviors such as "everyone has an opinion", "giving a chance, without preconceptions", "supporting the opinions of others", "trusting experience and reasoned propositions", "introducing order into utterances" and "assessing possibilities". The subsequent second discussion stage was significantly more effective and resulted in the least deviation from expert responses of all observed groups (28 compared to the mean 50), the greatest gain from group discussion (24 or 46% compared to the mean 11), and achieving synergy (6 better than the BIS).

The in-depth study of individual and group experiences can be also extended through the use of additional surveys such as those used by Deacon to increase understanding of the impact of interpersonal factors perceived by participants to enhance or diminish group effectiveness (Deacon, 2016).

On the other hand, it is useful to have the quantitative results themselves accurately measured and presented in the context of the performance of multiple groups for comparison. The established tendencies in the performance of the groups can serve as a starting point for analysis and discussion of the quality of group decision-making and the search for answers on how decisions can be improved. Usually, participants are interested in how they did, for which they receive an immediate answer by comparing expert answers. However, the calculated difference has greater value if compared to the results of as many other groups as possible.

To this end, for the two simulations where there is an accumulation of data, the average values and standard deviations of the measured criteria were calculated (Table 4). They can be used as benchmarks for comparison. The range of average scores is presented in the table. Values outside it can be considered respectively as significantly low and high results.

Table 4.
Comparison criteria.

AIS	Group score (GS)	Gain/ Loss	BIS	Difference BIS & GS
Subarctic Survival Situation, N=35				
X=60.9 σ=6.3 low < 54 67 < high	X=49.8 σ=12.7 low < 37 63 < high	X=11.2 σ=10.7 low < 1 22 < high	X=46.8 σ=9.2 low < 7 56 < high	X= -3.0 σ=12.8 low < -16 10 < high
Envisioning a Culture for Quality, N=60				
X=98.4 σ=11.3 low < 87 109 < high	X=86.5 σ=14.9 low < 71 101 < high	X=11.9 σ=12.6 low < -1 24 < high	X=79.0 σ=12.6 low < 66 91 > high	X= -7.5 σ=12.5 low < -20 5 < high

Based on the comparison of their position against the criteria, participants can analyze the quality of their interactions and seek an explanation of the reasons for their results. This can be done using carefully designed questions that target the characteristics of the group process or through retrospection using coaching questions such as "What did we do well?", "What prevented us from achieving a better result?", "What would we change next time?"

One of the advantages of the proposed methodology is to measure not only whether the group achieves a better result than other groups and whether the discussion process adds value to the quality of the decision. A key learning point for teams is whether they manage to achieve synergy and this can become an important focus of discussion regardless of the scores achieved.

After identifying areas for improvement, group members can plan how to work on developing the necessary skills and reassess how they handle a later situation of simulated or real problem solving.

6. FUTURE RESEARCH DIRECTIONS

Future research may seek to accumulate a larger database of group simulation results in order to perform more reliable quantitative and statistical analysis. The types of simulations used in the study could be expanded while maintaining the adopted methodology for evaluating the scores in order to ensure comparability. Other variables may be included in research for which there is reason to hypothesize over relationships and dependencies. For example, one such variable could be an estimate of the consensus or degree of acceptance of the group decision by each participant in the simulation. It would be interesting to check whether the achieved quality of group decisions correlates positively with the degree of the consensus. The results of the observations of some groups give grounds for such a hypothesis. As other variables, key behaviors could be identified to be observed using rating scales. Their correlations with the results of the group work can be calculated and in this way an answer to hypotheses concerning the relationship between behaviors and results can be sought. It would also be interesting to check how much dividing the group discussion into two stages and including a discussion to increase its

quality would significantly affect the results. This could be investigated using experimental groups in which such discussions take place and control groups in which they do not. From the above example, it is clear that there are grounds for such a supposition.

7. CONCLUSION

The results of the study unequivocally show that the quality of group decisions is in a very large number of cases better than that of a randomly taken individual in the group (measured by AIS). However, this is not the case when it comes to the quality of the group decisions compared to those of the best participants in the groups (BIS). Less than one-third of the groups manage to achieve a better solution, which means that in the other two-thirds of the cases, there is a better individual solution that has failed to manifest itself and be accepted. In other words, groups could improve the quality of their decisions if they identify their most competent members and listen to them. However, in order for this to happen, a high quality of interaction is required, related for example, to the rational structuring of the group process, specific leadership and achievement of the most constructive rather than defensive style of communication between participants. Obviously, such a quality is more difficult to achieve, which is why it is necessary for it to become the focus of working with the groups after the simulations.

For the purposes of continued learning and development of groups and their members, the benefit of applying a well-designed quantitative methodology to determine the results of individual and group work, allowing objective comparisons and directions for improvement, is clearly outlined. However, the established differences between groups from different cultures show that, despite the expressed similar tendencies, it would be more correct to compare the results of groups from the same culture.

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AUTHOR INFORMATION

Full name: Alexander Pojarliev
Institutional affiliation: Department Administration and Management, New Bulgarian University
Institutional address: Montevideo 21, 1618, Sofia, Bulgaria.
Email address: apojarliev@nbu.bg
Short biographical sketch: Dr. Pojarliev is a full-time lecturer at the New Bulgarian University in the MA and MBA programs in Management studies. He is a former Dean of the School of Management-NBU. His areas of teaching and research interests include: leadership, organizational culture, managerial learning and development, coaching, career management, organizational learning, creativity and innovation, business and management research. Alexander Pojarliev works as a trainer, coach and consultant to private and public organizations in the field of organizational, leadership and soft skills development. He is a co-founder and member of the management board of the Bulgarian Association for Training and Development. Member of the Bulgarian Psychological Society and the Bulgarian Association for People Management. Dr. Pojarliev has received the BAAP award for the best contribution to the development of psychological practice in Bulgaria, as well as the National Human Resources prize (2007).

Chapter #36

LEARNING ABOUT HERITAGE AND IDENTITY THROUGH ENGRAVING AND PRINTING
Artistic mediation workshops for students in TOMÉ, Chile

Jessica Castillo-Inostroza
Universidad de Las Américas, Chile

ABSTRACT
This work shares an innovative project, carried out with students from early childhood to secondary education in the commune of Tomé, Chile. It is an artistic mediation project materialised in an exhibition as a pedagogical proposal. It seeks to highlight the value of the territory through the observation of works of art in order to approach the creation of images that show the local identity. The plastic language mainly used are simple techniques linked to engraving and printing as the main strategy of knowledge. Through the Artistic Teaching Methodologies, creative exercises were proposed based on the work of 6 local artists with the aim of understanding what was observed in the works of art, relating to it from personal experience and, finally, creating something from it. In this way, art is taught through art. The dynamics and visual results of the students' work were analysed through Arts Based Methodologies, using visual tools.

Keywords: art education, mediation, artistic teaching methodologies, engraving, printmaking.

1. INTRODUCTION

The experience "Identity-based activities carried out through engraving and printing. Artistic mediation workshops based on regional engravers and aimed for students of the commune of Tomé" was an exhibition that had as a common thread the inquiry about territory, as well as individual and local identity. The strategy to deepen the aforementioned concepts was achieved through mediation between the works of art and the spectator via the art of engraving. The goal was to generate spaces for individual and collective creation around the work of 6 local artists. In this way, students of different ages abandoned the role as a passive spectator to adopt an active and creative role within the experience.

The proposal was based on the use of Artistic Teaching Methodologies (Mena, 2020; Rubio Fernández, 2021; Caeiro, Callejón & Chacón 2021), in which the main strategy is the use of experiential, creative processes and works of art as the central point to provide a learning experience.

For the analysis of results, the Arts-Based Methodologies (Roldán & Marín-Viadel, 2012), which use images as the most important data and findings, are employed.

2. PREVIOUS AND RELEVANT BACKGROUND IN THE DESIGN OF THE PROJECT

A fundamental antecedent in the design of our proposal and which must be mentioned beforehand is the exhibition "Arte para aprender" (2023), a Teaching Innovation project of the Department of Didactics of Musical, Plastic and Corporal Expression of the University

of Granada created in 2013 in collaboration with the CajaGranada Cultural Centre and whose main idea is to connect the school population and the people of Granada with contemporary art by highlighting the museum's collection.

According to its creators, the purpose of this project is to develop innovative strategies for education in museums, with the following objectives: Create artistic works that function as a teaching-learning tool; Promote forms of mediation in museums through processes of artistic creation; Favour the access of the participating public to a collection of contemporary art and cultural artistic heritage of the area; Develop new teaching-learning technologies; Generate an exhibition proposal centred on learning experiences and the creation of visitor images as creative experiences; To turn the learning process into the main dynamising element of the exhibition discourse and the forms of relationship between museum and visitor; To develop a methodological innovation on arts and education that can be used in museum and academic institutions; and finally, To interpret and interrelate the collections of ancient, modern and contemporary art in the city of Granada.

The above objectives represent a clear roadmap about the conditions that must be fulfilled within an experience of these characteristics, evidenced as a referential methodological proposal that crystallises under the guidelines of the Artistic Methodologies of Teaching.

3. KNOWLEDGE OF HERITAGE AND IDENTITY THROUGH ART EDUCATION

The most widespread ideas about heritage understand it as a set of goods of different nature that a society inherits from its ancestors and that gathers elements of different kinds (historical-archaeological, artistic, ethnic and even natural). These elements belong to a material range and are an instrument of both cultural identity and social connection. For this reason, their conservation and dissemination are generally ensured. This set of material components also include those that are immaterial or intangible (Calbó, Juanola & Vallés, 2011).

Memory and recollection are heritage elements which are intangible. Stored inside of each individual, they are essential in shaping the identity of a community as well as each individual's identity. Therefore, identity is born from both inner perception and outer vision: how we see ourselves (voluntary ascription), and how we are perceived (identification). Consequently, identity is based on a real construction and also on an ideological, political and cultural one, that hierarchizes symbols that allegedly belong to each person. This channels cyclically collective energies and feelings (Arévalo, 2004). From this point of view, it would be expected to think that heritage, as a cultural construction, takes a part in the construction of identity of each person that conforms the social fabric.

Articles 7 and 8 of the Convention on the Rights of the Child (approved in 1989 and passed into law in 1990) directly refer to respect every child's identity, as each child has a name and a nationality that must be respected by both parents and the State, as well as preserved, and restored in the event of deprivation of some of its elements (O.N.U., 1989). With this declaration, identity is granted as an indispensable attribute of each individual, which must be recovered if lost. The question, then, arises: how does education deal with this indispensable attribute?

Art today is demanded in the creative experience of every human being, acting as the device that makes it possible for the most personal and meaningful relationships to be born. Art also includes all kinds of aesthetic practices, which, in themselves, are constitutive of

patrimonial identity (Calaf, 2003). Art Education, as the discipline responsible for promoting productive and appreciative artistic processes, can and should contribute to the understanding of heritage (and, consequently, of the identities that make it up), as well as the relationships that are established between people and objects (Fontal, 2013; Fontal 2022) encouraging its communication and including as an important addition to the artistic curriculum of different education stages (Gutiérrez-Pérez, 2012).

4. PRINTMAKING AS A VEHICLE TO SHAPE THESE EXPERIENCES

One of the main interests within the current practice of printmaking is focused on investigating the different possibilities that this medium provides to creation in general. This refers to looking through how we can use printmaking in art education in order to know which are the contributions it leaves in relation to other aeras in education, identify the benefits related, and defend its relevance within the teaching-learning processes.

The different factors of this technique are well known for their influence and involvement in the teaching-learning process. It contributes to stimulate the development of rational thinking, it also provides rules for creation that can be connected to play, and it sets certain conditions that are ideal for collective work in the development of transversal values (Castillo-Inostroza, Palau-Pellicer & Marín-Viadel, 2020).

The art of engraving leaves an implicit print behind, creating a connection with the print that already lives inside the memory. This print comes to the surface when there is the motivation to review what has been experienced in everyday life and what has become part of a human's personal construction. Thus, engraving -as an accurate, concrete, and playful technique at the same time- embodies the metaphor of what a print is, becoming the main vehicle for creation.

Related to the above, although in a different direction, it is important to mention that traditional printmaking uses products that can have varying degrees of toxicity, some of which are particularly harmful to health and the environment. This means that it is often not easy to adapt traditional processes to a conventional classroom (Garrido, 2019). Knowing that these historical limitations have complexified and limited school printmaking and assuming the need to generate a practice that is friendly to the environment and to the health of those who practice this technique, the exercises related to engraving and printing that are proposed in these days of artistic mediation involve simple procedures and do not use toxic materials or dangerous tools. Without a doubt, this is not a minor commitment, as it contributes to giving a twist to the practice of the technique in the classroom by proposing ways of making engraving without traditional engraving, but through the use of materials and tools that are not invasive, toxic or dangerous, and which also allow the creation of matrices and prints.

5. ARTISTIC TEACHING METHODOLOGIES AS A STRATEGY FOR THE CREATION OF EXPERIENCES.

> *It is no longer believed in the existence of a creation that originates from nothing, maintained by the talent from which it comes in an artistic way, without taking into account in the aesthetic elaboration the performance of the personal background of each person, their experience and the environment in which they develop.* (Morales, 2001, p. 80)

Among the research practices that arise from qualitative interpretation are the Arts-based Methodologies (Roldán & Marín-Viadel, 2012). As a consequence of different methods related to this line of research, other methods related to teaching have appeared, such as the Artistic Teaching Methodologies, which emphasize the appreciative dimension.

The Artistic Teaching Methodologies were created as a strategy that allows the establishment of horizontal models to approach the works of art that are considered a novelty (Mena, 2020), being located in a place close to artistic activity. Based on this premise, these methodologies are based on the creative experience and creation strategies of artists, putting into action different teaching and learning methods (Caeiro et al., 2021). Thus, we can understand them as those methods based on the ways in which art uses ideas, processes and matter, grounded in the aesthetic as a producer of knowledge and thought.

The Artistic Teaching Methodologies do not refer only to teaching art, but to teaching art through art itself, joining language, art media and cognition processes. Teaching under this methodology should provoke situations in which aesthetics is the structural basis of the experience. For that, it is necessary to consider art education from a contemporary approach aspiring to teach art to learn art and adjusting pedagogical processes to artistic processes to open that medium to the educational experience (Rubio, 2018; 2021).

Our project enters into the spirit of the M.A.E. by using the work of 6 artists as the main activators of the experience. Each work (its composition, formal and semantic elements, materialities and techniques) is transformed into a teaching proposal that becomes, at the same time, individual and collective work. In this way, the creative processes that artists go through, as well as the characteristics and formal and symbolic elements of the works of art, can be integrated as a living strategy that requires thinking as an artist does. This strategic capacity will be present in the design of the interactive exhibition for the understanding of 6 works whose theme is linked to the valuation of everyday heritage.

6. MEDIATION DAYS: PROPOSAL AND UNFOLDING

> *To perceive, a contemplator must create his or her own experience. And this creation must involve relationships comparable to those experienced by the creator.* (Dewey, 2008, p. 62)

The Mediation Workshops were held at the Cultural Centre of Tomé, an important nerve centre of the city and a non-formal educational space. The invitation to the different schools, as well as the scheduling of the visit of each of the groups, was made through the Municipal Directorate of Schools, which allowed for direct communication with each school.

The workshops involved activities aimed at generating dialogues around our local images, knowledge, places, customs, histories, belief systems and other elements. These emerge from the analysis of works that lead to questions about those areas. Thus, the deployment of the conference included an exhibition organized in 6 modules in charge of mediators. Each mediator receives a small group of no more than 5 students -from kindergarten to high school including older public- inviting them to visit the exhibition.

Each module presents a graphic work that invites visitors to observe it, understand its meaning and create from it in an exercise linked to printing, which overthrows the position of inactive spectator in front of an artistic piece. The learning (contained in the visual result of the students), is arranged indistinctly around each work to generate an installation space in which each image is added to the other to develop a collective and gradual work during the period of the exhibition.

The following table shows the exercises developed by the students:

Table 1.
Summary of proposed actions for each module.

Artist	Action
Freddy Agurto. local identity	The reference work deals with characters, places and objects of the town of Tomé. Based on their observation, the students are invited to create a print depicting characters or places of personal importance. Eva rubber is used as a matrix, and a biro is used to make the grooves. Using black and orange colours, the students print the matrix directly onto a large white panel attached to the work. The prints are composed freely and without any preconceived organisation around the work, and can be superimposed one on top of the other if the visitor so wishes.
María Pavés. Urban identity	The work in question shows an urban landscape and a wasteland composed mainly of lampposts. The colours are ochre and brown. Based on this image, the artist invites the creation of a new landscape composed of several planes. Thus, different matrices of different sizes are offered with lampposts as the central figure to emphasise the closeness and remoteness of the elements. The prints are made on different acetate supports, which act as different planes of depth.
Américo Caamaño. Local traditions	This work tells the story of the traditional process of drying fish, an activity that is very characteristic of the town. For this reason, its central image narrates a string of fish drying in the sun by the beach. From the observation of the work, each student receives a cloth fish, which he or she textures by printing waste materials with ink. Each textured fish is hung on a string attached to the work, similar to the original process. This forms a small installation made up of fabric fish.
José Pedreros. Personal identity	A work that portrays an imposing human figure. Based on the observation of its shapes and colours, each student is invited to create a self-portrait with similar characteristics. To do this, a collage support is first created, on which the matrix is printed, which has the figure present in the reference work. Although the same form is used, the result is a personal and different portrait which, added to others, generates a collective portrait.
Lucía Hernández. Daily flora	The work shows details of natural forms. These are born from the augmented and scientific observation of their shapes. From this, the students are invited to directly observe natural shapes with a beholder to discover how they are made: their colours, shapes, textures, and other important elements. From that observation, each student creates a matrix in eva rubber, which he or she draws with a biro and prints on a semi-transparent paper. The resulting print is placed on a light table at the side of the work.
Tatiana Binimelis. Local landscapes	The work presents a natural landscape, without differentiation of planes, made up of different textures, as if it were a black and white puzzle. Based on the observation of these characteristics, the students are invited to freely extend the landscape to the sides, using inks and waste material. In this way, each student creates different textures of different shades, which he or she freely composes on the side of the work, enlarging it and making it grow.

7. INTERPRETATION OF THE DATA

This experience uses Arts-Based Methodologies as the main method to interpret the learning dynamics occurred and the visual results. "Arts-Based Research proposes an approach and openness from scientific research to artistic creation to use its forms, knowledge and wisdom" (Marín-Viadel & Roldán, 2019, p. 885), consequently, its deployment implies the systematic use of artistic processes of creation in current artistic expressions (and in all the different forms of the arts) as the first way of understanding and analyzing the experience, both by the researcher and by the people involved in the studies.

In this way, the production of images parallels theoretical development and shapes the visual data. This provides a perspective of interpretation of the self, shaping an investigation that gives more than just meaning to our experience.

What kind of images emerge when creation is elicited from an artistic work that invites us to reflect on different aspects of identity?

Each module involves the production of a set of images that act as data. The analysis of the iconographies contained in those images, as well as the students' creative dynamics, are summarized in the following table:

Table 2.
Summary of main findings for each module.

Artist/Identifying Feature	Findings
Freddy Agurto Local identity	In greater number, the images express elements related to the marine landscape of the commune and its related activities: fishing, beach, sun, sea, marine products and animals. Lesser numbers of important local urban elements appear, such as the textile factory, houses, roads or objects of family property. The natural landscape is represented in third place.
María Pavés Urban identity	The possibility of play offered by this module for the understanding of the composition in planes of a landscape gave rise to a dynamic result. In this way, to the poles of different sizes offered as the only element of composition, other patterns made by the students were spontaneously added: people, cars, lighting, roads and vegetation, elements that were added, enriched and changed the initially proposed landscape.
Américo Caamaño Local traditions	The experience was based on textural research for the creation of a fish. As a result, the variety of textures found by the visitors stands out, which implied the use of resources such as the overprinting of one or several textures to achieve a unique result. The use of waste material is positively valued for the different wefts it offers.
Jorge Pedreros Personal identity	The result is made up of different self-portraits of each visitor. Although the transversal resource for the creation is the figure present in the work of reference, the paper support that receives the print gives singularity to each image. Collage stands out as the most used strategy for the intervention of the paper support.
Lucía Hernández Daily flora	The experience manages to captivate visitors' observation. Lines and dots stand out as the most used strategies to interpret the observed shapes and their details.
Tatiana Binimelis Local landscapes	Although a limited spectrum of textures was proposed to be explored in the printing, a variety of tonal values emerged. The use of overprinting for the creation of new visual textures stands out. In this module, the students also proposed some figurative elements, beyond textures, to complement and continue the landscape, such as mountains, trees and rivers, present in the locality.

In order to treat the visual data of the experience, instruments derived from the Arts Based Methodologies are used, such as the photo-essay and the sample series. These instruments show and interpret the dynamics of creation and aesthetic production of the students. Figure 1 shows the development of the local identity module and its main visual results through photographs and a visual table that organizes the main findings.

Figure 1.
Dynamics and textures obtained in the module at Tatiana Binimelis. Photo-Essay.

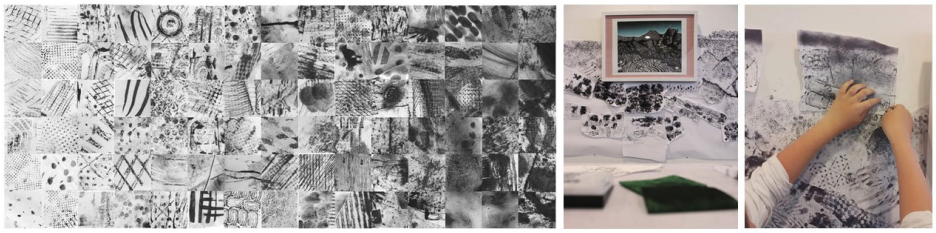
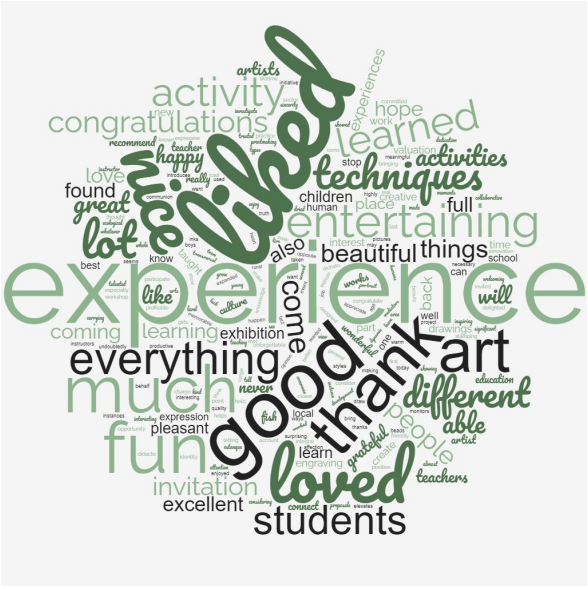


Figure 2 gathers in a word cloud the impressions of 100 students after visiting the exhibition. These were collected from a guestbook offered to anyone who wished to leave their impressions.

Figure 2.
Word cloud with the most important opinions of the students.



8. CONCLUSIONS

This proposal, being an unprecedented experience of artistic mediation in our territory, constituted an instance of methodological updating and of the discipline of engraving within art education. As main points of reflection, we mention the following:

Instances of this type should be conceived with aesthetic museum criteria and clear objectives. However, the fluidity, openness and divergence in decision making should not be forgotten, since these are dynamic actions that receive heterogeneous audiences. In this aspect, it is pertinent to adapt each experience according to the group, avoiding standardizing the action and respecting the initial criteria.

From the research point of view, we believe that it opens up the possibility of deepening the following points: first, in the work of training and theoretical deepening that is carried out with the mediators, which is presented as an instance that can influence and influence the education of their environments by contributing to improving their artistic practices. Secondly, the need to work on the adaptation of artistic actions for different audiences, such as groups in their initial stages, which implies finding new strategies to be able to carry them out.

On the other hand, the use of engraving was a highly motivating strategy, provoking great surprise in the visitors, who understood the basic processes involved in the creation of a print. In this aspect, it became clear that there is no need to resort to traditional and complex techniques to teach engraving.

As for the images obtained, these are derived from a clear knowledge of the local environment, which is identified and then transformed into iconography. In this aspect, we believe we have rescued aspects that run through the whole story, such as the marine imprint, its trades, products, places, family narratives and other properties. In this way, the exhibition does not present in its final composition a compendium of unconnected images, but a panorama of the individual and collective territory.

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AUTHOR INFORMATION

Full name: Jessica Castillo-Inostroza
Institutional affiliation: Universidad de Las Américas, Chile
Institutional address: Av. Pdte. Jorge Alessandri Rodríguez 1160, 4100000 Concepción, Biobío, Chile.
Short biographical sketch: A visual artist specialising in printmaking, Professor of Visual Arts and Doctor in Arts and Education, her work combines both fields, directing them to the benefit of art education. She currently works as a teacher and researcher in higher education. Her work focuses on the creation in printmaking as well as the research, innovation and implementation of didactic strategies applicable to different educational sites through the use of Arts-Based Methodologies, a/r/tography and Artistic Teaching Methodologies. From these, she emphasises the study of identity as an iconographic repertoire and theoretical substratum, as well as lateral printmaking practices as a teaching-learning tool.

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