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Education Applications & Developments VII

Editor: Mafalda Carmo

Education Applications & Developments VII
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Edited by: Mafalda Carmo

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FOREWORD

inScience Press is delighted to publish this book entitled *Education Applications & Developments VII* 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 seventh 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 7th 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", "Teachers and Learning", "Projects and Trends" 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) 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 25 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: *Mathematics Education and Performance, through the Prism of PISA, in Greece and Portugal*; by Eleni Nolka, & Chryssa Sofianopoulou. Greece and Portugal are two Southern European countries, with nearly the same population as well as a centralized educational system, which were both deeply affected by the economic crisis during the last decade. Despite being severely hit by the economic crisis, Portugal has advanced to the OECD average level in its students' mathematical performance in the Programme for International Student Assessment (PISA 2018), while Greece has performed below the OECD average. PISA, as one of the most influential international educational surveys, aims to evaluate educational systems and provides a valuable platform for comparisons. In the first PISA 2000, Portuguese students outperformed their Greek counterparts by only

7 points and went on to widen the difference by 41 points in PISA 2018. What national strategies have been set up and implemented in Portugal so as to foster student's mathematical literacy competencies? The main aim of this study is, through a recording of the Greek and Portuguese students' mathematics achievements in PISA and at the same time of the mathematics education in both countries, through available policy documents and research reports, to comment on the current outcomes of the two educational systems and their students' performance in Mathematics.

Chapter 2: *Social Validity of Special Education Intervention Programs: A Step towards Self-Determination?*; by Pagona Leonidou, & Lefkothea Kartasidou. The conceptualization of social validity emerged in the 1970s with seminal articles by Kazdin (1977), Wolf (1978) and Van Houten (1979). Since then its importance was accepted widely and is now considered a mandatory aspect of intervention research in special education (Horner et al. 2005 as cited in Leko, 2014). Pre and post intervention measures using qualitative and quantitative methods can be used in social validity research with benefits and limitations (Schwartz & Baer, 1991). Horner et al. (2005) asserted that social validity is enhanced when an intervention is implemented with fidelity in authentic contexts by typical intervention agents, so it seems preferable for interventions to be implemented in natural environment, the classroom, by typical agents, the teachers themselves. Self-determination, then, as a means of accomplishing specific goals established by the person itself and eventually improving quality of life, is highly related to quality-of-life matters and it may also serve as a valuable associated indicator of the social importance of intervention outcomes and overall social validity (Carter, 2010).

Chapter 3: *Assessment of Pupils' Social Relationships and Leisure Activities in Two Romanian High Schools*; by Adriana Albu, Mihaela Vlada, Adina Iustina Nechita, & Florin Dima. It is necessary to assess the way students spend their free time in the final years of high school due to the poor results that have appeared recently in the baccalaureate exams. The study was carried out using a group of 202 students from two high schools in the Romanian county of Botoșani. The young people filled in a questionnaire with questions about leisure activities and social relationships. The results were processed using Pearson's chi-squared test. The time allocated daily for physical activity is mostly 15-30 minutes (23.76%). The time spent watching television programs is mostly 0.5-1 hours (35.64%). Most pupils (44.05%) do not spend free time on the computer. In the majority of cases (32.4%) pupils have „one" true friend. In their free time, they go out, mostly 2-3 evenings per week (28.71%), but there are also 31.68% negative answers. Parents are less concerned about school activity ("never" answers – 34.15%) and are also less concerned with the way their children spend their free time ("never" answers – 34.65%). There is a series of situations that guide us towards a modest concern for the future, both from pupils and their parents.

Chapter 4: *Forensic Sciences as Educational Support for the Promotion of Teaching and Learning of Secondary Students*; by Shirlene K. S. Carmo, Luís Souto, & Carlos Silva. The search for improvements in education systems has grown sharply, from incentives in the educational area to changes in the legislation, highlighting a more contextualized teaching, especially in the field of science. However, the dissemination of knowledge transcends the need and becomes a daily challenge in the life of educators, who need to reinvent themselves, reform themselves, and especially develop activities that make the understanding of content more relevant and meaningful. Although it is an arduous task for many students, this learning is indispensable to adequate scientific education. Thus, this research aimed to synthesize studies that have been developed on the use of forensic sciences as a pedagogical approach in the improvement of secondary education. The methodology is based on applied scientific research of a qualitative-exploratory nature. The results show experiences of the school context lived in the United States, Brazil, Singapore, and Portugal, where it is observed that students feel more motivated and involved in educational activities when integrated into the forensic context. The implementation of this theme to the school curriculum has the potential to attract attention and arouse interest in the sciences, contributing to the reduction of retention rates and school dropout and increasing the demand for scientific and technological careers.

Chapter 5: *University College Students' Perspectives and Opinions on Digital Lectures*; by Marcin Fojcik, Martyna K. Fojcik, Lars Kyte, Bjarte Pollen, & Jan Ove Rogde Mjånes. The traditional lecture, with a teacher talking and writing on a blackboard interacting with students, has in many cases been exchanged with different digital or hybrid solutions. It was evident when the whole world went into lockdown, and education at all levels needed to emergency transform learning in classrooms to learning through digital platforms. New structures had to be made, new routines, and new approaches. It was necessary to develop solutions for presenting different programs or motivating students to be active, even without a camera or microphone. In some cases, the digital lectures were synchronous, with teachers and students meeting at the same time to discuss a topic both in small and big groups. Other times, the digital courses were asynchronous to give the students more time to prepare themselves and activate their learning by giving them the responsibility to study individually. This study has investigated the student's views on what they have experienced during digital lectures. The students from different programmes were asked to answer an anonymous questionnaire of their opinion, ideas, and experiences with digital solutions. The results were categorized and analyzed to select some tools or approaches that most students found better or worse for their learning.

Chapter 6: *Enlarging the View. A Model to Promote Quality in ECEC Services by Integrating the Indicator Framework Approach to the Situational Perspective of Children's Learning*; by Paolo Sorzio, & Caterina Bembich. In this contribution it is proposed a critical framework, based on Basil Bernstein's theory, for two aims: a) criticizing some tendencies in the Indicator Frameworks for the evaluation of the quality of Early Childhood Education and Care services (ECEC), which rely mainly on measures of the structural and processual characteristics of the educational settings. However, the processual dimensions are reduced to their individual components, overlooking the complex and contingent interactions that create opportunities for learning; b) proposing a critical framework, based on Basil Bernstein's theory to analyze the different child-centered approaches to ECEC.

Chapter 7: *Social Identity Formation of Black Learners in South African Historically White Schools*; by Anthony Mpisi, & and Gregory Alexander. The chapter engages with the issues influencing the social identity formation of black learners attending historically white schools (HWSs) in the Northern Cape province of South Africa. Black South Africans were treated as intellectually and racially inferior during the apartheid years. The situation was further exacerbated when black learners were admitted to HWSs. Consequently, the school that should normally contribute to developing a positive social identity formation of learners, seemingly has the opposite effect on black learners. An empirical investigation, by way of quantitative research, was employed to ascertain the issues influencing the social identity formation of black learners in HWSs. The authors, however, report on the data segment of 10 selected items pertaining to social identity formation, which was one of the components of an extensive doctoral study questionnaire, which was completed by 832 black learners enrolled at 27 HWSs in the Northern Cape province. Some of the findings indicate the manifestation of negative influences, low educator expectations, the disjuncture between home and school education as having an effect on the social identity formation of black learners. This chapter proposes certain suggestions to be considered by HWSs in South Africa to possibly mitigate the identified challenges.

Section 2, entitled "Teaching and Learning", offers research about foundations in the education process itself, in various contexts, both for tutors and students.

Chapter 8: *Learning Non-Euclidean Geometries: Impact Evaluation on Italian High-School Students Regarding the Geometric Thinking According to the Van Hiele Theory*; by Alessandra Cardinali, & Riccardo Piergallini. This paper aims to explore the impact of a non-Euclidean geometry course on Italian high-school students regarding the assessment of geometric thinking. To accomplish this, we analyse the results of the van Hiele levels test. We slightly modified and translated to Italian the van Hiele test, originally designed by Usiskin, and we used it to detect possible changes of the students' levels of geometric thinking after we taught a non-Euclidean geometries course of our design. The students involved in the test (N=56) span ages 15-18 and all attend the "Liceo Scientifico" high school type. The results show that

there is a statistically significant (p-value < 0.05) improvement in the median level of understanding in geometry if we consider the so-called modified van Hiele theory. Since we observe this improvement only for classes with an entering van Hiele level of at least 3, we suggest our non-Euclidean geometry course only for these classes of students, regardless of the grade.

Chapter 9: *Factors Influencing the Physical Sciences Pre-Service Teacher's Pedagogical Orientations in one of the Universities in South Africa*; by Aviwe Sondlo, & Umesh Ramnarain. To effectively teach sciences, science teachers require content knowledge of the science subject and know how to teach such content better. The purpose of this paper was to determine factors influencing the Physical Science pre-service teachers' pedagogical orientations. Orientations refer to teachers' knowledge and beliefs about teaching science at a particular grade level. Pedagogical orientations are classified into two approaches: direct approaches and inquiry approaches. A mixed-method approach was adopted, where a quantitative method was used to determine Physical Science pre-service teachers' pedagogical orientations and a qualitative method was used to establish factors influencing their pedagogical orientations. A questionnaire of ten items was administered to forty-five final year Physical Sciences pre-service teachers, and they were requested to select the most appropriate pedagogical orientation and then justify their choices. The questionnaire justifications and interviews were used to generate themes. This study's findings indicate that Physical Sciences pre-service teachers' preferred pedagogical orientations were between Direct Active and Guided Inquiry, and factors influencing their pedagogical orientations were: school resources, class size and teaching time.

Chapter 10: *4th IR – The Impact the Use of Mobile Teaching Devices will have on Higher Education*; by Johannes Andreas Gerhardus Beukes. Students and lecturers use mobile devices more and more and within a few years they will become indispensable tools in the classroom. Recent research clearly indicates that mobile devices such as smartphones, laptops and tablets are the tools of choice for students, scholars, teachers, and lecturers. It is playing a major role in teaching and learning, especially in higher education. It is therefore indisputable that the development of artificial intelligence and new ways of communication take their place in the classroom during the 4th IR. The integration of these new technologies into the teaching and learning experience in the classroom will be dependent on effective pedagogical implementation and planning to be successful. Taking this into account, this paper explores the effect that mobile devices have in the classroom on the teaching and learning experience of the student as viewed from the student's perspective. The advantages of the implementation of mobile devices must be weighed against the negative influence they may have. All the participants in the study reported that they have access to and use mobile devices to use the internet to source information.

Chapter 11: *A View of Secondary Technical School Students on the Support and Barriers to their Professional Growth*; by Dana Vicherková, & Josef Malach. The aim of the paper is to find out how Czech secondary technical schools students evaluate their professional growth in the course of their secondary school studies, what are the barriers to this growth and what are their views on the possibilities of schools to support their interest in the chosen field of study. Qualitatively oriented research focuses on the quality of secondary school studies as regarded by secondary technical schools students in the Moravian-Silesian Region of the Czech Republic. The research outputs provide suggestions for students to improve their professional growth throughout their secondary school studies and suggestions for procedures that may help remove barriers in their educational paths to a technically oriented profession. Respondents - secondary technical schools students - most frequently state the possibilities of their professional growth, comprising the "I-student" and "Teacher and teaching" factors. More than half of the barriers mentioned by students belong to the category of dispositional (personality) barriers. In second place are institutional barriers, and a negligible number of barriers have been included among situational barriers. The most significant number of students' opinions on how the school should deepen their interest in the field was concentrated in the group of factors "I - student". It is followed by opportunities to support interest in the "School" factor group.

Chapter 12: *Analysing Lesson-Based Interviews with Pre-Service Generalist Teachers who Lead Class Singing*; by Annamaria Savona. In pre-school and primary schools, teaching songs and leading class singing are often entrusted to generalist teachers. During their training, they are expected to attain and/or consolidate subject-specific skills. Research has yet to explore how generalist teachers make sense of their song-leading lessons and become familiar with subject-specific knowledge and skills. Using interviews based on video-recorded lessons from 10 pre-service generalist teachers, this study examines how each teacher experienced and managed leading class singing in their three-year training. The analysis includes the use of the visual tool Lesson Activities Map (LAMap), which is a graphical system for the organisation of lesson activities and is valuable for ensuring consistency in the interpretation of lesson-based interview analysis. This chapter presents a case study and offers implications both for the dissemination of new visual analytical methodologies in education and for understanding the teaching experiences of generalists involved in the professional development of teaching songs and leading class singing.

Chapter 13: *The Development, Piloting and Administration of an Instrument to Measure Nature of Science Understanding*; by Tarisai Chanetsa, & Umesh Ramnarain. The study describes the development of an instrument to measure the Nature of Science (NOS) understandings in high school Science teachers. The instrument was initially piloted on two high school teachers in South Africa, one teaching Life Sciences and the other Physical Sciences. It was subsequently used to measure NOS understanding in 10 high school Science teachers in South Africa over 6 months in 2021. The objective of the study was to construct a questionnaire that could measure NOS understanding based on the Family Resemblance Approach (FRA) and the Consensus View (CV). The NOS is a construct that has been defined by various scholars and there exist multiple perspectives. For this study, two perspectives that define NOS, the CV of Abd-El-Khalick and the Reconceptualised Family Resemblance (RFN) approach to NOS of Erduran and Dagher were considered. To collect data on NOS understanding, the researcher compared the Views of Nature of Science (VNOS) instrument used to capture NOS understanding under the CV, and the RFN questionnaire used to capture NOS understanding under FRA and compiled an Integrated Family Views of Nature of Science (IFVNOS) questionnaire. The findings revealed that the IFVNOS questionnaire developed can be used as a reliable tool to measure NOS understanding.

Chapter 14: *Performance of Brazilian Middle and High School Students in Reading Processes: Comparative Study between Public and Private Education*; by Adriana Marques de Oliveira, Jair Lício Ferreira Santos, & Simone Aparecida Capellini. This chapter discuss the following question: Is there a difference in the assessment for reading processes between students in public or private middle and high school? To answer these questions, this chapter aims to compare the performance of middle and high school students of public and private schools schools using tests from the Brazilian Adaptation of Reading Processes Assessment Battery - PROLEC-SE-R. The Reading Processes Assessment Battery - PROLEC-SE-R, individual version, was applied to 436 students: 221 from public school and 215 from private school, in the following order: 1) Reading Words, 2) Reading Pseudowords, 3) Grammatical Structures II, 4) Punctuation Marks, 5) Reading Comprehension I, 6) Reading Comprehension II, e 7) Oral Comprehension. A cross-sectional study was performed using descriptive and bivariate analysis. Based on these results, the answer to the initial question is affirmative. Private school students do indeed achieve a higher mean score when compared to public school students in word reading, showing that spelling helps in the reading processes. When knowledge of the use of the word in a sentence, extraction of meaning and its understanding is required, the difficulty of accessing the mental lexicon of the population studied becomes evident.

Section 3, 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 15: *Global Intercultural Project Experience (GIPE): A distributed interdisciplinary project-based learning framework*; by Manfred Meyer, Attlee M. Gamundani, Katja Becker, Daniel Malpartida, Agung Nugroho, José Ochoa-Luna, Colin Stanley, & Heike Winschiers-Theophilus. This chapter describes a new concept and experiences of a distributed interdisciplinary learning program for students across continents. The aim is to provide students with a truly Global Intercultural Project Experience (GIPE) by working together with peers from around the world and solving real-life client's problems. We have received seed-funding for four annual projects to engage students from Germany (Europe), Namibia (Africa), Indonesia (Asia), and Peru (South America). In 2020 and 2021, 28 and 44 students from four continents engaged in a one-semester distributed interdisciplinary project for a Namibian and Indonesian client, respectively. Despite Covid-19 they successfully completed the project expressing deep appreciation for the learning opportunities overcoming challenges of working across widespread time zones, cultures, changing requirements, and various technical difficulties. Considering the vast learning benefits, we suggest incorporating such projects in all tertiary education curricula across the globe, while streamlining organizational efforts based on lessons learned.

Chapter 16: *Exploring the Experiences of TVET College Educators Regarding Virtual Learning During COVID-19 in South Africa*; by Adebunmi Yetunde Aina, & Ayodele Ogegbo. This study explored the experiences of private TVET college educators regarding virtual learning during the Covi-19 school lockdown. The Kanter theory of change is adopted as the theoretical base in this study. Data collection was done through face-to-face semi structured interviews and non-participant observation with six educators from three TVET colleges in Gauteng Province, South Africa. Collected data was analyzed using content analysis. Findings reveal that though participants have positive attitude toward the process of change required in transitioning from traditional environment to virtual environment, majority of them did not receive substantive training on how to use technology to support virtual teaching. However, educators indicated that the change process comes with several challenges such as technical problems, ineffective communication from management, workload, inadequate training, lack of access to ICT tools and lack of other structural support within the college which impacts their effective implementation of virtual teaching. Thus, teachers should be adequately prepared, supported and empowered to cope with the changes and transition processes involved to continue teaching in a virtual environment. More so, TVET college managers and policy makers should priorities change management programmes designed to prepare teachers for the inevitability of technological change in education.

Chapter 17: *Understanding the Concept of Energy in High School: The Use of a Robotic System and Video Analysis as Teaching Resources*; by Galeno José de Sena, Leonardo Mesquita, Marco Aurélio Alvarenga Monteiro, Janio Itiro Akamatsu, & Maria Teresa Jacob. This article presents a work carried out to improve students' understanding of the concept of energy using a robotic platform and video analysis software. The electronic system made it possible to monitor a movement with characteristics similar to those of a simple harmonic motion, through a looping device, allowing the demonstration of the law of conservation of energy. The monitoring of the experimental configuration was carried out using the Arduino® platform. Demonstrations involving the use of the apparatus as well as the video analysis software were made for Physics students from a high school. The results showed that the automation of a simple experiment can become an interesting tool for both the teaching and learning process, triggering social interactions among students useful to assist in the fixation of physical concepts, even the most abstract ones such as Energy. In addition, the use of video analysis software provides students with experiences of collecting data, analyzing graphs and tables, which supplements the understanding of the nature of science and scientific practice.

Chapter 18: *Working with Digital Escape Rooms: Adding Value to the Teaching of Literature*; by Madalina Armie, José Francisco Fernández, & Verónica Membrive. The escape room, also known as an escape game, is a gamification tool that aims to enhance motivation and teamwork (Wood & Reiners, 2012). In the educational field, in particular, the escape room can be defined as an action game in real time in which the players, in teams, solve a series of puzzles or problems and carry out tasks related to the curricular contents studied throughout the course, in one or more rooms, with a specific objective and at a specific time (Nicholson, 2015). The use of escape rooms for teaching-learning the English language at different educational levels has been studied qualitatively and quantitatively (Dorado Escribano, 2019; López Secanell & Ortega Torres, 2020). However, there is no study on the applicability of the escape room in the English literature classroom at the level of tertiary education. This paper aims to demonstrate how the inclusion of this innovative pedagogical tool can be useful for working on theoretical-practical contents of literary studies of the undergraduate degree in English Studies. The study will focus on exercises to implement as part of the educational digital escape room using a sample of students and evaluating their motivation.

Chapter 19: *A Qualitative Case Study on the Self-Reliance Education Process of the Divorced Migrant Women in South Korea*; by Sooan Choi, & Youngsoon Kim. The purpose of this study is to explore the point where divorced migrant women who have been given the goal of self-reliance for their new lives are reconstituted as 'Adventurers' and identify the limitations. For this objective, a case study was conducted using the life histories of 5 divorced migrant women residing in the self-reliance support facility (named Didimteo), selected among the life history interviews of 80 migrant women. We performed open coding for data analysis, repeatedly reading the participants' interview data. As a result, qualitative classification revealed three distinct meanings for the self-reliance education process: Recovery of affirmative, Rediscovery of 'becoming,' Empowerment for the

future. If the self-reliance education experience is defined in terms of the results of this study, it may be described as a 'process of becoming an adventurer for economic self-reliance'. However, the psycho-emotional comfort and support that migrant women experience through self-reliance education at Didimteo confirmed the possibility that Didimteo could move forward as a self-reliance education community and social network for divorced migrant women.

Chapter 20: *Training Programs based on Reflective Strategies in the Context of MDVI*; by Andrea Hathazi, & Ioana-Letitia Serban. MDVI children acquire and develop communication skills based on their specific features and usually they need a large amount of time to learn how to employ different systems of communication to express a need and have an impact on other people or on the environment. In this context, a Consortium of 3 universities, 4 special schools, one NGO and one IT company have addressed the need of a professional training in communication abilities of the specialists working with MDVI children in an Erasmus+ European project called PrECIVIM. A training program has been created, based on common experiences, reflective strategies, and different components. The results of the training program are presented in terms of the data regarding the number of responses registered in the reflective logs (RL), the analysis of the professionals 'reflections on their interventions, the number of professionals who at the end of the training program began to use the RL to record data about MDVI children's communication skills and to acknowledge teamwork with specific feedback from the intervention sessions. The training program has emphasized the need of trainers and partners who offer constructive feedback and who implement reflective strategies in the intervention process regarding communication with MDVI children.

Chapter 21: *Impact of Identity-Oriented Literature Education on Adolescents' Learning Practices and Learning Outcome*; by Peter Grandits. A mixed-methods quasi-experimental study evaluated the effects of a pedagogical intervention in literature education on Austrian upper secondary high school students' insight into the self and the other. The intervention is based on the newly developed NDR-model, the letters in the abbreviation representing the basic practices of narration, dialogue and response underlying the model. Two cycles of NDR interventions on the identity issues of "happiness" and "relations" were implemented. An IPA study was conducted to explore how the implementation of the NDR-model of literature education affected participants' learning practices (narration, dialogue, response) and learning outcomes (self-understanding and understanding of the other). Qualitative analysis of interview and artefact data suggested that NDR students' learning practices were promoted. Additionally, they experienced insight into the self and the other because they were stimulated to engage with literary texts in the context of their personal identities.

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

Chapter 22: *PJI Principles: Taking Steps to have Conversations on Equity in our Classrooms and Daily Lives*; by Jennifer Sanguiliano Lonski, Laurinda Louise Lott, & Hank Van Putten. Today's educators, from kindergarten through higher education, are uniquely positioned to provide their students with real life opportunities that demonstrate and promote equity, change, and social justice ideals amongst their peers, throughout the schoolhouse and into their communities. These opportunities for students, supported by the norms and culture of the classroom, often come in the form of daily interactions with curricula, which affords teachers the window to teach how to disrupt inequity among students and in their lives. For teachers and school leaders to open this window, each must also have the courage to investigate and learn from the mirrors of the experiences of others reflected to them. The work of the Peace and Justice Institute at Valencia College provides educators with the courage to investigate those personal mirrors for the benefit of their students. Their courage is found in the sharing of stories about themselves and by turning off their automatic responses to the stories of others. The following chapter considers how The Principles, the philosophical foundation of PJI, translate into an equitable classroom practice. This qualitative case study of 24 teachers explores the impact of the PJI Teachers Academy in the k-12 classrooms of these teachers.

Chapter 23: *Education and Leadership as Drivers for Economic Growth - The case of Portugal*; by Natália Teixeira, Ana Lúcia Luís, & Paula Lopes. The competitiveness of nations requires several factors that must occur for it to attain sustained levels of economic development. Some of the most important vectors that constitute differentiators of nations competing globally are the qualification of its population, as well as the degree of sophistication, capacity for decision-making and strategic vision of its leaders and elites. A greater competitive ability of a nation translates into a higher capacity for wealth creation and a better performance on key items of social and human development. Often, small niches of excellence and strong leadership in key sectors are crucial, notably for the example that these examples of excellence signify to others, thus producing a dragging effect whereby other sectors and individuals are pulled in by inspiring role models and their examples. This chapter examines the performance of Portugal from different indexes, providing different perspectives, all related to levels of education and retention of qualified individuals, aiming to assess and evaluate the deep constrains that the country faces at a critical moment. Recommendations are centered around the key idea of a strong emphasis on the acquisition of knowledge as a catalyst for economic development.

Chapter 24: *The Perception of Employees in the Construction of University Brand: Spanish Context Case Study*; by Javier Casanoves-Boix, Ana Cruz-García, & Inés Küster-Boluda. This research was carried out to examine the role of brand capital in higher education. For this purpose, the main contributions of the literature to the study of brand capital and its application to the education sector were analyzed. Then, the variables determining brand capital in the higher education sector were identified and a comparison between the main employees was made. Once the

educational brand capital construct was established, an empirical study was carried out using a valid sample of 1,106 responses (690 from lecturers and 416 from service staff, belonging to eight public and private universities in Valencia (Spain). SPSS v.19 for Windows and EQS 6.2 were used as statistical work tools. The present investigation fills a gap in the marketing discipline because it is considered that there are no current investigations that analyze the perception of the brand capital through the opinions of the main employees involved in Spanish universities. The results obtained show the effects of each variable of brand capital in relation to the determining variables and, especially, to brand awareness, thus, helping the university managers to decipher the key aspects for their employees and thereby generate strategies to maintain them or improve them.

Chapter 25: *Women in Engineering: Actions for Improving their Integration in the Faculty of Engineering in Bilbao*; by Francisco Javier Maseda Rego, Itziar Martija López, Patxi Alkorta Egiguren, Izaskun Garrido Hernández, & Aitor J. Garrido Hernández. The situation of women in the engineering world has different aspects that should be carefully analysed. Last century, the woman who first broke this taboo in Spain was the mayor of Bilbao, the first female industrial engineer graduated in Spain in 1929, Pilar Careaga. By means of her public presence, her message could reach general society, but only as something exceptional. At the Faculty of Engineering in Bilbao, the first female Industrial Engineer was Pilar Ipiña, who graduated in 1965. Thirty six years later. After nearly a century, women in engineering remain a clear minority. Proposing solutions requires knowing the causes, in order to be able to carry out actions that lead to harnessing women's talent and enable them to realise their full potential. This paper presents a multi-staged process for the integration of women in engineering degrees. The first stage analyses different issues about the faculty structure and regulations. The second stage relates educational objectives and the gender perspective. The third stage marks the importance of educational materials. The fourth stage summarizes educational methodologies and activities. The fifth stage proposes a change of assessment model. Finally, the sixth stage comments on the importance of control and visualization of results.

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Section 1
Teachers and Students

Chapter #1

MATHEMATICS EDUCATION AND PERFORMANCE, THROUGH THE PRISM OF PISA, IN GREECE AND PORTUGAL

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ABSTRACT

Greece and Portugal are two Southern European countries, with nearly the same population as well as a centralized educational system, which were both deeply affected by the economic crisis during the last decade. Despite being severely hit by the economic crisis, Portugal has advanced to the OECD average level in its students' mathematical performance in the Programme for International Student Assessment (PISA 2018), while Greece has performed below the OECD average. PISA, as one of the most influential international educational surveys, aims to evaluate educational systems and provides a valuable platform for comparisons. In the first PISA 2000, Portuguese students outperformed their Greek counterparts by only 7 points and went on to widen the difference by 41 points in PISA 2018. What national strategies have been set up and implemented in Portugal so as to foster student's mathematical literacy competencies? The main aim of this study is, through a recording of the Greek and Portuguese students' mathematics achievements in PISA and at the same time of the mathematics education in both countries, through available policy documents and research reports, to comment on the current outcomes of the two educational systems and their students' performance in Mathematics.

Keywords: mathematics education, mathematical literacy, PISA, Greece, Portugal.

1. INTRODUCTION

One of the key competences necessary for personal fulfillment, active citizenship, social inclusion and employability in the knowledge society of the 21st century, is the mathematical competence (European Commission, 2011). Therefore, an understanding of mathematics is recognized by OECD as pivotal to a young person's preparedness for life in modern society and through the Programme for International Assessment (PISA), it measures the achievement of 15-year-old students on mathematical literacy which is defined as "an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive engaged and reflective citizens" (OECD, 2019a, p.75).

The intertemporal importance of PISA can also be located to the point that it has changed the philosophy of world educational policies, by giving feedback to policy-makers to reevaluate their educational system. That's exactly what happened in Portugal, starting from 2001 when the results of first PISA 2000 were published and were disappointing for

Portuguese students. It was then that policymakers started to set the stage for the endorsement of a series of ongoing education measures by placing great importance on mathematical education (Marôco, 2021). Furthermore, in Greece, according to Breakspear's survey, "PISA has provided policy-makers with useful information and tools to improve the quality and efficiency of the existing education system in Greece" (Breakspear, 2012, p. 19). Nevertheless, the Mathematics performance of Greek 15-year-olds students in PISA in all the cycles of PISA remains stable and below the respective OECD average, in contrast with Portugal, that has taken a quantum leap (Crato, 2020). More specifically, according to PISA's 2018 reports, Portugal is the only member of OECD that has experienced a significant improvement in its students' performance in all PISA's subject's, reading, science and of course mathematics, which is our subject of interest, throughout its participation in PISA (OECD, 2019b).

According to international surveys, mathematics education is influenced by the quality of teaching and certain structural and organizational features of education systems such as the curriculum, assessment arrangements, teacher education and support structures (European Commission, 2011). PISA's assessment is used as a very useful tool to measure the impact of educational policies on student performance and a lot of OECD publications, which are derived from PISA surveys include many analyses trying to identify which good practices distinguish good performing countries from the rest (OECD, 2016; OECD, 2019b; OECD, 2019d). Below we will develop the major educational policies regarding mathematics education, of both Greece and Portugal, with focus to the above structural and organizational characteristics which have taken place in the last 2 decades and which are explicitly justified or supported by PISA outcomes in both countries.

The data for this study comes first from the PISA's international assessment database for all PISA years between 2000 and 2018 and specifically of the mathematical literacy achievements and performance recorded for the two countries, Greece and Portugal. This data is available as online material provided by OECD. Second, more data for the present work comes also from available online policy documents for both countries, research reports, OECD and EU statistical data and reports.

2. KEY FEATURES OF GREEK AND PORTUGUESE EDUCATION SYSTEM

The Greek education system is highly centralized as it is overseen by the Ministry of Education and Religious Affairs (MofERA). Likewise, its Portuguese counterpart, Ministry of Education (ME), is responsible for the education stages from pre-school until upper secondary. Compulsory education in Greece lasts 11 years from the age of 4[1] to 15, or from pre-primary school to the end of lower secondary school, Grade 9, whereas in Portugal it lasts 12 years, between the age of 6 and 18 or from the beginning of primary school until the conclusion of upper secondary education, Grade 12. The stages of the Greek education system are comprised of Primary education which includes pre-primary schools and primary schools and spans six years and of secondary education which includes two cycles of study, the compulsory lower secondary which is called Gymnasio and lasts 3 years and the optional general or vocational upper secondary which is called Lykeio and lasts also 3 years (EC/EACEA/Eurydice, 2021a). The duration of the compulsory pre-primary education in Greece, until 2018, was one school year and since 2018/19 school year a

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[1]In 2018, the Greek Government extended compulsory schooling and pre-primary education to 4-year-olds, instead of 5-year-olds.

gradual implementation approach extended the duration into two school years. According to PISA's 2012 analyses, students who had attended pre-primary education for more than one year, outperformed the rest in many countries by more than one school year, even when taking into account the student's socioeconomic background (OECD, 2013). This is highly pertinent to Greek students, who were characterized as low performers in mathematics in PISA 2012, and who were far more likely not to have attended pre-primary school (OECD, 2018b). So, it could be said that the extension of compulsory pre-primary education into two school years seems a very promising measure for improving Greek mathematics education or mathematics' performance in PISA.

The Portuguese education system is divided in non-compulsory pre-school education (from the age of 3 until the start of basic education), in compulsory basic education which lasts nine years and in upper secondary education which lasts three years and has become compulsory since 2009. The basic education is also divided into three sequential cycles: a) the first cycle that corresponds the Grades one to four, b) the second cycle which corresponds Grades 5 and 6 and c) the third cycle which lasts three years and corresponds to lower secondary education, Grades 7 to 9 (EC/EACEA/Eurydice, 2021b).

3. PISA AND MATHEMATICS PERFORMANCE

Greece's mean performance in Mathematics has been consistently below the OECD average ever since it participated in PISA and can be described as hump-shaped, mainly due to a spike in performance in PISA 2009 while the performance in all other years was stable (OECD, 2019b). On the other hand, Portuguese students' mean performance in Mathematics has improved since 2000, 2003 and 2006 while their mean performance in 2018[2] was close to the level observed over the period 2009-2015 and is placed above the OECD average. The average 3-year trend in mathematics mean performance in Greece is only +0.1 points while in Portugal it is +6 points. In the latest PISA 2018, Greek students' mean performance in Mathematics (451) was statistically significantly below the OECD average (489) and between the lowest among OECD countries and simultaneously statistically significantly different from Portuguese's students mean performance (492), who had no statistical significantly difference from the OECD average. This difference of 41 points between the two countries' mean scores in Mathematics, corresponds to one whole school year, since the OECD has calculated that the 38 points correspond to one school year.

Results from PISA 2018 also showed that the share of Greek low achievers in Mathematics, those who scored below Level 2, remains among the highest in the European Union with a shrinkage of 3.1 percentage points since 2003. "The global indicators for the United Nations Sustainable Development Goals identify Level 2 proficiency as the "minimum level of proficiency" that all children should acquire by the end of secondary education. While students who score below this minimum level can be considered particularly at risk, Level 2 proficiency is by no means a "sufficient" level of mathematics proficiency for making well-founded judgements and decisions across a range of personal or professional situations in which mathematical literacy is required" (OECD, 2019b,

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[2]In PISA 2018 it was required that at least 80% of the students chosen within participating schools participated themselves and this percentage was not met by Portugal, where only 76% of students who were sampled actually participated. But, through a non-response analysis based on data from a national mathematics assessment in the country it was shown that the upward bias of Portugal's overall results was likely small enough to preserve comparability over time and with other countries. As a result, the data from Portugal were therefore reported along with data from the countries/economies that met this 80% student-participation threshold (OECD, 2019b).

p. 105). On the other hand, as top performers are characterized the students who are capable of advanced mathematical thinking and have performed at or above PISA's proficiency Level 5. The share of Greek top performers students has also decreased by 0.3 percentage points since 2003. However, in contrast to Portugal, both low and high achieving students have significantly improved their scores and the corresponding share of students who scored below Level 2 in mathematics has shrunk by 6.8 percentage points since 2003 while the share of students performing at or above proficiency Level 5 has increased by 6.2 percentage points. More specifically in 2018, more than one-third of Greek 15-year-olds participating in PISA were low achievers in Mathematics (35.8% compared to an OECD average of 22.2%) while in Portugal they were less than one-fourth (23.3%). The highest Levels 5 and 6, were reached only by the 3.7% of Greek students as compared to the OECD average of 11.4% and to the Portuguese corresponding average of 11.6%.

Another remarkable element is the girls' and boy's performance. In PISA 2003 while boys in Greece outperformed girls in mathematics by 19 points, by 2012 this difference had shrunk to 8 score points and in the latest PISA 2018 there was no difference in mathematics score points between genders. This, however, is due to the reduction of boys' performance and not to the improvement of girls (OECD, 2019d). At the same time the boys from Portugal in PISA 2003 outperformed girls in by an also notable amount of 12 score points, but in 2012 this gender gap narrowed by only 1 score point (11 score points). In PISA 2018 the corresponding gender gap has remained a notable amount of 9 score points which was greater than the OECD average (5 score points) (OECD, 2004; OECD, 2014c; OECD, 2019c). Moreover, between 2003 and 2012 and between 2012 and 2018, a reduction was showed in the share of girls in both countries Greece and Portugal, who performed below Level 2 and an increase in the share of girls who performed at Level 5 and 6 (OECD, 2014c; OECD, 2015; OECD, 2019c). On the other side the share of boys who performed below proficiency Level 2 shrunk between 2003 and 2012 in both countries, too, while between 2012 and 2018 in Portugal this share narrowed but in Greece increased. As far as the share of boys who were characterized as top performers in the two periods 2003-2012 and 2012-2018 is concerned, it decreased in Greece but in Portugal there was increase in both periods (OECD, 2015).

One of the most disturbingly facts resulting from Greek students' reports in PISA 2018, is that more than one in two students, which is one of the biggest percentages between OECD countries, agreed with the fixed mindset statement "*Your intelligence is something about you that you can't change very much*" (OECD, 2019c). Only in three OECD countries, Greece, Mexico and Poland, did the majority of their students appear to agree with this statement. Those students according to OECD are unlikely to make the investments in themselves that are necessary to succeed in school and in life (OECD, 2019c). On the other hand, the majority of Portuguese's students disagreed or strongly disagreed with this statement. A growth mindset could be described as "the belief that one's skills and qualities can be cultivated through effort, good strategies, and support from others, as opposed to a fixed mindset that supposes them to be determined at birth" (OECD, 2021, p. 14). Students with a growth mindset "is more likely to embrace challenges and learn from setbacks to reach greater levels of achievement than a person with a fixed mindset who avoids challenges and mostly seeks approval" (OECD, 2021, p. 14).

4. MATHEMATICS CURRICULUM

In both countries, curriculum is defined centrally. The latest revision and update of the mathematics curriculum for primary and lower secondary education in Greece took place in 2003 with the single cross thematic curriculum framework (DEPPS) and the detailed curricula (APS). In comparison, to Portugal's curriculum that was introduced on 2008, both countries' mathematics curricula are similarly more focused on cross-curricular links and on the interaction of mathematics with philosophy, science and technology (European Commission, 2011). A revision of the Portuguese curriculum for Mathematics of the second cycle of primary and lower secondary education took place in 2012/13 with the aim of setting learning standards of basic skills to be reached by all students and to give more flexibility over curriculum management (OECD, 2014b). A more flexible curriculum in Portugal has also sprung from a pilot programme in 2017/18 and has been in effect since 2018 (EC/EACEA/Eurydice, 2021b).

The poor alignment of Greek Mathematics curriculum in lower secondary school with the PISA's assessment Mathematics framework and the strong content focus (Breakspear, 2012; OECD, 2018b) are highlighted through an IEP's survey which showed that in Greek curriculum, Mathematics applications appear as consequences and not as fields within which Mathematics emerge, as stated in PISA (IEP, 2019). The problem solving in Greek curriculum appears as an application of a specific theory and not as a real-life problem which has an invisible or a subtle connection with the "theory", as encountered in PISA's mathematical literacy problems (IEP, 2019).

An important proxy that helps to explain the relative importance of Mathematics as a school subject, compared to others in the curriculum is the recommended taught time which means the curriculum time allocated for teaching mathematics (European Commission, 2011). According to last decades' annual European reports, the weight of mathematics in the curriculum of primary education in Portugal was placed in the highest rank among the European countries whereas in Greece it was in the lowest. Moreover, in Greece a student who completes primary school has been taught less than half the number of hours of mathematics in total than his Portuguese counterpart (European Commission/EACEA/Eurydice, 2018). In lower secondary education, Greece is between the European countries with the fewest number of hours but with not so wide gap with Portugal (European Commission/EACEA/Eurydice, 2018; European Commission, 2011). According to students' responses in PISA 2018, the learning time per week in regular mathematics lessons were estimated at 3.4 hours for Greece and 4.5 hours in Portugal (OECD average hours 3.7) (OECD, 2019d). Moreover, in Portugal, it was reported that in 2012 students spent one-and-a-half hours more per week in mathematics lessons than students in 2003 did while in 2012 they spent around one hour less in after-school study than students in 2003 did (OECD, 2013, p. 104).

The textbooks, being a central tool for the implementation of the mathematics curriculum, in Portugal are chosen from the teachers among all available textbooks previously approved by the Ministry of Education, while in Greece schools are limited to one specific authorized mathematics textbook that has been approved by the Institute of Educational Policy (IEP) and is the same for all students attending the same grade (EC/EACEA/Eurydice, 2021a). The Greek Mathematics textbooks in lower secondary school, according to an IEP's (2019) survey, contain low percentage of real-life math problems whilst the majority of them could be described as "standard" word problems, which can be solved with any combination of arithmetic operations, rather than "problematic" ones which can be compared to the PISA mathematical literacy problems, according to Verchaffel, Greer and De Corte classification.

5. ASSESSMENT IN MATHEMATICS

Student assessment in mathematics is a crucial element of the teaching and learning process and national tests in mathematics are widely implemented and used to inform or guide policymakers to support equity and quality of student learning (European Commission, 2011; OECD, 2018a). After Portugal was affected by the poor PISA results, the low-stakes were promoted in 2003 and the corresponding high-stakes exams for Mathematics at the end of Grade 9 were used in 2005 (Marôco, 2021). The application was also expanded (2012) to grades 4 and 6 (OECD, 2014b) but was terminated in 2016 (Santiago, Donaldson, Looney, & Nusche, 2012). Today, student assessment includes both internal and external national assessment in Portugal. The internal student summative assessment is organized by the schools while the external one is carried out by the Educational Evaluation Institute (IAVE) and involves national final exams in the end of basic education cycle, Grade 9, in the subjects of Mathematics and Portuguese, whereas in Grades 2, 5 and 8 standardized tests are administered. There are also national examinations in the end of general secondary education (Liebowitz, González, Hooge, & Lima, 2018; OECD, 2020a; EC/EACEA/Eurydice, 2021b).

In contrast to Portugal, the Greek educational system has no national assessments in mathematics to track student performance comparatively across schools, at a regional or national level, either in primary or lower secondary education. The only high-stake national assessment which takes place in Greek educational system is the Panhellenic university admissions examination which is administered only at the end of upper secondary education. In lower and upper secondary school, written progression and school leaving examinations are administered on a number of subjects, as is the case with exams in Mathematics, which are performed by each school and their respective Mathematics' teachers (EC/EACEA/Eurydice, 2021a). It was only as far back as in 2013 that efforts were made to create a more national approach to student assessment in selected school subjects, including mathematics, in upper secondary school (in Grades 10 and 11) with national tests banks including question items at different levels of difficulty. The use of these test banks was abandoned in 2015/16, given concerns about equity and early school leaving (OECD, 2018b).

In Portugal the research work of Marôco and Lourenço, has shown the concurrent and content validity of PISA with the national high-stake exams for mathematics (Marôco, 2021 Crato, 2020). In Greece, due to the absence of national student assessment it is difficult to conduct such surveys. IEP (2019), through some data from the promotion and school-leaving mathematics examinations in 9th grade which were delivered from individual schools and teachers of mathematics during the last decade, it was estimated that from 232 such tests only on 5 (2%) included at least one item of real-life problem, that could be compared to PISA mathematical literacy problems. So due to the absence of national standardized assessments in Mathematics to provide regular information about students learning outcomes (OECD, 2020b) PISA results in Mathematics and data could be provide some evidence to this direction or an international overview of student's performance in relation to other OECD and European countries in order to develop a higher-quality and more equitable mathematics education (OECD, 2018b).

6. IMPROVING STUDENT'S MOTIVATION IN MATHEMATICS

"Motivation and engagement can be regarded as the driving forces behind learning. Given the importance of mathematics for students' future lives, school systems need to ensure that students have not only the knowledge that is necessary to continue learning mathematics beyond formal schooling, but also the interest and motivation that will make them want to do so" (OECD, 2014a, p.1). As it is also referred on "PISA in Focus" (OECD, 2014a, p. 1), "students who are highly motivated to learn mathematics because they believe it will help them later on score better in mathematics – by the equivalent of half a year of schooling – than students who are not highly motivated" or it can be one of the most important determinants of students' achievements in school (European Commission, 2011).

In order to improve student motivation and encourage positive attitudes towards mathematics learning and education, Portugal implemented the "Action Plan for Mathematics", which was launched in 2005. The six components of the plan were: a)implementing a mathematics plan in each school, b)training teachers in basic and secondary schools, c)reinforcing mathematics in initial teacher training, d)readjusting the mathematics curriculum throughout the compulsory education system, e)creating a resource bank or database specifically devoted to mathematics and f)evaluating textbooks on mathematics (OECD, 2013). The Action Plan is referred that "allows students to dedicate more time to the study of mathematics and focus on exploration, investigation and problem-solving" (European Commission, 2011).

In Greece there are no such national strategies or initiatives (European Commission, 2011).

7. EDUCATION AND PROFESSIONAL DEVELOPMENT OF MATHEMATICS TEACHERS

In Greece both primary teachers and secondary education teachers who teach mathematics hold at least a first cycle degree (UNESCO, 2015; OECD, 2018b) and no additional degrees or pedagogical training certificates are required. In Portugal, with the implementation of the Bologna process (finalized in 2009/2010) the minimum requirement for teaching is a second cycle degree, a master's degree, and the preparation of secondary education mathematics teachers which includes components concerning mathematics, general education, didactics of mathematics and a period of teaching practice (Ponte, Santos, Oliveira, & Henriques, 2017). In all six grades of primary school in Greece and in the first four grades of basic education in Portugal, mathematics is being taught from teachers who teach the majority of the subjects but in Grades 5 to 6 in Portugal, mathematics is being taught by teachers who are qualified in mathematics and may be in other subjects as well. In secondary education, lower and upper, in both countries, mathematics is being taught by a single teacher with a qualification to this subject only.

The focus on mathematics teachers training could be regarded also as a measure responsible for the improvement of Portuguese 15-year-old students in mathematics (European Commission, 2011). Through the "Action Plan of Mathematics", the training of teachers in both primary and secondary education, collaboration between them and co-teaching in the classroom were developed. Also, in measures like "Teams for Success", schools received support teachers, specialists in mathematics teaching, to help them implement innovative three-year projects focused on the improvement of students' mathematics learning, the promotion of professional development programmes, the creation

of database of educational mathematics resources, the reorganization of initial teacher training programmes and access to STEAM teaching (Kearney, 2011). In additional, at the end of the school year, every school carried out self-evaluation within the scope of the Mathematics Plan II which included an evaluation of the strategies implemented, student performance in mathematics, and the development and implementation of the mathematics programme (European Commission, 2011).

8. FUTURE RESEARCH DIRECTIONS

The experience and the conclusions from this study could provide a platform or a guide for future discussions and researches. In the present paper took place a recording of students' mathematics achievements in PISA and at the same time analysed the mathematics education between the two Southern European countries, Greece and Portugal respectively. This research study could be a beneficial preparation for a possible enlarged study for mathematics education and performance, through the prism of PISA among more European countries or more specifically among Southern European countries.

9. CONCLUSION/ DISCUSSION

We believe that this paper has managed to show or to highlight some positively related factors to the performance of Portuguese students in PISA mathematics which have eventually fostered student's mathematical literacy competencies and which are the following: the frequent reevaluation or revision of mathematics curriculum in compulsory education, the improvement of the level of students' motivation in mathematics classrooms, as well as the focus on mathematic teachers' training that has laid emphasis on their collaboration. Last but not least, another factor is the implementation of national tests in mathematics in compulsory education with the scope to inform the policy makers for the curriculum development as well as the improvement in teachers training. Furthermore, we can also attribute their improved performance to the shift towards more outcome-oriented accountability, which could change the ways mathematics teachers and schools perceive external assessments like PISA. On the other hand, the stable and low position of Greece in PISA mathematics since 2000 till today could be justified to some extend by the poor alignment of Greek mathematics curriculum and mathematics textbooks in lower secondary school with the PISA's assessment mathematics framework and their strong content focus. Moreover in comparison to Portugal, by outlining the respective Greek reality in mathematics education during the past 20 years which runs parallel to the PISA survey, we can focus briefly on the infrequent reevaluation or revision of mathematics curriculum in compulsory education, the lack of the focus on mathematics teachers training for the purpose of their professional development, the lack of national assessments in mathematics and last but not least on the lack of organizing programs at a national level in order to improve Greek students' motivation in mathematics.

A positive conclusion that can be drawn, as demonstrated by the experience of Portuguese Education system and could prove useful to Greek education as well, is that top performers can be nurtured while simultaneously assisting struggling students, thus strengthening the OECD view that "*Countries do not have to choose between nurturing excellence in Education and reducing underperformance*" (OECD, 2016, p. 266).

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Chapter #2

SOCIAL VALIDITY OF SPECIAL EDUCATION INTERVENTION PROGRAMS: A STEP TOWARDS SELF-DETERMINATION?

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ABSTRACT
The conceptualization of social validity emerged in the 1970s with seminal articles by Kazdin (1977), Wolf (1978) and Van Houten (1979). Since then its importance was accepted widely and is now considered a mandatory aspect of intervention research in special education (Horner et al. 2005 as cited in Leko, 2014). Pre and post intervention measures using qualitative and quantitative methods can be used in social validity research with benefits and limitations (Schwartz & Baer, 1991). Horner et al. (2005) asserted that social validity is enhanced when an intervention is implemented with fidelity in authentic contexts by typical intervention agents, so it seems preferable for interventions to be implemented in natural environment, the classroom, by typical agents, the teachers themselves. Self-determination, then, as a means of accomplishing specific goals established by the person itself and eventually improving quality of life, is highly related to quality-of-life matters and it may also serve as a valuable associated indicator of the social importance of intervention outcomes and overall social validity (Carter, 2010).

Keywords: social validity, intervention program, special education, behavior problems, self-determination.

1. INTRODUCTION

The concept of social validity was at first applied to behavioural interventions, even though it could pertain to any multi-component intervention targeting behavioural, educational, functional or psychological outcomes for people with disabilities (Carter, & Hughes, 2005). *Social validity "generally refers to whether the focus of the intervention and the behavior changes that have been achieved meet the demands of the social community of which the individual is a part"* (Kazdin, 1982 as cited in Turan & Meadan, 2011, pp. 13-14). Social validation, broadly defined, refers to assessing the social acceptability of intervention programs, that is mainly the behaviors selected as targets, intervention procedures and behavior change (Kazdin, 1977). Social validity measures, though, were rarely employed until 1970s, when Kazdin (1977) and Wolf (1978) published their seminal articles (as mentioned in Carr, Austin, Britton, Kellum, & Bailey (1999)), who in their research related social validation to treatment acceptability (e.g. Turan, & Erbas, 2010). Treatment acceptability refers to "the judgments by persons, clients and others of whether treatment procedures are appropriate, fair, and reasonable for the problem or client" (Kazdin, 1981, p.493 as cited in Elliott, Witt, Galvin, & Peterson, 1984). Wolf (1978), though, specifically, suggested that programs need to be acceptable on three levels: the social significance of goals, the social appropriateness of procedures and the social importance of outcomes.

A research concerning social validity measures reported in articles published from 1968 to 1998 of the JABA was published by Carr et al. (1999), whose results indicated that in that period after increases and declines in the reporting of measures of social validity the measures stabilized at approximately 25% of research articles. Someone would expect that things would have changed over time, but a recent research by Hurley (2012) on preschool education in U.S.A. revealed that only 27% of 90 behavioral intervention studies published social validity assessment results, on goals (n=7), on procedures (n=8) and on outcomes (n=9). According to Ferguson et al. (2018) the publications still remain low, in the range 12-25%. Therefore, there seems to be a methodological gap in intervention research, since such an important measurement is often not conducted or even not published, as many scientists avoid publishing the results if they are not supportive of the intervention's effectiveness. And, undoubtedly, a social validity measurement that is supportive of a program's effectiveness and acceptability should be published, but even a negative result is still a result and should be published as well (Schwartz & Baer, 1991). Indeed, a negative result might be even more imperative to be published, because it would help upcoming program developers to rethink some options and avoid some possible design mistakes.

In this particular chapter, there is going to be an overview of the main points of social validity assessment and its importance for the implementation of special education programs. Particularly, the connection of social validity and self-determination of people with disabilities is going to be outlined. This connection is thought to be of substantial value, as, already since Kazdin's and Wolf's seminal, social validity came up as an intriguing issue of respect of individuals' rights to the informed consent and related ethical matters when receiving support.

2. SOCIAL VALIDITY ASSESSMENT PROCESS AND METHODS

The behavior change deriving from an intervention program does not only affect direct recipients, e.g. primary recipients of a program, but also indirect recipients, e.g. direct-care staff, teachers, parents, members of the immediate community and members of the extended community (Schwartz & Baer, 1991), whose opinion on intervention issues is quite important. Therefore, based on Rademaker, de Boer, Kupers, and Minnaert (2021), it is important to search out an optimal balance in intervention design so that it still includes all essential intervention components, and it also meets the demands of teachers. Thus, social validity assessment can be that valuable tool to guide intervention design in finding this balance.

"Social validity assessment is ideally a two-part process: first an accurate and representative sample of the recipients' opinions is collected. Then, that information is used to sustain satisfactory practices or effect changes in the program to enhance its viability in the community" (Schwartz & Baer, 1991, p. 190). Thus, social validation must be conducted on 3 levels: Social validation of a) goals, b) processes and c) outcomes (e.g. Carter, & Wheeler, 2019; Turan & Meadan, 2011; Kennedy, 1992; Wolf, 1978; Kazdin, 1977). So, three questions should be posed (Wolf, 1978):

a) *Social significance of goals*. Are the targeted behavioral goals what participants, caregivers, and society actually need?
b) *Social appropriateness of procedures*. Do the ends justify the means? That is, do the participants, caregivers, and other recipients consider the program procedures acceptable?
c) *Social importance of effects*. Are recipients of intervention satisfied with the results, including the unpredicted ones?

More specifically, research using social validity measures can be analyzed in terms of three distinct dimensions: 1. the type of information, 2. the focus of the collected information, and 3. the time between intervention and the assessment process (Kennedy, 1992). Various combinations can then be used as the basis for content analysis. Two basic strategies have been used for the collection of social validity information: (a) subjective evaluation and (b) normative comparison. *Subjective evaluation* is based upon individuals' (e.g. students, teachers, experts, relatives) ratings or statements regarding some aspects of the intervention (Kazdin, 1977; Wolf, 1978), so questionnaires, focus groups, interviews and rating scales serve this function. *Normative comparison* is based upon the comparability of a person's performance with a group of people whose behavior is considered to be typical or desirable (Van Houten, 1979), so e.g. rating scales with norms, performance criteria, case descriptions or evidence-based interventions can be used. The second dimension actually concerns the aforementioned three levels of social validation. The focus of the collected information can then be on the selection of goals, procedures or outcomes (e.g. Kennedy, 1992) As for the third dimension, the time between intervention and the assessment process, social validity assessment can be carried out before the intervention (pre-intervention), after the intervention (post-intervention) (e.g. Schwartz & Baer, 1991; Kazdin, 1977) and, equally importantly, "periodically throughout implementation" of intervention as suggested by Schwartz and Baer (1991, p. 197), because an initially acceptable program at a pre-intervention measure could possibly be unacceptable during the actual procedures risking the program's effectiveness. Therefore, changes could be made so that the program's goals or procedures would become acceptable by recipients. Of course, a combination of the aforementioned could be conducted e.g. both pre-intervention and post-intervention assessment of social validity.

Both qualitative and quantitative methods can be used in social validity research with accordingly benefits and limitations. As mentioned before, social validity can be assessed using a variety of methods including having recipients of a program (e.g. direct-care staff, parents, teachers) complete questionnaires (subjective evaluation) and/or by comparing treatment outcomes with established behavioral norms (normative comparison). Usually, it is examined using questionnaires, rating scales or direct observations, which are easy to administer and relatively inexpensive (e.g. Leko, 2014), generating quantitative data (Wolf, 1978). While the psychometric properties of many of the instruments may be questionable, measures of social validity nevertheless are thought to be important in ensuring recipient acceptance of behavioral programs (Kazdin, 1977).

As Leko (2014) mentions, in recent years many researchers increasingly use mixed-method designs in which social validity data are collected from interviews with teachers, students with disabilities, their family members or peers typically post-intervention. So, for instance, as shown in table 1 below, a researcher could carry out a pre-intervention assessment of social validity of goals and procedures using normative comparison (e.g. a rating scale), a subjective evaluation (e.g. questionnaire) during the intervention and a post-intervention assessment of social validity of outcomes using subjective evaluation methods (e.g. interview) and normative comparison (e.g. the same rating scale as in the beginning). Any type of combination could be made, even multiple instruments could be used, for example both questionnaires and interviews if conducting subjective evaluation. In general, it is upon the researcher who is going to apply the intervention to decide the social validity assessment schema.

Table 1. Example of a social validity assessment schema under the three levels and three dimensions.

	Pre-intervention		During the intervention		Post-intervention	
	Subjective evaluation	*Normative comparison*	*Subjective evaluation*	*Normative comparison*	*Subjective evaluation*	*Normative comparison*
Social validity of goals		√				
Social validity of procedures	√		√			
Social validity of intervention outcomes					√	√

In any case, it is imperative to implement systematic, accurate and objective procedures in order to access and validate information which will be relevant for the implementation of special education programs, as emphasized by Cook, Tankersley, Cook and Landrum (2008, as mentioned in Acle Tomasini, Martinez Basurto, Lozada García, & Ordaz Villegas, 2015). Also, as Carter (2010) stated, always assessing social validity according to the same plan or measures would not promote measuring actual importance of treatment effects for each recipient of a program, as it might lead to evaluating some variables irrelevant to their circumstances. Thus, research design of social validity measurement is of substantial value and should be unique for each intervention program, as the researcher must know who and when to ask and what methods and instruments are best to use each time. After all, "sound social validity assessment consists of asking the right questions, to the right people, in an appropriate manner" (Schwartz & Baer, 1991, p. 195).

2.1. Social validity assessment instruments

Storey and Horner (1991) pointed out the importance of social validity data, which is enhanced if the information is obtained through standardized instruments with established validity and reliability. Even though the psychometric properties of many of the instruments used to determine social importance and treatment acceptability may be questionable, measures of social validity nevertheless are thought to be imperative in ensuring recipients' acceptance of behavioral programs. Therefore, a range of instruments can be used in various combinations to socially validate goals, procedures and outcomes in a pre, during and post intervention schema. Some of the most commonly used methods are briefly described below:

a) Rating scales

As cited in Carter (2010, 2007) some of the most used original formalized instruments (and their extensions, modifications or revisions) developed to measure treatment acceptability are the following:

- Treatment Evaluation Inventory (Kazdin, 1980)
- Intervention Rating Profile (Tarnowski & Simonian, 1992)
- Treatment Evaluation Inventory-Short form (Kelley, Heffer, Gresham, & Elliot, 1989)
- Treatment Acceptability Rating Form (Reimers & Wacker, 1988)
- Treatment Acceptability Rating Form Revised (Reimers et al., 1991)

- Intervention Rating Profile-15 (Martens, Witt, Elliott & Darveaux, 1985)
- Children's Intervention Rating Profile (Witt & Elliot, 1985)
- Behavior Intervention Rating Scale (Von Brock & Elliott, 1987)
- Intervention-Process Rating Scale (Kutsick, Gutkin, & Witt, 1991)
- Abbreviated Acceptability Rating Profile (Tarnowski & Simonian, 1992)

They are all easy to administer and simple to score, as total scores are obtained by summing all items with higher summed total scores indicating greater levels of treatment acceptability. The first two of them, though, were the most often used according to Carter's review (2007). Endeavours to create new social validity instruments, though, have not ceased, as, for instance, the Usage Rating Profile-Intervention (URP-I; Chafouleas, Briesch, Riley-Tillman, & McCoach, 2009, as cited in Briesch, Chafouleas, Neugebauer, & Riley-Tillman, 2013) which was recently developed. Certainly, improved construction of social validity assessments is an important goal, but basic rules of test construction and statistics should be taken into account by researchers when developing such instruments (Baer, 1987).

Concluding, rating scales and questionnaires can be either a subjective or a normative type of measuring social validity, depending on if norms are used or not to compare the individual's level in relation to peers' level of functioning evaluation. So, they are considered a subjective type if they are simply based on individuals' opinions about the behavior of the individual targeted or a normative measure if a standardized psychometric rating scale is used, as it is based on the comparison to same age, culture, socio-economic level peers. Rating scales and questionnaires could be used for social validation of goals, procedures and/or outcomes.

b) Interviews

Interviews from parents, teachers or generally personnel related to the targeted individual are another method of assessing social validity, that can provide substantial amount of information in a short period of time. Indeed, an unstructured interview may subdue to procedural inconsistency, according to Luiselli (2021), as it may lead to discussions not directly related to the social validity assessment if interviewers don't follow a script or if interviewees are affected by the face-to-face interaction. On the other hand, a semi-structured interview based on the three levels of social validity (e.g. Gresham & Lopez, 1996) uses questions relevant to the specific areas. Moreover, information collected within Functional Behavior Assessment (FBA) questionnaires and interviews can provide evidence of social validity and, as Carter (2010) proposes, it might be beneficial for future research to consider correlating FBA types of assessment with measures of social validity. It seems, though, that the information collected by the functional assessment process would be incomplete without the participation of the students themselves (Wehmeyer, Field, Doren, Jones, & Mason, 2004), so by including the student's preferences into the intervention program design it may be possible to increase the social validity of the program, from the student's viewpoint (Carter, 2010). In that case, the use of a student oriented functional assessment (e.g. O'Neill et al., 1997) could be more than useful. In conclusion, Interviews of any type (structured, semi-structured, student-assisted/parents/teachers interviews) seem to be a subjective type of measuring social validity, as evaluation is based upon individuals' opinions concerning the behavior of the individual targeted. Interviews are easy to use and could be used for social validation of goals, procedures and/or outcomes.

c) Direct observation

Ideally, as recommended by IDEA, observations could be held in the context of Functional Behavior Assessment, as it would be, then, possible to obtain a great amount of information about functional relations concerning problem behavior(s), even though a substantial amount of time and effort is required. Observations can be made regarding the targeted person's or/and others' functioning in the same environments and afterwards comparison can be made to conclude how close is the targeted individual's behavior to others' who are considered to be functioning well in the same type of environment (Carter, 2010; O'Neill et al., 1997). Data from direct observations are thought to be more likely to lead to more effective interventions relative to data from an interview (Shriver, Anderson, & Proctor, 2001), even though it is suggested that multiple forms of FBA be exploited so as to identify all important functional relations (O'Neill et al., 1997). Concluding, direct observation seems to be a normative type of measure of social validity, as there can be a comparison to a group of individuals whose behavior is considered to be typical or desirable. Also, it could be used to socially validate mainly goals and/or outcomes, and less intervention procedures.

d) Performance criteria

Prior to the implementation of an intervention performance criteria can be established and then intervention outcomes are compared to the pre-established criteria. Fawcett (1991) suggested using proficiency criteria at three levels for comparison of post-intervention effects: ideal performance levels (consistent behavior, highly efficient with no need for further improvement), normative performance levels (behavior efficient and comparable to others functioning in the same environment) and deficient performance levels (behavior that lacks efficiency and needs improvement for the individual to function effectively within the environment). This type of comparison to specific criteria is a highly structured method for determining the social importance of intervention outcomes (Carter, 2010) and consists of a normative type of measure. An example of this is the Interventions based on Functional Behavior Assessment for which, as a result of the assessment, specific goals are set and performance criteria can be established and that could serve as a normative measure of social validity of outcomes.

e) Case descriptions

As stated by another strategy that the vast majority of analogue investigations of treatment acceptability have used is a *case description methodology* (firstly developed by Kazdin in 1980) (e.g. Elliott, & Treuting, 1991; Elliott et al., 1984). Specifically, pencil and-paper descriptions of problem behaviors were usually used. Each participant is given a packet including instructions, demographics, one case description or more, which were typical of classroom problems, and an acceptability questionnaire. The case descriptions included problem behaviors, interventions and information concerning the effectiveness of the proposed interventions. This strategy could be used as a subjective measure of social validity of procedures (Elliott, & Treuting, 1991).

3. IMPORTANCE OF SOCIAL VALIDITY ASSESSMENT FOR INTERVENTION PROGRAMS

"Social validity is intrinsically an adjunctive measure; its function is not to evaluate program effectiveness, but program acceptability and viability. Similarly, its purpose is not to compare programs, but to safeguard programs against rejection or sabotage" (Schwartz & Baer, 1991, p. 197). Results from social validation assessment could very well serve as

evaluative feedback from recipients of a program to guide program design and evaluation (Schwartz & Baer, 1991). Furthermore, designing and implementing practices based on scientific evidence is one of the main challenges for special education worldwide (Cook, Tankersley, & Harjusola-Webb, 2008, as mentioned in Acle Tomasini et al., 2015) with the permanent purpose of not only benefiting students with special education needs, but also promoting school, family and social inclusion. In the same sense, they emphasize the importance of implementing accurate, systematic and objective procedures to help access and validate information which will be important for the implementation of special education programs. Furthermore, Lane, Beebe-Frankenberger, Lambros, and Pierson (2001) also list social validity, along with treatment integrity and generalization - maintenance, among an intervention program's evaluation factors, as it provides information about the social significance of the intervention's goals, the social acceptability of the intervention's procedures and the social importance of the effects resulting from the intervention. According to Anderson, Taylor, Taylor, and Virues-Ortega (2021), though, 'side effects' of the intervention should also be taken into consideration. For example, an intervention with the intention of increasing a child's self-feeding with utensils could also result in improving tooth brushing acceptance and verbalizations (i.e., *positive side effects*).

The social validity of program goals, methods and anticipated outcomes needs to be known prior to the beginning of the program and should be assessed periodically throughout implementation (Schwartz & Baer, 1991). Therefore, social validity is a process rather than a result (Fawcett, 1991), which can and should be assessed at different stages during intervention in order to evaluate a program's acceptability or viability (Barret, Shortt, Fox, & Wescombe, 2001). The results of research programs are not considered credible or replicable without assessing the reliability and validity of their measurement procedures. And specifically in the case of application programs, it is not only the credibility of their outcomes, but the programs themselves that are at risk when they proceed without a reliable assessment of social validity (Schwartz & Baer, 1991).

4. SOCIAL VALIDITY OF PROGRAMS AS A STEP TOWARDS SELF-DETERMINATION OF PEOPLE WITH DISABILITIES

Historically, many people with disabilities have been deprived of opportunities to explore the range of life experiences and interests available to their typical peers (Bannerman, Sheldon, Sherman, & Harchik, 1990). Indeed, Kleinert, Harrison, Mills, Dueppen, and Trailor (2014) suggest that even students with more significant disabilities may not be experiencing what those with milder disabilities enjoy, for instance hobbies, academics, and social interactions. Even in terms of Functional Behavioral Assessment, although substantial efforts have been made to obtain information from the person exhibiting the problem behavior, often such involvement is too passive and much of the FBA process still is adult-directed (Wehmeyer et al., 2004). Therefore, although students with most significant disabilities may need much more support to participate in self-determination activities, adults must carefully access other same age peers for socially valid goal selection when assisting these students. Most importantly, school personnel must work to ensure that students with disabilities really participate in selecting their own goals (Kleinert et al., 2014). Dunlap et al. (1994) pointed out the importance of choice-making by considering it a management strategy which can lead to more adaptive forms of responding, including improved social behavior and task performance, and can even help reduce behavior problems.

Active involvement in planning and decision-making by the person for whom supports are being designed is a critical feature (Wehmeyer et al., 2004), because "if the participants don't like the treatment, then they may avoid it, or run away, or complain loudly. And thus, society will be less likely to use our technology, no matter how potentially effective and efficient it might be" (Wolf, 1978, p. 206). So a way of including participants in the program design is to do so within the context of Positive Behavior Support by promoting self-directed planning which results in self-regulated interventions (Wehmeyer et al., 2004). Of course, despite of possible obstacles to self-determination in schools, students with disabilities must have at a young age the necessary supports by their family and teachers to set realistic goals, additionally to tools to revise their goals as required (Kleinert et al., 2014), even though sometimes school personnel have to work on goals that are not always the foremost preferred by targeted individuals.

In any case, despite all the criticism, social validity measurement is of substantial value, even just because, already since Kazdin's and Wolf's seminal, social validity came up as an intriguing issue of respect of individuals' rights to the informed consent and related ethical matters when receiving support. And it is important exactly because it is in accordance with self-determination's definition as identified by the American Heritage Dictionary of the English Language (1992 as mentioned in Wehmeyer, 1998, p. 5): self-determination is defined as "1. determination of one's own fate or course of action without compulsion. 2. freedom of the people of a given area to determine their own political status; independence". Self-determination, then, as a means of accomplishing specific goals established by the person itself and eventually improving quality of life, is highly related to quality-of-life matters and it may also serve as a valuable associated indicator of the social importance of intervention outcomes and overall social validity (Carter, 2010). In that sense, taking interventions' social validation into serious consideration might be a step towards self-determination of individuals!

5. DISCUSSION

Baer, Wolf, and Risley (1987) as cited in Kennedy (1992, p. 333) observed that "social validity is sometimes assessed at present in very rudimentary ways that may too often find social validity where it does not actually operate" (p. 333) and that is clearly a serious limitation that researchers should take into account. Indeed, the relation between subjective evaluations or normative comparisons and the way behavior change affects a social ecology is also too remote to reflect many changes of experimental interest (Kennedy, 1992). For instance, subjective data might not have any relationship to actual events. When we are posing for a statement concerning a personal event or experience, such as satisfaction with our program, we must be very cautious because we have no adequate way of checking the reliability of the statement in an independent way, since statements concerning a personal event are open to "fictional distortion" as Skinner (1959) pointed out in Wolf (1978). Moreover, as Kazdin (1977) had already noted, matters concerning the type of assessment (e.g. likert scale) and the interpretation of subjective evaluation results should be taken into deep consideration by the researchers.

But the reliability of objective measurement systems can also be manipulated, as the scoring behavior of observers can often be affected by a range of variables, such as experimental feedback. Also, a discrepancy might be caused if the participant of the program responds to changes that we are not recording with our particular measures or if the respondent to the social validity questionnaire (e.g. parent, teacher) may consider a

change important and be satisfied with it, while it is not measured by us (Wolf, 1978). Furthermore, inadequacies of normative standards and identifying the normative group are also posed as potential impediments by Kazdin (1977).

As for the focus of research, according to Kennedy (1992), during the period 1968 to 1990 the largest proportion of articles presenting social validity data used subjective evaluation. For instance, in 1983 91% of Journal of Applied Behavior Analysis (JABA) articles presenting social validity data used subjective evaluation, whereas only 9% of articles used normative comparison. Post-intervention assessments were slightly more frequent than pre-intervention assessments. In regard to pre-intervention normative comparisons, 86% concerned only the goals of the intervention and Post-intervention normative comparisons occurred only for the outcomes (Kennedy, 1992). Therefore, pre-intervention assessment of social validity of goals and procedures should be carried out and would surely generate useful results to be used in the design of the intervention program. In any case, most of the studies were decades ago and since then the way of thinking and the society itself has changed, so new studies are needed so as to extract results about which programs/methods/teaching techniques/behavior management techniques are acceptable or not.

Concerning the intervention program design, the primary goal of social validity assessments should be to gather accurate and useful information about possible obstacles rather than encourage false praise from recipients of a program. Actually, two are the basic points of social validity assessment. First of all, it is important to the advancement of research to know in advance which programs are liked and which are disliked, and thus publication of negative social validity assessments is certainly as valuable and important as publication of positive ones. It is equally important, then, to analyze why these certain programs are liked and others disliked, so that social validity assessment potentially becomes an evidence-based prediction rather than an empirically assessed warning. For that second goal to be achieved, publication of a rich sample of negative instances to compare with the positive ones is needed (Schwartz & Baer, 1991; Storey, & Horner, 1991).

In conclusion, Social validity measurement of intervention programs is imperative, because, as Kazdin (1980), as mentioned in Reimers, Wacker, and Cooper (2014) states, equally effective interventions are not necessarily equally accepted in terms of goals, procedures or outcomes, so even implementing an evidence-based intervention which has already proven effective is not certain that it will be an acceptable one by the participants of a program or the important Others. As Wolf (1978) remarkably described it, *social validity brings society into science*.

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Chapter #3

ASSESSMENT OF PUPILS' SOCIAL RELATIONSHIPS AND LEISURE ACTIVITIES IN TWO ROMANIAN HIGH SCHOOLS

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ABSTRACT
It is necessary to assess the way students spend their free time in the final years of high school due to the poor results that have appeared recently in the baccalaureate exams. The study was carried out using a group of 202 students from two high schools in the Romanian county of Botoșani. The young people filled in a questionnaire with questions about leisure activities and social relationships. The results were processed using Pearson's chi-squared test. The time allocated daily for physical activity is mostly 15-30 minutes (23.76%). The time spent watching television programs is mostly 0.5-1 hours(35.64%). Most pupils (44.05%) do not spend free time on the computer. In the majority of cases (32.4%) pupils have „one" true friend. In their free time, they go out, mostly 2-3 evenings per week (28.71%), but there are also 31.68% negative answers. Parents are less concerned about school activity ("never" answers – 34.15%) and are also less concerned with the way their children spend their free time ("never" answers – 34.65%). There is a series of situations that guide us towards a modest concern for the future, both from pupils and their parents.

Keywords: physical activity, friends, computer use, watching television.

1. INTRODUCTION

In recent years, we have witnessed in Romania a drastic reduction in the percentage of pupils who finish high school. It is necessary to evaluate some factors that may explain the causes of this result. We focused on the elements represented by leisure activities and social relationships because they can be quite demanding.

Unfortunately, in Romania, the studies oriented towards the way children spend their free time and the relationships they develop are few and are restricted by geographical area. In this context, it was necessary to report on studies carried out in other countries, in different geographical areas, which allows a better interpretation of the results.

Sports activities are a healthy way to spend your free time. There is an interesting result for pupils with anemia in Damanhur that should attract the attention of specialists. Only 44.2% of those with anemia admit to exercising while 78.5% of those without anemia exercise, with statistically significant differences (Naglaa & Marwa, 2018). Daily physical activity contributes to the support of cardiac function, the development of motor andcognitive skills, and metabolic improvement (Haapala, 2013). Unfortunately, most young people do not pay attention to this way of spending their free time.

A special problem occurs in the family because parents are very busy and do not pay attention to how much exercise their children do (Tanaka, Okuda, Tanaka, Inoue, & Tanaka, 2018). Parents can become role models for their children by systematically engaging in

physical activity. This type of activity can take place in the family, which contributes to the improvement of relationships between its members (Bringhof-Iser, Schinder, Kayser, Suggs, & Probst-Hensch, 2018).

Their favorite activities are watching television shows and playing computer games. Such activities are also preferred by young women in Damanhour with and without anemia, but there are no significant differences, so it represents the same way of spending free time (Naglaa & Marwa, 2018).

Adolescents in the Philippines recognize the constant watching of television programs as the main way of spending free time, while exercise is practiced "sometimes" or "often" (Yap, 2017).

Special attention should be paid to the time spent at the computer because currently, the literature describes the term "digital addiction" as highlighting the situations in which a person uses the computer intensely, uncontrolled, in a pathological way (Baciu, 2020a). It also describes internet addiction present in people who use the internet in a pathological sense, being unable to use it constructively. Unfortunately, we reach a situation of social isolation, the appearance of stress reactions, and depressive states (Baciu, 2020a). At present, it is important to pay special attention to computer activities because modern pedagogy is increasingly based on this type of education with a major development of digital platforms. This phenomenon was extended in the last period of the pandemic, which allowed the continuation of teaching in special conditions (Montebello, 2020).

Social isolation can be associated with the orientation towards alcohol consumption, some drugs, and even with the emergence of ideas of suicide or self-aggression (Endo et al., 2017). Starting from these elements, special attention must be paid to body appearance and diets that are uncontrolled and performed only according to the recommendations obtained from the Internet. Serious eating problems can occur due to a lack of control from family and low support from friends (Arseniev-Koehler, Lee, McCormick, & Moreno, 2016; Haynos, Watts, Loth, Pearson, & Neumark-Stzainer, 2016).

In Romania, we pay special attention to food because we face a strong anchoring in the traditions of families. Sometimes there are deficient eating habits that will persist throughout life, which will affect the health of young people (Albu, Moraru, & Hodorcă, 2015). All these aspects must be in the attention of parents and preventive medical services. Specialized intervention is needed to address issues related to alcohol and drug use, unprotected sex, nutrition, and physical activity. Risky behaviors are becoming more common with age, so the role of preventive services is becoming increasingly important (Harris et al., 2017).

The family is the environment in which a child develops fully physically and mentally. For this reason, it is important to carefully evaluate the situations present in family life and especially the parents' level of interest in the pupils' school and leisure activities (Popescu, 2015). Any inattention can lead to inappropriate behaviors that will have negative effects on the further development of the young person.

2. OBJECTIVES

- to assess the daily time set aside for physical activity, differentiated by class and starting from the specifics of the high school;
- to study the daily time spent by young people watching TV and using the computer, focusing on pupils in the 12th grade of the theoretical high school;
- to estimate the number of friends and the time spent with them - an essential study especially for students in the 12th grade where the group of friends should become less important;

- to assess the extent to which parents are involved in the school and leisure activities of their children, taking into account the fact that they are in the final years of high school and want to become independent.

The evaluation will be performed by comparing school years and the two schools to be able to assess the changes that appear or do not appear according to these two parameters.

3. METHOD

The study was carried out in Dorohoi, a small city in Botoşani County. The studied group consists of 202 pupils from the 11th and 12th grades from a National College (117 young people) and a School Group (85 young people). The National College is an elite high school with a theoretical program. The School Group is a high school with a technical/vocational program where pupils prepare to become specialists in various fields. Out of the total number of pupils that received the questionnaire, 98 were from the 11th grade and 104 from the 12th grade. The questionnaire contained questions about how they spend their free time and about their social relationships.

  o Leisure was studied using three questions:

  - How much sports or other physical activities do you practice per day (in minutes)?: under 15; 15-30; 30-45; 45-60; over 60 minutes.

  - How many hours per day do you spend watching television?: none; 0.5-1 hour; 2-3 hours; 4-5 hours.

  - How many hours per day do you spend on the computer?: none; 0.5-1 hour; 2-3 hours; 4-5 hours.

  o Social relationships were assessed using four questions:

  - How many true friends do you have?: none; one; two; three or more.

  - In general, how many times per week do you go out with friends after school?: 0 times; 1 time, 2-3 times: 4-5 times; 6-7 times.

  - Do parents (at least one of them) have time to help you prepare your homework?: always; often; rarely; never.

  - Do your parents have time to organize your free time?: always; often; rarely; never.

The study does not focus on the relationship between students' school results and the way they spend their free time, as we did not intend this element. Instead, we analyzed the level of the determining factors that can lead to school failure.

The processing of the results was done taking into account school years and the two communities out of the desire to try to understand the disastrous results that have appeared lately in high school final exams.

The statistical interpretation was performed using Pearson's chi-squared test.

4. RESULTS

The study focuses on two main directions represented by leisure time and social relationships. Also, the evaluation will be performed by school years (11th and 12th) but also by school (the School Group and National College).

When looking at free time activities, we will insist on physical exercise, watching television, and using the computer. Sustained physical activity (over 60 min.) is present in 19.30% of cases; the dominant response is 15-30 min. (23.76%) or 30-45 min (23.26%). Pupils in the 12th grade do fewer sports, an easy situation to understand considering the time needed to prepare for the graduation exams, thusly the calculated differences are significant ($p<0.05$; $f=4$; $\chi^2=10.213$) (Table 1).

Table 1.
Daily time spent doing physical activity/sports (by school year).

Time	under 15 minutes	15-30 minutes	30-45 minutes	45-60 minutes	over 60 minutes
11th grade	15	24	31	10	18
12th grade	30	24	16	13	21
Total	45	48	47	23	39
%	22.27	23.76	23.26	11.38	19.30

We also did a comparison between the two schools. The pupils from the National College do more sports compared to those from the School Group so that the calculated differences are significant at a $p<0.01$ ($f=4$, $\chi^2=13.570$) (Table 2). It is an interesting result when considering pupils from a technical-agricultural high school.

Table 2.
Daily time spent doing physical activity/sports (by school).

Time	under 15 minutes	15-30 minutes	30-45 minutes	45-60 minutes	over 60 minutes
School Group	29	15	15	8	18
National College	16	33	32	15	21

Another leisure activity is watching television programs or playing computer games. Television programs are watched mainly 0.5-1 hour, daily (35.64%). There are also 32.67% of young people who mark the "none" answer. There are 26.73% of teenagers who sit 2-3 hours per day in front of the television screen and 4.95% who mark the "4-5 hours" answer.The calculated differences are statistically insignificant ($p>0.05$, $f=3$, $\chi^2=3.076$) an unexpected result in young people in the final years of high school who should be preoccupied with preparations for the graduation exams.

The situation is even more interesting in terms of time spent on the computer because 44.05% of pupils choose the "none" option. We must not overlook the 16.33% of pupils who mark the "4-5 hours" result which is difficult to understand especially for pupils in the 12th grade (Table 3).

Table 3.
Time spent watching television/using the computer (by school year).

Time	None	0.5-1 hour	2-3 hours	4-5 hours
	Television			
11th grade	32	40	22	4
12th grade	34	32	32	6
Total	66	72	54	10
%	32.67	35.64	26.73	4.95
	Computer			
11th grade	40	22	19	17
12th grade	49	22	17	16
Total	89	44	36	33
%	44.05	21.78	17.82	16.33

The calculated differences are statistically insignificant (p>0.05; ƒ=3; χ²=0.791) and draw attention to the young people in the final year who have time to sit at the computer, socialize or play games.

Television is an uninteresting leisure activity for most pupils so the calculated differences between schools are statistically insignificant (p>0.05, ƒ=3, χ²=4.255) (Table 4).

Table 4.
Time spent watching television/using the computer (by school).

Time	None	0.5-1 hour	2-3 hours	4-5 hours
	Television use			
School Group	28	26	24	7
National College	38	46	30	3
	Computer use			
School Group	39	20	12	14
National College	50	24	24	19

The results are interesting in terms of time spent using the computer. The pupils from the National College should have more activities in front of the computer compared to those from the other high school but the calculated differences are statistically insignificant (p>0.05, ƒ=3, χ²=1.406).

In adolescents, social relationships diversify, being necessary to assess the existence of the group of friends but also the relationships with the parents. The group of friends is essential until the age of 14-15, after which its importance decreases, with restricted, selective friendships being preferred.

In the pupils in the studied group, the group of friends is still present in 28.21% of situations, but the calculated differences are statistically significant (p<0.05; ƒ=3; χ²=8.33) which leads to the reduction of its role in young people in the final years of high school. The "none" answers in 10.89% of cases are worrying, which leads us to the situation of dangerous social isolation in this age group (Table 5).

Table 5.
Number of true friends (by school year).

Number of friends	None	One	Two	Three or more
11th grade	8	24	37	29
12th grade	14	39	23	28
Total	22	63	60	57
%	10.89	31.18	29.70	28.21

The presence of the group of friends (socializing) is not dependent on the type of school. We can see that pupils from both high schools recognize the presence of the group of friends even at 17-18 years of age, the calculated differences being statistically insignificant (p>0.05, ƒ=3, χ²=6.304) (Table 6).

Table 6.
Number of true friends (by school).

Number of friends	None	One	Two	Three or more
School Group	6	33	26	20
National College	16	30	34	37

The presence of the group of friends also means the existence of time spent with them outside of school. The result obtained is interesting because 31.68% of pupils mark the "0 times" answer. Being a small town, there are not many possibilities to spend time somewhere with friends where teenagers will find it interesting (Table 7).

Table 7.
Going out with friends (by school year).

Going out	0 times	1 time	2-3 times	4-5 times	6-7 times
11th grade	35	24	24	8	7
12th grade	29	27	34	8	6
Total	64	51	58	16	13
%	31.68	25.24	28.71	7.92	6.43

We can see that 7.92% of young people marked the "4-5 times" answer and 6.43% marked the "6-7 times" answer. The calculated differences are statistically insignificant (p>0.05; $f=4$; $\chi^2=2.325$) a result difficult to understand for young people in the final year of high school.

Limited socialization possibilities are present in pupils from both high schools so the calculated differences are statistically insignificant (p>0.05, $f=4$, $\chi^2=5.181$). In small towns there are too few areas of interest and fun for teenagers thusly socialization outside the school environment is limited. This should be in the attention of parents but also of the school psychologist (Table 8).

Table 8.
Going out with friends (by school).

Going out	0 times	1 time	2-3 times	4-5 times	6-7 times
School Group	31	23	22	3	6
National College	33	28	36	13	7

These results require further study with the assessment of the parents' interest in the pupils' school activity.

In most cases (34.15%) parents are not at all concerned about school activity. At the opposite pole are placed 13.36% of families in which this concern is permanent (Table 9).

Table 9.
Parents' interest in school activity and free time (by school year).

Level of interest	Always	Often	Rarely	Never
		Homework		
11th grade	6	23	38	31
12th grade	21	18	27	38
Total	27	41	65	69
%	13.36	20.29	32.17	34.15
		Free time		
11th grade	7	34	25	32
12th grade	19	20	27	38
Total	26	54	52	70
%	12.87	26.73	25.74	34.65

The calculated differences are statistically significant ($p<0.01$; $f=3$; $\chi^2=11.375$) and draw attention to the parents of pupils in the 12th grade who are more interested in preparing their homework.

Leisure activity is not supervised by 34.65% of parents; there are also 12.87% of families where there is permanent supervision. However, the significant differences calculated ($p<0.05$; $f=3$; $\chi^2=9.125$) are encouraging because they focus on the higher percentage of parents of pupils in the final high school year who are interested in this aspect.

It is important to assess the concern of parents by also looking at the differences between the two schools. The pupils from the National College dream of going further with their studies so they need the support of the family but the level of support they obtain is insufficient. The calculated differences when looking at parents' concern for school activity are statistically insignificant ($p>0.05$, $f=3$, $\chi^2=3.097$) as are those related to how young people spend their free time ($p>0.05$, $f=3$, $\chi^2=1.282$) (Table 10).

Table 10.
Parents' interest in school activity and free time (by school).

Level of interest	Always	Often	Rarely	Never
		Homework		
School Group	10	13	31	31
National College	17	28	34	38
		Free time		
School Group	10	24	19	32
National College	16	30	33	38

5. DISCUSSION

The focus is mainly on pupils in the 12th grade who will take the graduation exam. It is an important exam because it allows them to continue their studies at a college or a post-secondary school. Solving this problem requires in-depth study that leads to the minimization of free time.

In this context, more attention must be paid to the pupils from the National College who need to be oriented towards a certain profession, which will ensure success in their future. The pupils from the technical high school are already oriented towards a certain profession (agriculture) but also some of them want to continue their studies.

Systematic physical activity is recommended for any age group. According to WHO recommendations, young people (5-17 years old) need at least 60 minutes of sustained activity per day, and adults (18-64 years old) need 150 minutes of moderate activity per day (WHO, 2017a; WHO, 2017b). Unfortunately for pupils in the studied group, such an answer appears only in 19.30% of situations, a result also present in other studies carried out on adolescents from a high school in the county of Iasi (15.8%) who were not in the final year of high school (Albu, Onose, Negrea, Crăcană, & Hodorcă, 2015).

When looking at schools, the calculated differences are statistically significant and draw attention to pupils in the School Group who are less interested in physical activity. It is a difficult result for pupils who are preparing for a job that requires a lot of movement. The pupils from the National College are a bit more interested in physical activity, but they also do not consistently reach the internationally recommended norms of at least 60 minutes a day (WHO, 2017b).

The modest time allotted for physical activity is recognized by most pupils, being present in 60.6% of young people in the USA (Miller, Sliwa, Brener, Park & Merlo, 2016). Instead, these young people spend more than 3 hours per day watching television programs (33.2%) or using the computer (40.3%).

In Ghana, many young people have a television in their room, which is turned on during their homework (27.6%), have a personal computer/laptop (41.7%) and even a gaming console (38.1%) in their room, so they have all the conditions to spend too much time in front of the television or computer (Gaa, Apprey, Annan, Mogre & Dzogbefia, 2019).

For pupils in the studied group, the result is interesting because there are many negative answers for both television programs (32.67%) and computers (44.05%). The study carried out on pupils from different high schools in Iasi highlights 22.78% negative answers for watching television programs and 11.81% for computer use (Albu, Hodorcă, Onose, Negrea & Crăcană, 2016). In the studied group, the differences obtained between the two schools are not statistically significant, an aspect that is difficult to understandwhen considering the pupils from the National College. Elite high schools, even in smaller cities, insist on computer activity and the development of educational and didactic programs with the help of digital technology. However, most pupils in our group do not spend much time on the computer, an aspect that must be taken into account.

Adolescents in southeastern Iran respond negatively in 9.03% of situations for watching television programs and in 49.34% of situations for computer use (Shahraki-Sanavi, Rakhshani, Ansari-Moghaddam & Mohamad, 2017). At the same time, dailyphysical activity that lasts 60 minutes is recognized by only 4.19% of girls. It is necessaryto carry out in-depth studies related to pupils' habits of spending free time. These assessments are especially important for final high school years and pupils in large cities, but also in small cities where leisure activities are less numerous or tempting (Baciu, 2020b). Social relationships become essential for the evolution of young people. In the studied group, there is an interesting situation represented by maintaining the group of friends (3 or more friends) after the age of 14-15 years (28.21%) which demonstrates a later development of pupils in the studied group. Unfortunately, there are many negative responses (I do not spend time outside of school with friends) which raises some worries related to the trend of isolation.

Parents still have an important role to play. They must closely monitor the pupil's school and leisure activities. We obtained an important result because the parents of the 12th-grade pupils show a greater level of interest in these aspects, however, permanent supervision is present in about 10% of families. Results obtained when looking at the differences between the two schools are interesting but also alarming. Parents of pupils from the National College do not show an increased preoccupation with school activity, eventhough it is essential to graduate high school and go towards a higher level of study that will give them a better chance for employment. At the technical high school, the pupils are already oriented towards a certain type of profession, which can ensure their future, so the modest concern of parents for school activity and free time is easy to understand.

These are important issues because they can often be associated with inappropriate behavior. In England, lack of parental supervision (never/rarely) is associated with smoking (1.5%), alcohol consumption (10.4%), antisocial behaviors (18.5%) and behavioral problems (19.4%) (Zilanawala, Sacker & Kelly, 2017).

The study should continue by following issues related to when fatigue occurs and the clinical signs present in students. It is necessary to extend the study to larger and larger groups of students, from all geographical regions of Romania. Unfortunately, the ongoing global pandemic caused by the new coronavirus makes it extremely difficult to perform such a study.

6. CONCLUSION

Leisure activities must be closely supervised by parents as they can easily become tiring and disruptive for the sustained study required to finish high school. The time spent in front of the television screen does not indicate any major problems as in most cases it is between 30 minutes and 1 hour. The results are surprising when looking at time spent at the computer, where 40% of pupils choose the "none" option. The young people from the National College do not show a special interest in computer activity, which is interesting because they have computer classes in the school program and carry out a series of such activities. The many negative answers for watching television programs but also for computer activity highlight an unusual case for high schoolers.

Physical activity is practiced systematically by only 20% of young people, a result that is not encouraging. The pupils from the National College are more interested in this way of spending their free time, even though they are intensely preparing for their future careers. Sustained sports activity is not a concern of most pupils, an interesting result especially for young people from the school with a technical profile.

Social relationships are present in most cases but there is still a group of friends even in the 12th grade. The age of 17-18 years is associated with a change in social relationships and the orientation towards the formation of pairs of friends (especially boy-girl pairs) but this aspect is not yet present in a third of the students in the studied group. There is slow social evolution where we see young people maintaining the same group of friends, which in the final years of high school is an aspect that must be carefully monitored by specialists in the field. There is also a tendency towards isolation in a third of cases, which is worrying.

Generally, parents of students in their final high school years are less concerned with school performance or leisure activities, with more than 60% of cases choosing the "rarely" or "never" answers. This is especially important for pupils from the National College where graduation is essential for career orientation or continuing education at the postgraduate or university level, yet we do not see a significant difference between the two schools. In some cases, parents show an increased level of interest, because they are

preoccupied with securing their children's future. It is an essential moment in the young person's life, because at that age they do not become fully independent and aware of the importance of passing the graduation exam and securing a good career. Modest support from the family can easily be associated with school failure.

Such studies are important because they allow us to account for some factors that can be considered a risk in ensuring the future of young people.

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Chapter #4

FORENSIC SCIENCES AS EDUCATIONAL SUPPORT FOR THE PROMOTION OF TEACHING AND LEARNING OF SECONDARY STUDENTS

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ABSTRACT
The search for improvements in education systems has grown sharply, from incentives in the educational area to changes in the legislation, highlighting a more contextualized teaching, especially in the field of science. However, the dissemination of knowledge transcends the need and becomes a daily challenge in the life of educators, who need to reinvent themselves, reform themselves, and especially develop activities that make the understanding of content more relevant and meaningful. Although it is an arduous task for many students, this learning is indispensable to adequate scientific education. Thus, this research aimed to synthesize studies that have been developed on the use of forensic sciences as a pedagogical approach in the improvement of secondary education. The methodology is based on applied scientific research of a qualitative-exploratory nature. The results show experiences of the school context lived in the United States, Brazil, Singapore, and Portugal, where it is observed that students feel more motivated and involved in educational activities when integrated into the forensic context. The implementation of this theme to the school curriculum has the potential to attract attention and arouse interest in the sciences, contributing to the reduction of retention rates and school dropout and increasing the demand for scientific and technological careers.

Keywords: interdisciplinarity, scientific methodology, criminal investigation, school dropout, CSI effect.

1. INTRODUCTION

According to D'Ambrosio (1996), education should develop strategically in individuals, promoting stimuli that contribute to individual and collective relationships in a given culture, promoting the achievement of goals, and the satisfaction of survival needs and transcendence. This shows that education must be part of the individual's constitution so that they can understand, debate, and make decisions based on the understanding of scientific progress, in order to relate it to the factors present in their life.

In recent years there has been an increasing search for improvements in education systems, from incentives for research in the educational area to changes in the legislation itself (Lima, 2015), highlighting a more contextualized teaching to reflect in benefits to the teaching and learning of students, especially in science education. Science education is considered essential from the early years of schooling, as it prepares students for a more adapted social life and a qualified professional life. It promotes stimulation and develops a natural curiosity about things, and this contact contributes to the development of intellectual capacities.

In Brazil, a high number of students entering universities, especially in courses in the areas of exact and natural sciences and engineering, present difficulties due to learning failures throughout their compulsory education, especially when they come from public schools, where there is a very strong absence of teachers with training in the area and little structure of didactic support for the development of teaching. Silva, Viera, and Ferreira (2017) address points that directly affect address aspects that directly affect teaching and learning process, including the school structure, the absence of science laboratories, and adequate teacher training.

Especially nowadays, the dissemination of knowledge in science transcends necessity and becomes a daily challenge in the lives of educators. Transferring theoretical knowledge to everyday practice, whether in the personal or professional environment, remains a major challenge for science, especially when it comes to teaching (Cadola et al., 2020). The educator needs to reinvent himself, reform himself, and especially, develop work and research based on issues or problems of their daily life because this will make all this mobilization for teaching and learning become something meaningful for such.

Understanding the school subjects that derive from exact and natural sciences, which are integrated into the natural sciences, mathematics, and their technologies, according to the areas of knowledge of secondary education according to law Nº 9.394, article 35, Dez 20 of the National Education Guidelines and Framework Law (LDB), is not an easy task for many students, due to the fact that several contents are difficult to assimilate, especially when taught in the traditional way considered by many students as boring, dull and not very profitable. This demotivation has increasingly contributed to school retention and dropout rates.

While learning the syllabus contents of exact and natural sciences is characterized as a difficult task for many students, it is indispensable to adequate scientific education. Connecting science to social phenomena and applying technology to everyday life makes science more relevant and meaningful to students (Pais, 2009). The distance between the curricular content and the experience of integrating it to the phenomena present in the students' daily lives certainly accounts for their lack of interest and even dropout. Meaningful learning presupposes the existence of a referent that allows students to identify and identify with the proposed questions (Souza, 2016).

The articles arranged by LDB (Law Nº 9.394/1996) and National Council of Education (CNE, 1998) point to orienting learning towards a greater contextualization, effective interdisciplinarity, and a broader human formation, not only technical, already recommending a greater relationship between theory and practice in the learning process itself.

In 2018, according to Organisation for Economic Co-operation and Development (OCDE, 2020), the proportion of young adults without complete secondary education in Brazil were still large compared to other developed countries. On average, in the countries that make up the OCDE, 47% of 18- to 24-year-olds have dropped out of the education system, which is closely linked to leaving secondary school for higher education. In Brazil, Colombia, Israel, and New Zealand, more than 65% of these young adults are no longer studying. Therefore, pedagogical alternatives are needed to contribute to the interest in science teaching, thus, the implementation of interdisciplinarity presents itself as a possibility to overcome the fragmentation of sciences and the knowledge produced by them.

In this relentless search for improvements in education, Forensic Science emerges as a student-centered scientific methodology, where its content naturally lends itself to constructivist inquiry-based learning because students are constantly fostered to ask

questions, evaluate evidence, and use critical thinking and reasoning to promote explanations to issues under analysis. It contemplates a range of sciences to answer questions of legal significance, thus it plays a crucial role in solving crimes (Hemanth, Tharmavaram, & Pandey, 2020). Besides its broad, diverse, and integrative context, it allows various fields of knowledge and science to be interconnected, such as Mathematics, Physics and Chemistry, Medicine, Engineering, thus making it an interdisciplinary science.

As a scientific discipline, it has its roots within the natural sciences. It is an area that has gained dimensions over the years by arousing curiosity and fascination for its contribution to justice. The media has expanded forensic science around the world through news and publicity. TV shows, such as investigative sitcoms, have played a large part in this expansion that has given rise to the "CSI effect" (Siegel, 2009). The investigative process often follows steps similar to a conventional laboratory exercise. This methodology can result in creating unrealistic expectations in students about how science is done.

In view of the above, this theme becomes extremely relevant to be worked in the classroom, because from fictional, expert case studies, it allows students to develop critical thinking and reasoning, in addition to creativity and independence in the development of activities, seeking to integrate various disciplines, thus expanding the range of observations and phenomena of everyday social life. The use of this tool to promote scientific literacy is a strategy for reducing school retention and dropout rates and the pursuit of scientific and technological careers.

This work aimed to attest through synthesis, studies that have been developed around the implementation of forensic sciences as a pedagogical practice in the promotion of teaching and learning in secondary school. Due to its interdisciplinary character, this approach allows contextualizing several contents, thus providing the integration of several sciences to solve a specific problem. The fact that forensic sciences are associated with mystery captivates even the most reluctant students, thus allowing an approach to the scientific method, helping them to think like real scientists.

2. METHODOLOGY

This study was based on applied scientific research, whose purpose is to generate solutions to human problems. Trujillo Ferrari (1982) emphasizes that "notwithstanding the practical purpose of the research, it can theoretically contribute to new facts regarding the planning of new research or even to the theoretical understanding of certain knowledge sectors" (p. 171).

Regarding the nature of this research, it fits into a qualitative approach located within the exploratory paradigm from a systematic review of the literature. The qualitative design was appropriate for this study, as it provides consistent information about the context and provides an understanding of the factors to be observed (Mcleod, 2017).

The study explored from recent studies, pedagogical practices benefits around forensic sciences adopted in the educational context of secondary education in schools of the United States, Brazil, Singapore, and Portugal. The qualitative evaluation of the results obtained in these surveys was based in the analysis of questionnaires and exercises proposed to students before and after carry out actions.

3. RESULTS AND DISCUSSION

Several kinds of research focusing on educational methodologies for secondary education have been discussed around the world, and, concerning the Brazilian educational system, it is the level of education that provokes the greatest debates, either by the persistent problems of retention and school dropout; by the lack of attractiveness of its curriculum; by the quality of education offered or yet, by the discussion about its identity (Souza, 2016). The school may be responsible for the success or failure of students during their academic life, as they are very quickly led to disinterest in studies, especially in the years comprising elementary and secondary education. Seeking methodological alternatives that promote student engagement and motivation becomes increasingly indispensable, especially for teaching exact and natural sciences.

At the international level, Saccaro, França, and Jacinto (2019) found that dropout in higher education is the result of several reasons, among which is the deficient quality of schooling in primary and secondary education. The subjects of Differential and Integral Calculus, for example, inserted in courses of exact and natural sciences and Engineering, present high retention rates, which commonly derive from the gaps in previous knowledge in physics and mathematics acquired during their previous education (Bigotte de Almeida, Queiruga-Dios, & Cáceres, 2021).

Students in Science, Technology, Engineering and Mathematics (STEM) are more likely to drop out than students in other areas of knowledge, instead of motivating the technical-scientific area, they end up being discouraged, contributing to the reduction, increasingly, of skilled professionals in technological areas (Costa, 2020).

The search for scientific methodologies that increase the interest and performance in these areas, make forensic sciences with high didactic potential to the learning and intellectual development of students in their construction of knowledge, indispensable to social and professional life. They allow advances in the concepts and processes explained in the classroom, thus, several studies have been developed to validate the insertion of this methodology in the school context, as a strategy to improve the teaching and learning process.

Based on the observation of studies that have been taken around the use of forensic sciences for science teaching to secondary school students, it was made a synthesis about some of these actions proposed in secondary schools, as shown in Table 1.

Table 1.
Actions in forensic science for education.

Author	Methodology used	Site	Main results
Raza (2012)	A six-week module involving practical forensic science activities. The evaluation about this action was based on a quantitative and qualitative analysis around mini evaluations applied to the students.	United States	The qualitative evaluation indicated: benefits of group work and discussion in problem solving process; higher-order thinking skills in evaluation and analysis in training; and connections between classroom learning and the real world. Quantitative analysis revealed an increasing level of higher-order thinking and enhanced use of cognitive skills.

Author	Methodology used	Site	Main results
Low and Yow (2014)	A ten-week module covering forensic science-based learning through workshops, laboratory practice, and sharing the experiences of professionals in the field. At the end, students were evaluated based on a series of questions prepared by teachers during their presentations.	Singapore	The qualitative analysis showed that the insertion of this module promoted the improvement of communication skills among students and provided a better interpretation of the concepts acquired in class.
Rocha, Garrido, and Garrido (2014)	An action involving six easy-to-use and low-cost forensic tests as a practical activity in science classes. For evaluation purposes, questionnaires were applied to assess the students' knowledge and interest in a practical program involving this theme to be included in the school curriculum.	Brazil	It was observed an absence of practical classes in the teaching of these sciences, and about 94% of these students have great interest in improving learning through the visualization of content in a more tangible way, especially if these classes are contextualized with topics related to forensic science. They also demonstrated that the use of topics related to forensic sciences would provide more motivation and would certainly result in great benefits to the teaching and learning process.
Souto et al. (2015)	They proposed the use of a forensic science educational kit, to be used by students under the supervision of their teachers. The kit allowed them to relate these activities to curricular subjects, such as Biology, Chemistry, Physics and Mathematics. The effectiveness of this action was evaluated through questionnaires applied to teachers.	Portugal	According to surveys, teachers considered that the activities presented could improve the subject they teach, since they promote interdisciplinarity and diversification of practical work. They also consider that these activities lead to encouragement, creativity and critical thinking, allowing students to develop new abilities to question and to connect the classroom to reality.

Author	Methodology used	Site	Main results
Munayer (2018)	The author investigated the use of a textbook consisting of suspenseful short stories about real facts about forensic science. The technique employed in the implementation of this scientific methodology allowed the use of curricular topics of the chemistry discipline to promote productive disciplinary engagement of students. The feedback for the action was based on the application of a questionnaire about the proposed activities.	Brazil	Students were engaged in discussions that permeated the application of scientific concepts in solving the problems involved. In students' records, it was found that the activities enabled the understanding of Chemistry content from the investigations, where they could review concepts already seen in the classroom and integrate them into the construction of new knowledge.
Santos and Amaral (2020)	In this study their applied a series of activities related to forensic chemistry to promote potentially meaningful learning of curriculum content in chemistry. The research approach was qualitative of action-research type and applied to secondary school students. The activities involved the resolution of a "crime". The action evaluation consists of the application of three questionnaires (Pre, Post test 1 and 2), and aimed to measure the effect of the intervention on long-term learning.	Brazil	The questions showed that the videos provoked dialogic discursive interactions between student/student and student/teacher. Based on the interpretation of the results from the completion of the exercise lists before and after the activity, we noticed an evolution around 42% and 30%, respectively, evaluated by the significant learning of the scientific content covered in class.

Author	Methodology used	Site	Main results
Lino, Sá, and Silva (2020)	They used a learning model involving interactions with forensic sciences, the practice was based on the simulation of a crime scene composed of several pieces of evidence distributed throughout the site, involving interdisciplinarity and contextualization in a playful way, addressing issues related to human identification. The effectiveness of the proposal was based on the application of questionnaires before and after the action, addressing students' knowledge about human identification, levels of interest in natural sciences, and levels of satisfaction with the classes.	Brazil	In the initial questionnaire, of the 37 students interviewed, 51% said they knew the concept of human identification; 81% of the students said they did not know the methods used for this analysis; and 95% of the students said they did not take practical classes often. After the activity, students illustrated the importance of practical classes in science teaching, since triggering themes such as criminalistics and forensic science promote an increase in the level of interest for learning in science subjects.

The results obtained by Raza (2012) indicate that the forensic science curriculum offers students ample opportunities to learn and practice skills associated with scientific literacy. Students had the opportunity to acquire specific knowledge and domains in biology, chemistry, and physics, as well as to experiment the path into which knowledge of these areas is integrated, based on the context of its application to forensic science problems. The results indicate that students perceive that scientific knowledge is evolution and subject to change due to new trends and discoveries. In this way, learning provides a source of support and insight that help students deal with the challenges presented by the curriculum's problem-solving process. In addition, students are given the opportunity to reflect and receive feedback by teachers and other students, which helps to value social negotiation and group learning.

The study developed by Low and Yow (2014) show that students indicated that they enjoyed this type of activity because it allowed them to learn beyond the limits of the curricula offered in school, enabling them to acquire useful skills and competencies. In addition to developing a greater interest and motivation demonstrated during the development of the activities, it inspired many to explore the field of forensic science as a future career option, triggered especially, from work experiences shared by professionals in the forensic field.

According to Rocha, Garrido, and Garrido (2014) most of the students interviewed had already watched movies and television series related to forensic science activity, thus, this observation opens an important opportunity to bring students to the knowledge of the natural sciences in their curriculum, since they had indicated that these contents did not attract their interest when taught by traditional methods.

In your study, Souto et al. (2015) shows that teachers' feedback confirms the benefits provided by the implementation of these activities in the educational context and considers it to have great potential to attract the attention and arouse the interest of students in the science areas, thus improving the understanding of the theoretical concepts of the contents integrated into the school curriculum. They also add that this educational tool can contribute to minimize the disinterest and dropout of students at critical ages, as well as contribute to the motivation of the educational agents themselves. From the qualitative analysis by Munayer (2018), it was possible to notice the interest, motivation, performance, and engagement of students in the classroom during the implementation of this practice so that they could experience in a new way the understanding of scientific concepts and ideas worked in the school context.

In your results Santos and Amaral (2020) showed that forensic chemistry as a contextualizing theme in the teaching of chemistry, promoted a greater involvement, interest and motivation to the students, thus allowing a better understanding of the contents. Evaluating the before, during and after the development of the activities, it is possible to perceive the promotion of potentially significant learning from the use of this methodology.

In the work developed by Lino, Sá, and Silva (2020), the data indicate that the natural sciences still face a low acceptance among students, however, the simulations of forensic practices inserted into the classroom didactics contributed to the scientific stimulation of students from the interconnection between theory and practice, promoting curiosity and helping to keep them motivated within the teaching and learning process.

Forensic science is a subject that creates an conducive atmosphere to increasing student interest in science learning. The students are required to use scientific information as well as be involved in the investigation process in order to solve problems in a real-world environment. Forensic science becomes a strong ally in science teaching, since the inclusion of topics based on forensic scientific investigation shows an active involvement of students in the teaching and learning process, improving their critical thinking skills, developing scientific literacy, and improving interpersonal relationships through collaborative work. The interdisciplinarity and contextualization of content with forensic themes, besides benefiting learning, stimulate interest in technological areas.

5. CONCLUSION

Forensic science is an authentic subject that can be used to connect the classroom to a real working environment. Due to its nature, which is based on the mystery of the investigative process, it allows subjects such as Physics, Mathematics, Chemistry, and Biology to be approached in a contextualized way, promoting scientific learning. As observed by the studies outlined in this research, the use of forensics in the school setting has reflected in advances in the concepts and processes explained in the classroom, from the connections made with the real world, enabling other advantages such as the improvement of interpersonal relationships, based on the engagement arising from collaborative work, as well as in higher-order thinking skills in knowledge formation. Moreover, teachers evaluate the implementation of these activities in educational contexts with great potential to not only awaken the interest of students in areas of science, but also contribute to the motivation of educational agents themselves. The actions proposed by the insertion of forensic sciences in education reflect benefits on a horizon that goes beyond the high school barrier; these results can be observed in a more qualified schooling experience of the student who reaches higher education, being this decisive for their success in the course. The developed pedagogical activities that rely on non-conventional techniques,

complementary to traditional ways of teaching, provide meaningful learning, allowing students to identify and identify themselves with the proposed issues, acquiring the ability to understand and intervene, in an autonomous and not alienated vision of reality. The inquiry-based learning of sciences, effectively contributes to the development of scientific literacy, developing from a constructivist approach, a greater integration between science-technology-society-environment, contributing, consequently, to the reduction of retention and dropout rates and the search for technological careers.

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Chapter #5

UNIVERSITY COLLEGE STUDENTS' PERSPECTIVES AND OPINIONS ON DIGITAL LECTURES

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ABSTRACT

The traditional lecture, with a teacher talking and writing on a blackboard interacting with students, has in many cases been exchanged with different digital or hybrid solutions. It was evident when the whole world went into lockdown, and education at all levels needed to emergency transform learning in classrooms to learning through digital platforms. New structures had to be made, new routines, and new approaches. It was necessary to develop solutions for presenting different programs or motivating students to be active, even without a camera or microphone. In some cases, the digital lectures were synchronous, with teachers and students meeting at the same time to discuss a topic both in small and big groups. Other times, the digital courses were asynchronous to give the students more time to prepare themselves and activate their learning by giving them the responsibility to study individually.
This study has investigated the student's views on what they have experienced during digital lectures. The students from different programmes were asked to answer an anonymous questionnaire of their opinion, ideas, and experiences with digital solutions. The results were categorized and analyzed to select some tools or approaches that most students found better or worse for their learning.

Keywords: digital learning, remote learning, students views on digital tools, synchronous and asynchronous lectures.

1. INTRODUCTION

The pandemic changed higher education. There was a need to deliver many lectures digitally, via video or streaming, or through other resources. Both teachers and students had to adapt to this (Hussein, Daoud, Alrabaiah, & Badawi, 2020, Lin & Gao, 2020, Nieuwoudt, 2020). When the world was battling the virus, and everyone was in self-quarantine, the progression in higher education courses was not canceled but instead transferred into new communication media. In some places, physical meetings were canceled for months, while in others, just a few weeks, depending on local and national restrictions. In Norway, delivering higher education through digital lectures differed between schools, professions, courses, and teachers. Some teachers preferred to hold synchronous (real-time) lectures and just changed the classroom with a digital conference. Others decided to give more asynchronous (not real-time) lectures filled with video files, pictures, and text explaining the topic that students could do independently. Then, they supported students with online seminars, group work, or Q&A sessions (questions and answers). Every teacher in Norway could adapt to the digital setting they preferred and what they considered would be the best (and quickest) solution for their students and their topics.

The need to transfer teaching into a digital setting (due to pandemic and closed campuses) caused changes in how the knowledge was shared and delivered. These changes were significant and rapid. Many teachers just went with ideas that might not have been scientifically researched before and tried to do something that could fit the new and unexpected situation. At the same time, the students tried to make sense of the new learning environment when staying home and connecting through digital media. In addition, the students had to deal with the rapid increase of self-study when most of the formal and informal group activities were canceled. The pandemic forced a quantum leap in digitalization for both students and teachers.

This book chapter describes different perspectives and opinions of university college students on different institutions, campuses, or programs. This relatively small study aims to present some circumstances that affected teaching in higher education in Western Norway University of Applied Sciences (HVL) and Volda University College (HVO) during the second year of the pandemic and discuss some tendencies connected to teaching through digital lectures. The authors conducted an empirical study with the research question to map students' voices in how they want to be taught through a digital lecture. What are university college students' opinions and experiences regarding digital lectures?

2. BACKGROUND AND PREVIOUS RESEARCH

Due to the Covid pandemic, many changes in teaching practices were made in a short time. As a result, questions and concerns were raised about the effectiveness of teaching and the impact on teachers and students. The previous research on remote learning focused on students' motivation or on finding factors that could support students that did not meet on-campus to participate in lectures. Remote learning is a method of teaching through various technical supportive platforms and software to teach students who choose to study off-campus, as they work full-time, have family commitments, live far from the college campus, and lately because of the pandemic restrictions. Due to the variety of the different teaching methods in higher education that fits with the term' digital lecture', there was a wide variety of types and approaches conducted during the courses. This study separates between synchronous lectures, where the teacher and students were meeting on digital platforms through audio (and video) at a certain time, and asynchronous lectures, where teachers prepared materials (audio, video, text, etc.) that students could work through at their convenience.

The 'digital lecture' aspect used in this study is relatively new. Still, it shares some similarities to remote learning, which had been researched for almost twenty years. Burston (2003) presented one of these similarities when he pointed out the need to focus on different aspects of remote lectures rather than on the immediate results of implementing new technologies. He claimed that there is more that is affecting students learning than just the technological equipment. In 1990, Donna Gee investigated variables, such as students' learning style, affecting remote learning through teleconferencing. Her study was relatively small-sized, but she found that students' attitudes and learning styles affected their performance and implied that some students worked more effectively on-campus while others were better remotely. Remote learning is a flexible and desirable option for independent students that like to have autonomy over their studies. Students that have self-discipline and enjoy working at their individual pace. However, students who sign up for on-campus studies generally want the entire college experience, collaboration, and group-studying, participating in exercises and laboratories. Such students expect to be on campus for long hours and have a strict schedule to follow. They still need self-discipline and

self-motivation, but the setting of everyone being in the same shoes makes it easier to accommodate. This does not mean that students cannot change between these learning methods. While some students can make sense of every learning method, other students might find remote learning challenging.

The pandemic raised again many of these questions about remote learning as teachers working at home had to reach students off-campus to carry out lectures that were not intended to be digital in the first place. How to adapt technologies to the course content? How to motivate students to participate and ask questions? How to keep their attention for more extended periods? How to practice collaboration and discussion remotely? How to reach students through screens and make them feel seen and heard? How to address technical difficulties and teachers' improvisation when things do not go as planned? The same challenges that remote learning raises were transferred to digital lectures for students and teachers worldwide.

The change that higher education in Norway went through during the pandemic became an important topic for teachers and researchers, and many of them conducted research in this new situation. A survey, conducted one year after the start of the pandemic, asking students what kind of teaching they preferred, showed that 73% of the students wanted a physical lecture in a classroom with a teacher and classmates (Figure 1 – after a year) (Fojcik, Fojcik, Kyte, Pollen, & Mjånes, 2021). Furthermore, 57 students responded wholly or partly to the survey, in which they evaluated teaching methods they were experiencing during the pandemic. The vast majority of students desired to return to campus and to the traditional lectures setting. A similar study before the pandemic, conducted on the same campuses, showed that students previously wanted a variety of digital and non-digital teaching methods (Figure 1 – before pandemic) (Fojcik & Fojcik, 2020). The most significant change in students' preference is that more students wish to interact with the teacher present, and fewer want just online lectures. Another interesting fact is that fewer students wanted both methods than before the pandemic.

Figure 1.
HVL: Lecture type according to student's needs
(Fojcik & Fojcik, 2020, Fojcik et al., 2021).
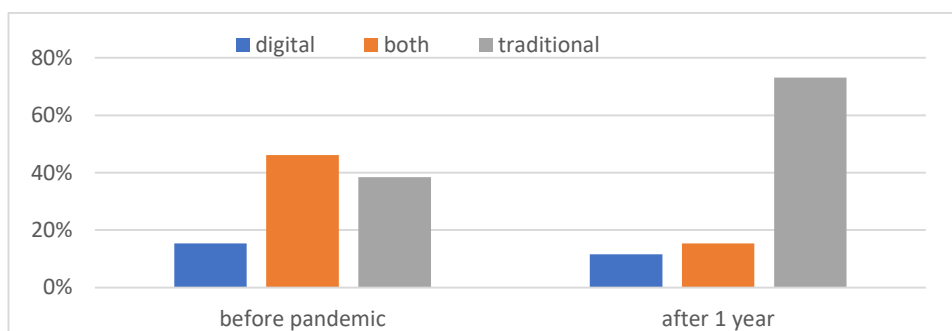
Many researchers (Li & Tsai, 2017; Kyewski & Kramer, 2018; Özhan & Kocadere, 2020) that studied remote or digital lectures suggested that the concept of motivation is an essential element. It is closely related to the professional engagement of students. Another fundamental concept is the teacher-student relationship that significantly impacts students'

achievements, according to Ayllón, Alsina, and Colomer (2019). Dörnyei (2020) suggested that teachers should actively keep students engaged and not just focus on the subject content.

Sun, Siklander, and Ruokamo (2018) identified, in a literature review, factors that trigger and stimulate learning in digital environments. According to their results, visible in Figure 2. there are four categories of factors in the literature: support to the students (as scaffolding), collaboration (through discussion and common activities), learning approach, and acceptance and use of technology. These factors look like elements of social constructivism theory (Vygotsky, 1978; Kurt, 2020).

Figure 2.
Factors that trigged students' interest in digital learning environments and the amount of research articles that examined these factors (Sun et al, 2018, p.70).
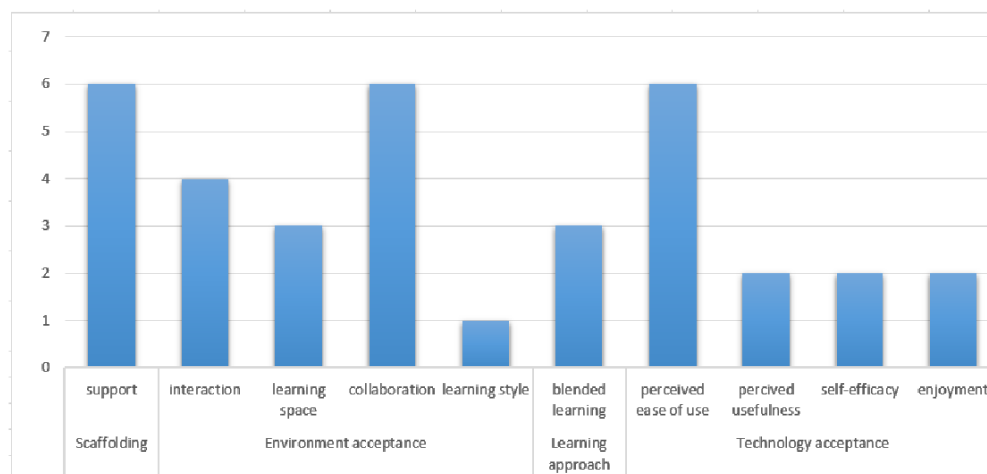
Other research presented by School Educational Gateway (2020) shows some challenges in using digital technology in teaching and learning remotely. The survey tried to find the most difficult (or essential) elements in digital education (4859 respondents). The most difficult/critical components are:

- Access to the technology 49%
- Stress working home 43%
- Keeping motivation and engagements 42%
- Involving persons from socially disadvantaged homes 36%
- Teachers access to technology 32%
- Digital competencies – students 24%
- Digital competencies – teachers 24%

In the same survey, respondents were asked how they would evaluate the teachers' experience. The results show (Figure 3.) that over 2/3 of the students experienced that the teachers did not have any previous experience with digital teaching. Regardless only 24% of people, in an earlier survey, complain about it (School Educational Gateway, 2020).

Figure 3.
Students' opinions regarding teachers' previous experience with online teaching
(School Educational Gateway, 2020).
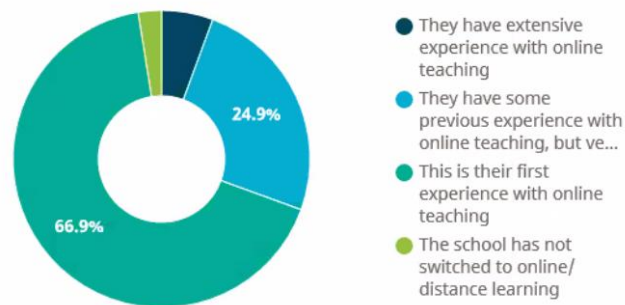
3. METHOD

3.1. Description of the study

The authors decided to conduct a survey for university college students to answer the research question. The survey was given to students from various size campuses, studying different professions and experiencing various teaching methods to include students with different experiences, perspectives, and opinions on digital lectures. The aim was not to analyze a particular class or a teaching approach from an individual teacher but rather to get more perspective from students' point of view. Therefore, students were asked to share their opinion not for a singular course but for all their experiences with digital lectures. The idea was to divide students' views into different categories like:

- what kind of real-time or non-real-time lectures do they prefer,
- what kind of digital equipment they have access to,
- how they use their digital equipment,
- how their well-being is through digital studies,
- their motivation for learning, etc.

So that university college students' perspectives and opinions came to light in a way that makes it possible to facilitate change and development.

3.2. Data collection and description of participants

This study asked the students about their opinions, experiences, and attitudes towards the digital and on-campus lectures these past semesters. The data was collected in two parts. Firstly, similar size groups from different professions from two different colleges were asked to participate in this study. The first collection consisted of students from two study programs at HVL, campus Førde, and two at HVO. This collection was gathered in November 2020 after students had a hybrid semester combining digital and non-digital lectures through different methods. The results – from 57 students – showed some tendencies (Fojcik et al., 2021). Still, the authors decided to extend the survey to other campuses and professions to get more data. Still, due to the Covid-19 restrictions, the second collection needed to be postponed till May 2021. Therefore, the second data collection consisted of students from another program at HVL, campus Førde and students from campus Bergen. It was gathered in May 2021 after two semesters with digital or hybrid lectures.

The first group consisted of automation and ICT students from HVL, campus Førde. This student group had digital lectures and physical laboratories weekly during the last semester before participating in this study. The second group consisted of students at Volda University College who were studying Teacher Education. They had either on-campus lectures or digital lectures changing approximately every three weeks. All groups were located on small-size campuses, with groups of max 30 students that could remain open during the pandemic, as long as restrictions were held and some of the teachings were held online. Participation in this study was voluntary, and about 60-80% of the students participated in each class. Thus, altogether 57 students participated in this data collection.

The third student group consisted of 33 nursing students at HVL, campus Førde. They had most of the lectures digitally, while seminars with practical exercises were delivered on campus. The fourth student group consists of 48 students located on campus Bergen. HVL campus Bergen is a large-size campus, and students were not allowed to have on-campus lectures. Still, in spring 2021, they were allowed to return to campus for small self-organized seminars. Students were asked to participate to get opinions about large-size campuses, even if they did not represent the same study program. In the second data collection, altogether 144 students participated.

Some of the students did not fill out the entire questionnaire, and thus some of the questions had a different number of responses.

3.3. Survey

As previously mentioned, the study consists of a self-completion survey (Bryman, 2016), with 21 open-ended questions and 3 either-or questions. The survey covered several aspects of teaching and learning in digital lectures. Students were asked, among other things, about the self-assessment of their digital skills, the learning software used, their favorite or expected forms of lectures, exercises, and teaching methods. They were also asked if and why they use a camera in synchronous online lectures, if and why they use a microphone or chat, how they acquire study materials, what equipment and internet connection they use. Due to space constraints, only selected elements will be described in this article. The survey was anonymous and voluntary and no personal information was gathered about the participants. However, some of the obtained results were compared with the previous survey conducted before the pandemic (Fojcik & Fojcik, 2020). In addition, some preliminary results from the first data collection were presented (Fojcik et al., 2021).

The entire questionnaire, including the space for the answers, was given on one A4 sheet, printed on both sides. This was made to indicate that although these questions were open-ended, short and precise answers were expected. Most of the questions asked for choosing between a few suggested alternatives. Still, since there were open-ended questions, the students who did not have a particular opinion about these alternatives could write their own explanation. For example, question 5 stated: "What do you prefer; synchronous or asynchronous teaching? Why?". This allowed for quantitative analysis of the first part of the question while letting each participant explain their point of view in the last part.

4. RESULTS AND DISCUSSION

4.1. Teaching form: Digital or on-campus

One of the most fundamental questions in the questionnaire was questions concerning the type of lecture students preferred and wanted. Questions 5 and 6 (Figure 4 and Figure 5) were open-ended, and students wrote their opinions in their own words. They were also asked

to explain their point of view. Questions 22a and 22b were either-or questions (Figure 6 and Figure 7). Students were asked to choose if they preferred digital or on-campus lectures and exercises/laboratories. Diagrams below show how different groups of students answered in the study, and the bars on the right show the sum of all 144 students.

Figure 4.
Results from Q5: What do you prefer: synchronous or asynchronous lecture?
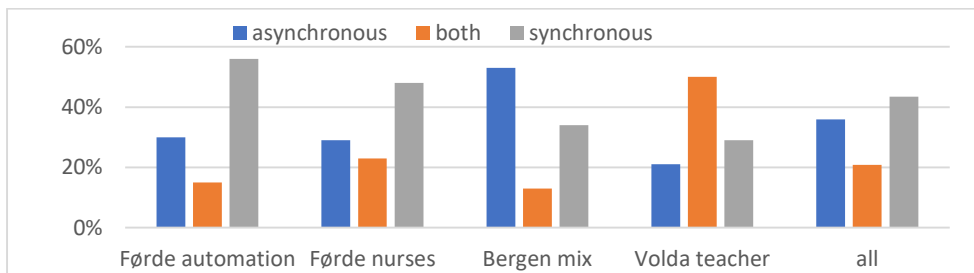
Figure 5.
Results from Q6: According to question 5, do you want both or choose one of them (synchronous or asynchronous)?
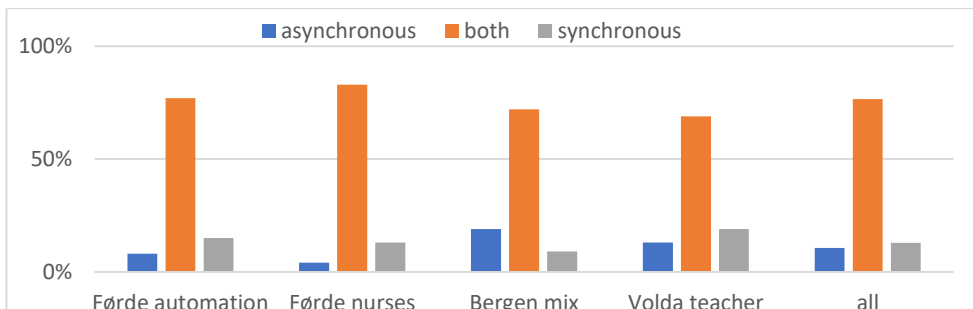
Students indicate advantages to both teaching methods, and the majority want access to both. Students claim that synchronous lectures are best for active participation and collaboration and asynchronous for their own repetitions and self-study before examinations.

Figure 6.
Results from Q22a: What type of lecture do you prefer: digital or on-campus?
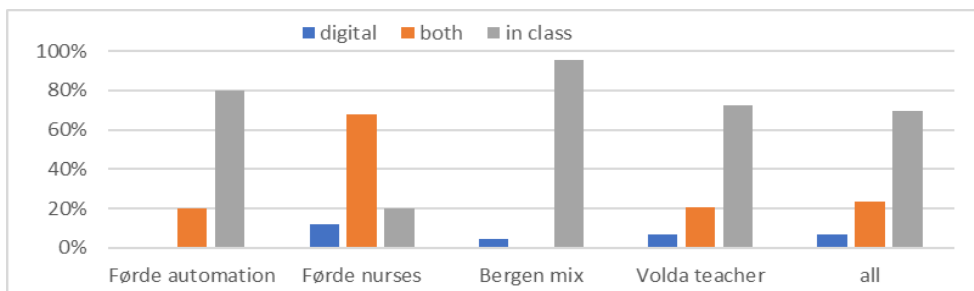
Figure 7.
Results from Q22b: What type of practical exercises/lab do you prefer: digital or on-campus?
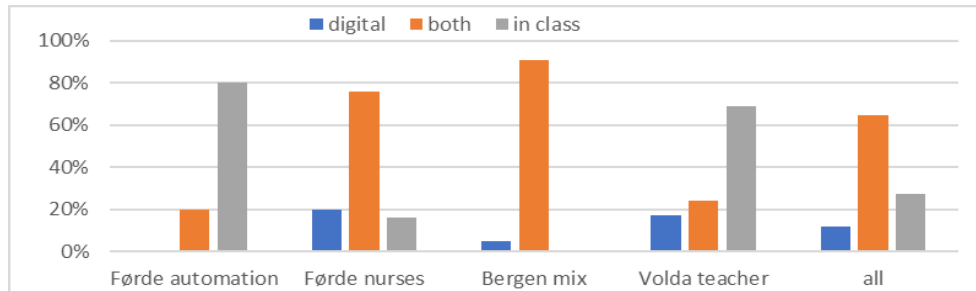
There is a visible tendency that the students are not very fond of digital lectures and that they would choose on-campus teaching if they get to choose the type themselves. This correlates with the pre-and post-pandemic diagram shown in the introduction (Figure 1). The following questions examine the background, and the students' reasons, why they prefer on-campus teaching.

4.2. Participation during digital activities

Figure 8.
Results from Q10: Do you activate/turn on your camera for digital activities?
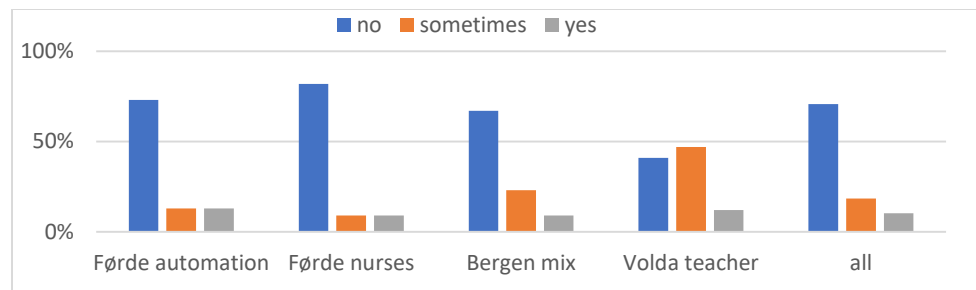
Figure 9.
Results from Q11: Do you ask questions in digital activities?
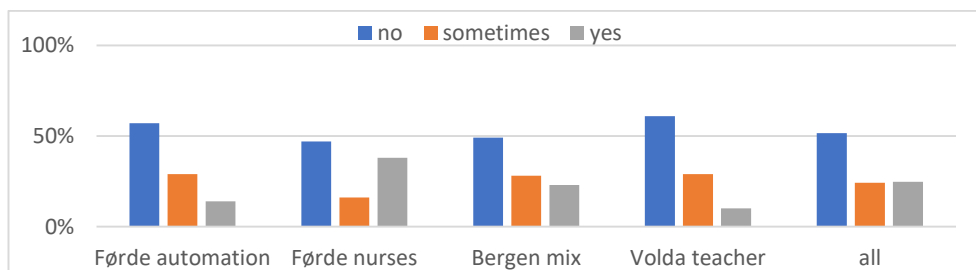
It is clear that the students do not use their cameras (Figure 8) and rarely ask questions (Figure 9). In addition, many of them explain that they still expect others to both ask questions and turn on their camera. Therefore, this suggests that they do not want to be the first person to turn on their camera. Using a camera in digital lectures can be both an advantage and a disadvantage. Advantage – it simplifies contact, makes better emotional participation (Gao, Zhao, Xiong & Gan, 2021), and weaknesses familiar with modern technology. The students do not want to show part of their homes or even themselves on camera for all to see. They indicate that having a camera off gives less pressure to look a certain way etc. Some students said that they take comfort in seeing other students listening to the same lecture. In contrast, others are distracted by all the faces on the screens.

The authors found some tendencies in students' answers about their views on a student's role in a lecture. One of them is that many students seemed to expect to be comfortable. In contrast, learning and the feeling of comfort and security seem stronger than learning for some students. While describing digital synchronous lectures, many students express that they are not accustomed (especially when using digital media) to being involved, visible and active. They focused more on not being seen, not disturbing the teacher, not being taken a picture of, not showing on camera, not being active, not asking questions, and generally not getting any attention from the class at all. 63% of the students in this study do not use the camera at all, 23% of the students only use the camera occasionally (in smaller groups/when others do the same/when they are in a good mood), and only 10% of the students answered that they use the camera constantly during the digital lectures.

4.3. Student's motivation for learning in lectures

Other questions asked about the motivation for learning with digital methods or comparing motivation in different types of lectures. The survey asked the students whether they think that digital lectures have less variety than on-campus lectures, and if so, why, and whether the motivation is different: in on-campus and digital lectures, what about the synchronous or asynchronous lectures (Figure 10 and Figure 11).

Figure 10.
Results from Q16: Are you affected by lack of variation in digital teaching?
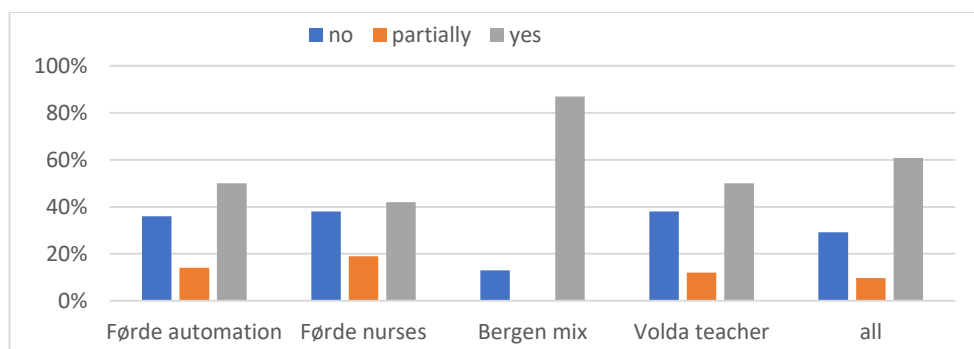
Figure 11.
Results from Q18: Is the lecturer able to motivate you in digital lectures in the same way as in physical lectures?
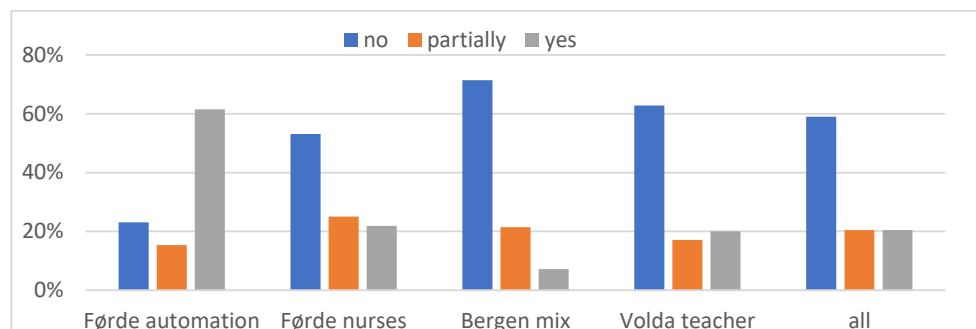
Most students (59%) report that digital lectures do not motivate them, some (20%) express that they are partially or temporarily motivated (responses are divided, some are motivated only by asynchronous lectures, and some only by synchronous with collaboration). Only 20% of students felt they were inspired.

Students complained about various factors that made it difficult to concentrate on learning through digital lectures in the answers to the survey questions. Often the disadvantages for some are benefits for others (Lin & Gao, 2020, Nieuwoudt, 2020). Students commented both the teaching modality: monotonous monologue by the teacher, staring at the screen for many consecutive hours, lack of discussion, dialogue, social elements, and technical aspects: problem with hardware configuration, inability to use it properly, either by the students or the teacher, internet connection problems and so on. Some students explained why they were motivated by asynchronous lectures, comparing them to podcasts, praising the ability to stop the video or repeat a segment, or just deliver the lecture when they felt well awake and well-rested. On the other hand, other students complained that the asynchronous lectures were challenging to do individually because of lack of self-discipline, too little interaction and/or discussion, the video did not answer their questions, or did not understandably explain the topic. This shows many different opinions about digital lectures and whether and how they succeed in motivating students to learn. Similar results have also been found in other universities in Norway, such as OsloMet (Almendingen, Morseth, Gjølstad, Brevik, & Tørris, 2021).

Figure 12.
Results from Q17: Did you learn during digital activities the same as expected?
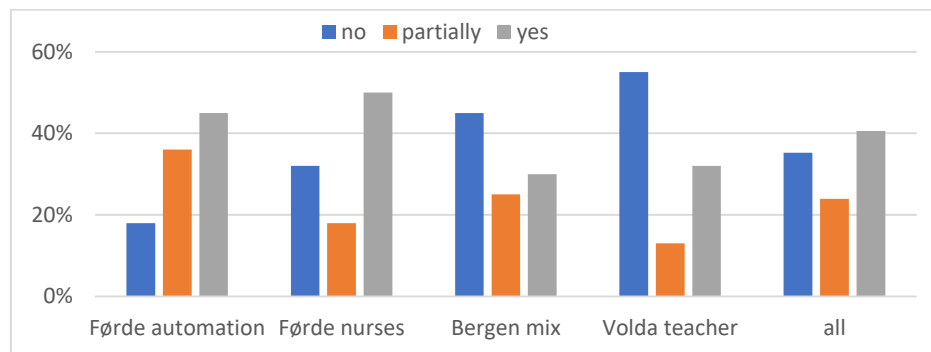
Figure 13.
Results from Q20: Is it important for you to influence teaching methods?
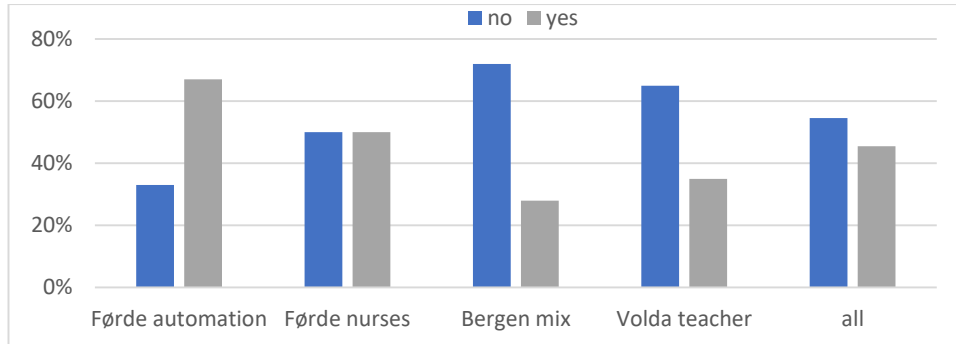
Figure 14.
Results from Q4: Are you using materials only from a teacher, or are you looking for additional information?
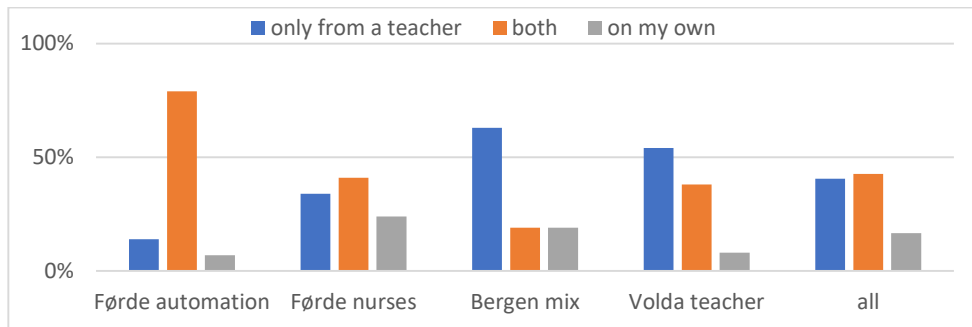
The last three charts are very similar (Figures 12-14). Many students did not feel that they had learned what was expected, did not feel the need to influence teaching methods, and did not use materials not provided by the teacher.

4.4. Students environment and self-evaluation

The students' responses in the questionnaire indicate that they have access to good quality technical equipment for digital learning. They all have laptops (but many write they don't use a camera because they don't have a built-in one?) and a mobile smartphone. Most also have a desktop computer with several monitors at home. In addition, about 1/3 of them have a notepad/MacBook/tablet. The need for technical equipment comes with a cost, which can be a problem, especially for students. Students were satisfied with their equipment, but most explained that they only use one or two devices in lectures, both on-campus and digital lectures.

In addition to questions about their technical equipment, students were asked to rate their own digital skills on a scale of 1-5, where 1 meant very poor, and 5 meant very good. Figure 15 shows the average of each group of students. The average of every group was between 3 and 4, with teacher education students rating themselves lowest. The highest-rated students, on average, were the nursing students.

Unfortunately, when comparing the students' self-assessment of their digital skills with other survey responses, there are many uncertainties about their basic skills. This manifests itself in how they describe the programs they use, the technical problems they have, the quality of the Internet connection, etc. Most students responded that they had a relatively fast broadband connection when asked about their Internet connection. Still, students who rated their digital skills as very good answered: "good quality", those students who consider themselves less competent answer: "50/50Mb/s" or "300Mb/s". These descriptions demonstrate an ability to name and define certain technical elements. However, they do not coincide with self-assessment, or self-assessment can be interpreted differently (Fojcik, Galek & Fojcik, 2017). It is often, but of course not always, more of an opinion about oneself than an assessment of one's abilities.

Figure 15.
Results from Q1: self-evaluation of digital competencies.
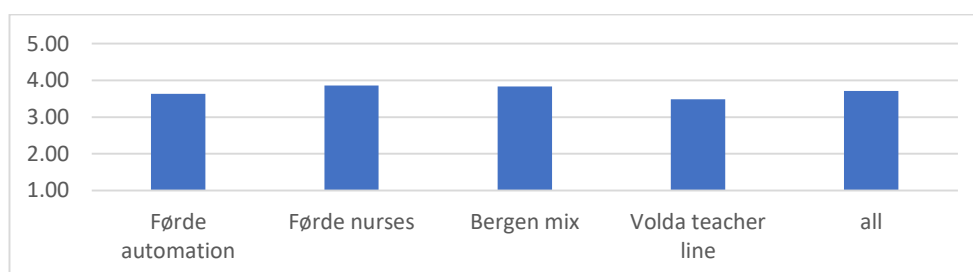
4.5. Additional results

Students participating in this study want a teacher who will use various devices and different learning methods to present the content and make it interesting and exciting for the students to attend the lecture. Most students explained that they do not have strong opinions about their preferences for digital lectures (Brockfeld, Müller, & de Laffolie, 2018) and that they like to have both types, asynchronous and synchronous lectures combined. The reasons for this are interesting and sometimes in opposition to the wishes of others (Nieuwoudt, 2020). Students want the synchronous form so that they can interact with the teacher, ask questions, ask for clarification, or repetition. However, very few of them ask questions at all. 70% of the students in this study do not ask questions at all, and 29% do so only sometimes, in smaller groups.

The survey showed that today's students expect lectures to have good quality recordings, various activities, and interactive forms, even in the case of digital lectures - Padlet, Kahoot, or quiz. Such a recording should have both relevant subject content pedagogical approach and be of high quality. Before and at the beginning of the pandemic, the students paid little attention to the technical quality of the recording and were satisfied if the content was explicit (Fojcik et al., 2020). Now, one year later, they are much more likely to expect teachers to have better video quality or at least be more proficient with the equipment.

When students were asked to describe their ideal lectures (without thinking about practical applications), many responded that on-campus/digital synchronous lectures with various activities, exercises, and discussions would be best, as well as watching asynchronous videos explaining the topic while writing assignments or preparing for an exam. Combining classroom teaching with videos is an efficient learning method (Noetel et al., 2021, Means,

Toyama, Murphy & Baki, 2013). Some students preferred to have separate videos, while others said recording lectures/exercises would be sufficient. Students want a videotaped format to learn at their own pace, with the ability to pause and rewind and fast-forward or repeat more complex parts. One course in this study records all lectures (both digital and on-campus). Unfortunately, statistics from video managing software show that most students will only re-watch the recording a few days before the exam if they watch it at all.

5. CONCLUSION

Digital lectures were needed during the pandemic. Teachers and students had to change their routines and try different tools and methods to create learning environments through digital media. It is not possible to say whether digital lectures will continue even after the pandemic or whether they will be reduced to students who choose to learn remotely. This article presented some results of the questionnaire given to different students in which they were able to provide their perspectives and opinions on digital lectures.

The overall result is that there are advantages and disadvantages of teaching digitally. For instance, digital lectures have a different setting than on-campus meetings, and many teachers do not have sufficient experience in getting through to the students through digital media. This requires different preparation than on-campus lessons, both for teachers, who must consider different social dynamics through digital communication and for students who must choose and arrange the space at home for studying. The equipment needed for digital lessons may be easier to obtain in a multicampus environment than for a single subject, but even with special equipment, digital lectures can be monotone, with low levels of interaction. Whether it is monotone or not is mainly up to the teacher, not the teaching method. Teachers can be tedious in on-campus and digital classes, depending on how they incorporate new elements and new methods for students.

Most of the students in the selected subjects taught at HVL and HVO participated in the survey. Still, both schools are relatively small, so the survey is not quantitatively representative. Thus, the results can only show general tendencies in both places.

This study tried to answer the research questions: How do digital lectures work, and what are students' opinions and experiences about their lectures? The results show that the students seem to have specific expectations about the different methods of lectures. They know what they like and what they dislike. Still, their answers often contradict each other both within a class and among the students themselves. Some students like asking questions, using the camera, and participating actively in the lectures. Others prefer to learn at their own speed, with videos and less interaction, or just without any camera or microphone so that no one can notice them. Most students in this study seem to have struggled with motivation for online lectures and the social connection with other students. Another result is that some of the students comment on the insufficient technical knowledge of the teachers; errors in recording, problems with sound, image, graininess, illegibility of text, image freezing, constant switching, etc.

The authors have noticed multiple times that learning is much more effective when the teacher is a part of the learning process and can guide and support the students. While students comment on things like "they would not want to disturb" or "they want to do this themselves", which often may be a good idea. Still, the students should know that teachers' role is to guide and support them so that they are not entirely on their own. The teachers' involvement in students' learning process is important for the students' achievements (Ayllón, Alsina, & Colomer, 2019).

The arguments students use to describe why they don't switch on the camera are reasonable in larger groups or publicly open lectures. Still, they are, in some part, questionable when the student meets the same group of people again and again, both in digital lectures and on-campus lectures. The groups are less than 30 students. Another questionable factor is the lack of technical skills such as removing the background (available in many programs) or switching the microphone (mute on / mute off), or the lack of conditions or interest to find creative solutions such as preparing the learning station before the lecture, clear the presence of other people, noise and other distractions which in itself makes learning difficult. There may be many reasons why the students rather choose not to participate in online lectures than take some time to prepare their surroundings, physically or digitally.

The widespread availability of video games and movies with special effects means that a "normal" lecture recording can be uninteresting. That might signify that the students are more occupied by the quality of the digital lectures when they are exposed to them for more extended periods than when the videos were used as a variation in the learning process.

Students want a combination of synchronous and asynchronous teaching. Watching videos asynchronously has the advantage that students can watch something repeatedly. However, only watching videos is not necessarily the best way of learning (Haakens, Karlsen & Bråten, 2021), and earlier studies point at the combination of videos and other learning methods as face-to-face classes as preferable (Means et al., 2013, Noetel et al., 2021).

The study shows that most students do not use a camera in three of the study programs. However, using a camera does not necessarily correlate to asking questions during digital lectures. The study program where students use cameras to the smallest extent is also the study program where students, to the greatest extent, ask questions during lectures. This may imply that other factors than switching the camera on are more important than using the camera to activate students during lessons. There are claims that social presence is a powerful concept within digital teaching since it positively influences student participation, satisfaction, and student engagement (Bentley, Secret & Cummings, 2015). This could be a topic for further research in future studies. Students in our study propose "camera on" as a measure to make digital teaching better regarding the social aspect. Still, they also propose other measures such as using smaller groups, discussions, and talking together. Learning through discussions and collaboration is well established in physical learning environments(Lim et al., 2019). In an era of digitalization, we need to explore how these elements best can be transferred to a digital learning environment.

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Chapter #6

ENLARGING THE VIEW. A MODEL TO PROMOTE QUALITY IN ECEC SERVICES BY INTEGRATING THE INDICATOR FRAMEWORK APPROACH TO THE SITUATIONAL PERSPECTIVE OF CHILDREN'S LEARNING

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ABSTRACT
In this contribution it is proposed a critical framework, based on Basil Bernstein's theory, for two aims: a) criticizing some tendencies in the Indicator Frameworks for the evaluation of the quality of Early Childhood Education and Care services (ECEC), which rely mainly on measures of the structural and processual characteristics of the educational settings. However, the processual dimensions are reduced to their individual components, overlooking the complex and contingent interactions that create opportunities for learning; b) proposing a critical framework, based on Basil Bernstein's theory to analyze the different child-centered approaches to ECEC.

Keywords: child-centeredness, quality of services, indicator frameworks, reflective practice.

1. INTRODUCTION

According to Chung and Walsh (2000), three major perspectives on child-centered practices have historically evolved: Romantic, Developmentalist and Democratic. Each identifies the child as at the center of the educational practices, characterized by the identification of each child's needs, competencies, interests. However, each perspective proposes its own declination of what the child is at the center of (Romantic: her/his world; developmentalist: the curriculum; democratic: the community).

The "Romantic" conception, elaborates the "naturalistic" idea of childhood as an age of harmony between the Child and Nature; the adult has the task of "fertilizing" the environment, to promote the development of the child's potential, which is expressed through play.

The "Developmental" perspective assumes a universalistic and sequential process of children's growth, characterized by a match between the children's ages and the expected achievements. In this perspective, greater attention is paid to lessons and structured materials, to the learning of counting, to the recognition and reproduction of written letters, numbers and geometric figures. In this conception, more sophisticated competencies such as metacognition and peer collaboration are learned after basic skills (recognition, reproduction and simple problem solving activities).

The "Democratic" perspective is characterized by the idea of the child as rich in expressive competencies, able to construct her/his own knowledge through meaningful experiences in collaboration with others. The socio-constructivist conception emerges from the interpretation of Piaget's and Bruner's theories and in particular of the practical elaboration of the Reggio Emilia approach. The central concept concerns the role of

individual interests and skills in the development of the child, supported by a stimulating environment. In this perspective, development implies greater self-regulation of thought, greater expressive mastery and motivation to explore the environment. The role of the adult consists in the design of stimulating learning settings, supporting children's initiative and thinking through appropriate discursive interventions (Bruner, 1978). In this perspective, the adult assumes new and sophisticated skills in planning, documentation and the organization of educational activities to support children's participation and self-reflection (Hendy & Whitebread, 2000).

2. CRITICISING THE QUALITY INDICATOR FRAMEWORKS METHODOLOGY

In developing a Quality Framework, Policy Institutions have usually identified some structural and processual indicators, in order to signal the level of achievement in the relevant dimensions of the educational practices, according to given benchmarks.

The focus of this contribution is to question the validity of measures of the interactional processes, as well as reflecting about the potentiality of the introduction of qualitative evidence to promote quality and child-centeredness in the Early Childhood Education and Care services.

The Quality Indicator Frameworks are supposed to be the "objective" devices to comparatively evaluate the quality of Early Years services as well as to highlight their critical elements. According to this approach, any educational practice is cut up into its constitutive elements: each component is evaluated on the basis of simple measures, typically obtained by using standardized instruments (for example: rating scales, check-lists; standardized observational schemes); then its quality assessed according to given standards.

Table 1.
Relevant features usually incorporated in the Quality indicator frameworks.

Structural factors	*Organizational factors*	*Process factors*
Finances	Staff qualifications	Staff responsiveness
Indoor/outdoor spaces	Staff/children ratios	Complexity of tasks
Playing materials and furniture	Health/food regulations	Quality of social interactions
Impact over the community	Design/documentation strategies	Children's attendance
	In-service teacher training and action-research	Relationships with families

However, there are methodological limits in the analysis of the educational processes: for example, frameworks such as CLASS (Pianta, La Paro, & Hamre, 2008) and ECERS-R (Harms, Clifford, & Cryer, 2004) are intended to single out and measure isolated dimensions as proxies of complex and dynamic processes, such as respect of children's rights, promotion of good relationships between adults and children, non-invasive care, autonomy, respect for children's interests and emotions, close listening, joint meaning making, prosocial behaviors.

Peter Moss and collaborators (Dahlberg, Moss, & Pence, 2013; Moss, 2016) introduce some epistemological criticisms toward standardized tools:

- The Quality Indicator Frameworks are based upon a philosophical conception of an absolute rationality, developed by external experts; any educational service should be measured and compared through the same criteria. However, this approach lacks cultural sensitivity: Early Childhood educational services usually act as bridges towards families and communities, in order to integrate different developmental demands and to promote children's participation in culturally meaningful activities. As a consequence, each educational institution is related to its specific community and develops its own characteristic organization (Fuller, 2007); in the Quality Indicator approach, complexity and diversity are overlooked, although these are essential components of the professional work;

- By transforming education into a technical project, the educational means are separated from their aims; the apparently neutral question of "What works?" substitutes the more relevant questions of "Working for whom?", and "Where to?";

- the standardized measures tend to separate professional agencies from the contexts in which they occur: in fact, educators deliberate in the emergent contingencies of their practical conditions, acting what is considered possible, given the contextual constraints, rather than according to an abstract rationality.

Although the systematicity and elegance of many Quality Frameworks are to be appreciated, there are two critical points:

a) the Frameworks tend to merge the concept of "indicator" and the concept of "measure" (Alexander, 2008). Some measures of quality can be easily assessed (space per child; teacher/children ratios; health quality of food; daily schedules); however, rating scales do not suffice to evaluate the child-centeredness and the opportunities for learning, since they single-out individual dimensions from the complex and dynamic processes of interaction; since educational processes are dynamic and contingent system of interacting conditions, they are not easily captured by static measures of isolated variables. Indicators tend to be easy-to-formulate aspects of complex processes, however they lose sight of the layered nature of the constitutive components of the educational practices; as a consequence, a high degree of inference as well a high level of ambiguity can be found in applying the Quality Frameworks (Alexander, 2008).

b) Assessment of singled-out dimensions of the educational practices creates a rift from the direct experiences of practitioners, children and families in their everyday practices (Hammersley, 1995). The contingent and variable conditions that act as "gravitational forces" (Erickson, 2006) on the participants in any educational setting are undervalued. In turn, educational deliberations emerge as perceived opportunities in the contextual contingencies. As a consequence, evaluation procedures should not isolate the participants' acts from the complexity of their educational situations.

By confounding measures and indicators, the complexity of the child-centered pedagogy is overlooked. The construct validity of the quality indicators needs to be assessed through educational theories, rather than relying only upon the management approach. Furthermore, practitioners develop their professional activities in a context characterized by specific settings, tools, norms and people that together constitute the situated conditions for

the development of the curricular activities. As a consequence, from the point of view of the practitioners, each setting is a unique context of practice. The ranking of each specific dimension on the standardized measures is only an information that must be interpreted.

2.1. Integrating the measurement approach with the insiders' accounts

The measurement approach can be considered conducted by a detached subject who applies standardized instruments to gather data (which represent the magnitude of specific dimensions in a setting), in order to compare them with given standards. This distant evaluative look can be complemented with in-depth professionals' accounts in narrative terms.

In Pastori and Pagani's research (2017), the introduction of Quality Frameworks tools in a professional practice is an opportunity to offer a pattern of information about the setting that can trigger the educators' reflection, narrative account and innovation. Pastori and Pagani (2020) subsequently conducted a participatory action-research with professionals, by introducing the tool Classroom Assessment Scoring System (CLASS - Pianta et al., 2008), with the aim of engaging the participants in a critical discussion of their practice. Participants reported some positive aspects in the use of the framework, such as the centrality of the educator-child relationship in defining the quality of the service and the focus on the emotional dimension of learning. On the other hand, there are some shortcomings: the framework lacks a deep focus on the interactional competence of children; it emphasizes productivity ("doing something"), rather than the opportunities for learning attributed to the educational activities (which are the "meaningful, rich experiences for children?", "Why do some activities become learning experiences?").

3. DEVELOPING AN ALTERNATIVE FRAMEWORK BASED ON BASIL BERNSTEIN'S WORK

Since the simple sets of distinctive features that are represented in the Quality Indicator Frameworks cannot define the complexity of historically evolved practices, we propose an alternative framework, based on the concepts introduced by Basil Bernstein (1973; 1999), to understand the practical organization of the child-centered perspective, in terms of the curriculum, the interactional patterns and the levels of cognitive engagement in the Early Years settings. This approach may complement the more established model of standard measures to evaluate the quality of ECEC services.

According to Bernstein, the practices of schooling can be identified by intersecting three dimensions:

a) Classification: the degree of insulation an element has in relation to others, for example: experiences in-school and out-of-school; the degree of separation of activities in the same educational practice. The higher the classification, the stronger is the instructional approach;

b) Framing: the degree of adult's control of the interaction; the higher the control of discourse by the adults is, the stronger is the teacher's voice; the higher the opportunities of children's contribution, the more the children's voices are valued;

c) Vertical and horizontal discourse is a dimension that can highlight some differences within the child-centered approach. The socio-constructivist approach, such as the Reggio Approach promotes a vertical discourse, since it is based not only on child-initiated activities, but also on higher order thinking strategies, such as planning, revision, communication.

Democratic and constructivist approaches in early childhood education are characterized by children's interests and inquiries, exploratory talk, in which the adults accept and extend the children's thoughts and contributions. Democratic approaches to child centered education give value to a variety of children's contributions through different sign systems (should they be verbal language, visual, dance, musical, etc) to make children become the authors of their own individual contribution to the conversation. In these contexts, the professionals adopt practices based on the principles of "children as active constructors of knowledge. In classrooms consistent with this theory, teachers provide direction and guidance as they assist children in developing their knowledge, but they also provide opportunities for children to direct their own explorations of objects and academic topics" (Stipek, 2004, p. 550). Characteristically, settings are integrated and children can move freely, in order to overcome differences in gender, abilities, ethnicity and to some extent in age. Each organized space can create the opportunity for children's initiative, rather than fragmenting the curriculum in simple and repetitive exercises (Low classification). Interactions tend to promote children's genuine contributions to joint activities, to emphasize democratic dialogue, reflection and metacognition, rather than imposing an instructional script (Low framing). Romantic and constructivist Child-centeredness tend to diverge in the role of adults: in the constructivist approach, such as in the Reggio Emilia experience, the teachers' questions are oriented to extend the children's thinking processes, in order to achieve more clarity and systematicity during the joint curricular activities (Vertical discourse). In the Romantic perspective, adults let the children play according to their personal feelings and interests. As a consequence, the documentation tends to be a static representation of memorable events and situations, rather than an opportunity to highlight some crucial elements of the children's participation and learning; practices tend to be fragmented into different centers of interest.

Table 2.
Different educational approaches according to Bernstein's theory.

Educational approach:	Instructional	Romantic Child-centeredness	Constructivist
Classification	*Strong*	*Weak*	*Weak*
Principles	Focus on the acquisition of behavior. Children are not considered competent in setting up their own objectives and strategies	Variety of children's behavior is the object of development. Not a prescriptive scheme of behavior	Focus on promoting personal growth rather than on instructing children. Children are considered accountable for selecting their own projects and for self-regulation
Metaphor of learning	Learning as acquisition	Learning as exploration	Learning as construction and transformation

Goals of education	Children master procedures for external tasks. Focus on correctness	Well-being and self-regulation	Metacognitive dispositions; higher order thinking and understanding
Teaching/education	A piecemeal approach to learning. The activities relate to isolated elements of learning. repetition; memorization.	Children's conducted global activities: they set goals; select tools and strategies	Project-based learning; children set up their own goals and collaborate; teachers promote
Framing	*Strong/visible*	*Weak/invisible*	*Weak/visible*
	Instructional script; children's contributions should be filled in a prescriptive scheme; they are predictable; the expected answer	less directive approach; children are expected to regulate peer group relationships and individual behavior	High variety of scaffolding strategies, since the children's thinking processes are at the center of the educational practice
	The teacher models the activity and has an expected behavior in mind	The teacher supports the child-initiated activities; gives freedom and monitors behavior	The teacher: expands children's activities; promotes dialogue; privileges goal-based activities, in which some relevant aspects are highlighted in order to promote learning

By analyzing the educational settings in relation to the three critical dimensions of classification, framing and discourse, practitioners and researchers can map the position of their specific educational activities in the continuum of the three approaches of Child-centered practices, with opportunities to plot the route of their subsequent projects.

4. EXAMPLES OF APPLICATION OF THE OBSERVATIONAL SCHEME IN DIFFERENT EDUCATIONAL CONTEXTS

In order to understand the educational activities in relation to the Child-centered approach, an open observation scheme has been worked out, to situate the child in the complex system of practice, constituted by people, tools, norms of interaction, educational objectives (Adams et al., 2017)[1].

The observational device does not isolate the child from the context of her/his environment, but it offers the opportunity to analytically reconstruct the organization of the educational activity (according to Strong/weak classification), the interactional texture that emerges within specific educational events (Strong/weak framing), and the level of cognitive

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[1] In the "Erasmus+ 2019-1-UK01-KA203-061665 "Child-Centred Competences for early Childhood Education and Care", the observational device was applied to identify different child-centered practices, as evidentiary basis to support an online course (Child-centred Competences for early Childhood Education and Care, 2021).

engagement, as well as the teachers' scaffolding strategies to promote children's learning (Vertical/Horizontal discourse). The goal is the recognition of the environmental conditions that affect each child's opportunities to participation and learning and the identification of the developmental paths.

As a result of the application of the observational device, the practitioners work out short narratives that represent prototypical episodes in their institutional settings. In turn, the episodes can become case studies that are characterized by all the contextual conditions that are relevant in the unfolding of an educational activity. Qualitative analysis (Erickson, 1987) may offer an evidentiary basis for:

- Recognizing the specific conditions that hinder the children's participation and learning according to the child-centered practice, especially the constraints to the recognition of children's voices, rights and agency;

- Promoting collaborative design of educational activities, in order to encourage children's exploration, dialogue and thinking processes;

- Conducting action-research projects within the services, in order to promote joint reflection among practitioner, to enhance the professional resources in the service.

The open observation scheme has been applied in different early Years educational settings, which, in turn, were analyzed according to the proposed Framework, and discussed with the practitioners, in order to reconstruct the practice and to identify opportunities to change. The different Child-centered approaches are introduced in the following examples. It is worth-noting that there is no single measure to characterize an educational event according to a given category, but the analysis highlights a system of possibilities that can evolve in specific directions.

The three examples differ in the degree in which the organization of the setting, the interactional patterns and the cognitive engagement of the activity combine together, to the establishment of the conditions for children's participation.

a. Instructional approach: learners' utterances evaluated in relation to an implicit ideal model; learners' contributions are valid only in relation to the teacher's perspective (strong classification and strong framing), as in table 3:

Table 3.
Example of the Instructional approach.

Time:	Episode	WHO	Reflection
The activity lasts 40 minutes	The children are now disposed 2 for each table, one in front of the other; the objective is to make a drawing of a wood; they can pick up objects from the big box to make individually a collage. They work alone, but allowed to exchange ideas, tools, help. Ilaria is making a collage by placing all the light objects of a wood near the upper margin of her large paper sheet and the other objects progressively below, according to their weight. Therefore, clouds, small leaves and small fruits are above larger leaves and fruits. Accordingly, pebbles are above stones. the teacher tells her that she should draw	16 children, 9 f; 7 m, 5 year olds. **WHERE** The room is the largest of the school. It is called the "Color Room" but at 12am it is transformed in the lunch room	The teacher does not accept Ilaria's interpretation of the Wood and asks her to rely upon a "naturalistic model" of representation. She asks Matteo to follow the correct procedure in his artefact.

	a "real" tree "otherwise one cannot understand that it is a wood" as the teacher says, "You have already put this [indexing a piece of bark] you need small branches". The teacher suggests other children to draw a line to mark the separation of the wood and the underwood. She asks Matteo "try to make visible the water flowing from the spring".		

b. Learner-centered approach: learners' experiences and differences are valued; multiplicity of voices. The teacher does not instruct; however, has set up the conditions for the learning situation (low classification, low framing, horizontal discourse):

Table 4.
Example of the Learner-centered approach.

Time:	episode (…..)	WHO	Reflection
The activity lasts 30 minutes	The children sit in a circle and sing a song in unison. 6 children are very focused on singing; 3 listen and sometimes chat together; Mario dances. A child leaves the group and plays with a puzzle, another one enters in the playhouse. The teacher calls the children's attention towards the singing group. She eventually asks each child in the circle to indicate her/his best friend. Marta is disappointed because the girl she has indicated as her best friend does not reciprocate. Progressively, the group loses its cohesion. Arianna goes to wash her teeth's; Lorenzo plays with an airplane. There are 11 groups or individual children playing.	25 children, 12 females, 13 males. 5 years old. **WHERE** A large room in the pre-school/preparatory class	The teacher sets up the activity and tries to involve children by catching their attention; some children shift their attention toward other activities. The group activity gradually dissolves and some children begin individual activities.

c. Constructivist approach: the teacher promotes exploration of new meanings and connects levels of thinking and arguing (Vertical discourse, low classification, low framing, encouraging multiple perspectives in conducting the activity):

Table 5.
Example of the Constructivist approach.

Time:	Episode	WHO	Reflection
The activity lasts 15 minutes	The teacher asks the children to represent their daily route from home to school, by using small wooden sticks and blocks. The children look at the map. The route has some turns and inclinations. They recognize some elements of the landscape they went across (trees, stones, meadows, animals) and reproduce them using the objects on the table. A." I shall mark the path with the small sticks M:" I put those high trees right here; here, I put the school because we started over there and arrived there [higher] Teacher: Why do you make the turn in this way? A: I would have made also the climb but I wasn't able to G: "you can make a kind of ladder" Teacher: "How can you made the ladder?" A: "Make use of the sticks, a lot underneath, fewer on the top" Teacher "How many do you put on the bottom and how many on the top?" A "I try with 3 on the bottom, then 2 and 1 on the top M: "we should build it on the chair, which is the hill, how can we make it stable?" A: "We balance them".	The children collaborate in small groups of 4, on a common task. In the observed group there are 4 children of mixed age (4 and 5 year-olds) and gender (2 males and 2 females) **WHERE** The setting is a multifunctional room. Previously, the children sketched a map of the route the school bus takes to bring them to the preschool. The map is projected onto a wall. The teacher also predisposes a construction set of small wooden sticks and other stuff.	During the activity the children discuss and develop strategies to represent their route to the preschool. They are collaborative and respectful of their peers' ideas. Some children show good metacognitive competencies and reflect on their strategies (i.e. 'if I lean the sticks on the wall, they don't fall down and I 'll be able to make the climb'). The teacher's interventions invite children to reflect on their strategies. This activity promotes competences in diverse experiential fields as: language, knowledge of the world, graphical representation.

In the first example (Instructional approach), the setting is organized to support the individual activity (strong framing); the teacher adopts a strong implicit prescriptive model of a "naturalistic representation" of a woodland (strong classification); as a consequence, Ilaria's abstract representation is not recognized as appropriate and she is asked to modify her artefact; Matteo is invited to add more conventional signs in his representation (vertical discourse). The children's divergent points of view are not considered acceptable and not encouraged.

In the second example (Learner-centered approach), the teacher tries to direct the children's attention toward a unified and structured activity (low classification), consisting in a common participation in a choir. However, the children tend to have a limited role in developing the activity (horizontal discourse) and soon feel disengaged; some show limited attentional clues, others start to play individually, creating 11 centers of interest (low

framing). As a result, the group is loosely connected, there is not a common center of attention, to exchange ideas and to construct new understandings.

In the third example (Constructivist approach), the teacher promotes the development of integrated competences in the children, by engaging them in a complex task (vertical discourse) consisting in a connected representation of their daily route from home to school in different formats: a collective drawing, a three-dimensional model (low classification), encouraging dialogical interactions and multiple perspectives in conducting the activity (low framing). Furthermore, the teacher's interventions are not directive, but oriented to promote the children's reflection on their cognitive strategies ("Why?", "How?").

5. CONCLUSION

The Quality Frameworks are useful tools to register a great amount of information about the magnitude of relevant dimensions of the Early Years educational settings. However, their usefulness relies in understanding their implicit rationales and as an opportunity to promote critical reflection among practitioners, as the principal agents of change and improvement of the internal quality of the setting. Through reflective documentation, practitioners can recognize the quality of their child-centered practice, by recognizing potential boundaries to the children's participation, the degree of control of the communication between adults and children, the opportunities for learning created by the curricular design, dialogic communication and meaningful experiences.

By the comparative analysis of different educational events, it is possible for researchers and practitioners to identify the particular structure of interaction, the opportunities and constraints that are offered to the children's participation and learning. In turn, this analysis allows for both a reflection on the implicit model of Child-centeredness and a progressive transformation of the educational practice.

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Chapter #7

SOCIAL IDENTITY FORMATION OF BLACK LEARNERS IN SOUTH AFRICAN HISTORICALLY WHITE SCHOOLS

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ABSTRACT
The chapter engages with the issues influencing the social identity formation of black learners attending historically white schools (HWSs) in the Northern Cape province of South Africa. Black South Africans were treated as intellectually and racially inferior during the apartheid years. The situation was further exacerbated when black learners were admitted to HWSs. Consequently, the school that should normally contribute to developing a positive social identity formation of learners, seemingly has the opposite effect on black learners. An empirical investigation, by way of quantitative research, was employed to ascertain the issues influencing the social identity formation of black learners in HWSs. The authors, however, report on the data segment of 10 selected items pertaining to social identity formation, which was one of the components of an extensive doctoral study questionnaire, which was completed by 832 black learners enrolled at 27 HWSs in the Northern Cape province. Some of the findings indicate the manifestation of negative influences, low educator expectations, the disjuncture between home and school education as having an effect on the social identity formation of black learners. This chapter proposes certain suggestions to be considered by HWSs in South Africa to possibly mitigate the identified challenges.

Keywords: learners, historically white schools, social identity formation.

1. INTRODUCTION

The first democratic elections in 1994 made it possible for black learners to enrol at multicultural schools, more specifically historically white schools (HWSs). Many of these HWSs, who previously exclusively catered for learners from monocultural backgrounds, responded to the opening of schools for all learners by adopting an assimilationist approach. Assimilation is perceived to be the dominance of values, traditions and customs of one group in framing the social context of the school (Soudien & Baxen, 1994). According to Fataar (2010), learners from a cultural origin other than that of HWSs' existing culture and identity had to identify with and follow acceptable cultural expectations and behaviour. Within the boundaries of HWSs, cultural wealth, values and norms of black learners are perceived to be inferior to that of white middle class knowledge-based trusts, values and social standards (Lemon & Battersby-Lennard, 2011). This situation in turn provides unfertile grounds for the instilment of common experiences, mutual understanding and healthy social interactions. It stands to reason that black learners' sense of social identity (culture, heritage, language and traditions), and consequently the intricacies associated with their self-concept, are relegated to the archives in these white learning settings (Bazana & Mogotsi, 2017). Therefore, the employment of racially representative teachers in former House of Representatives (HOR), House of Delegates

(HOD), and House of Assembly (HOA) schools is crucial in defending and upholding learners' interests and issues pertaining to learner diversity and inclusivity (Fiske & Ladd, 2004; Neluvhola, 2007). It needs to be noted that black learners in former racially homogenic schools may experience various barriers to learning that white, Indian, or coloured learners do not, which may be owing to the lack of appreciation for their culture, race and language which inevitably may affect aspects confined to learners' social development, such as their socialisation, interactions and identity formation.

Research undertaken by Erasmus and Ferreira (2002) in a similar regard, implies that the development of positive social identity formation of black learners attending HWSs is intermittently under attack. These perceived attacks may take many guises and may appear to have a racial undertone. Equally, Davids (2018) contends that education in South Africa remains profoundly racialised, notwithstanding the concerted efforts made in post-apartheid South Africa to circumvent racism. In keeping with the racial undertone of education, Erasmus and Ferreira (2002) conclude that positive "mirroring" about the general self is important in the development of an affirmative social identity formation during the adolescent phase. Likewise, Webbstock (2016) advises that transformation in education could play a critical role in training socially responsible, independent citizens. However, destructive occurrences at HWSs, as mentioned earlier, may steadily erode any positive feelings of self-worth and self-esteem, which in turn will affect the social identity development of black learners. These destructive manifestations may be intensified by feelings of marginalisation and non-belonging to the in-group. Regrettably, social exclusion and marginalisation are still visible in many of these schools, based on sporadic media reports. A case in point is a media report by News 24 (Karrim, 2020), stating that students from former Model C (HWS) schools in Gauteng, the Western and Eastern Cape, as well as KwaZulu-Natal provinces, and others have posted their experiences of alleged racism at their schools by teachers and fellow students. Nonetheless, social exclusion is hardy only about unequal access. It also includes exclusionary institutional and academic cultures, in relation to teaching and learning, curriculum development and pedagogical practice (Badat, 2010; Mavuso, 2019). All these mentioned forms of exclusion and marginalisation mitigate against the development of a positive social identity. The aforementioned is supported by Schwartz, Côtè and Arnett (2005) in their assertion that social identities and even inter-personal identities are interrelated with individuals' categories of otherness (race, class, gender, religion) and, depending on the context they move into, individuals can either experience inclusion (acceptance) or exclusion (marginalisation). In the same manner, Markus and Kitayama (1994) caution that danger might satisfy when individuals attempt to satisfy their need for belonging. In this process, learners at HWSs may develop their own in-groups with "exclusive" memberships. Should these groups be created along racial lines, it could promote racism and precipitate an unintended cycle which may threaten peaceful co-existence within HWSs.

2. BACKGROUND

In South Africa the official and formal racial segregation of schools commenced in 1948, when the white Nationalist Party came to power. The racial, ethnic and geographical separations within the education system led to the formation of 15 separate education departments which operated until the advent of the new South African democratic dispensation in 1994. As part of the ideal of democracy, the new South Africa aimed at providing an equal and quality education system for all of its citizens and to abolish the stratified education system of apartheid (Apartheid was a system of institutionalised racial

segregation that existed in South Africa from 1948 until 1994). The aim of the white apartheid government was to subject black people in South Africa to a subordinate education system that was based on maintaining control and reproducing inequality (Dolby, 2001; Arendse, 2020). Black people in South Africa were regarded and treated as both intellectually and racially inferior during the apartheid years, which invariably could have influenced the healthy social development of citizens. Mwamwenda (2004), Ndimande (2013) and Mogashoa (2019) echo this view by stating that there was hardly any situation in the life experience of many blacks during pre-democratic South Africa that created the space for the enhancement of a constructive social identity formation.

As part of the ideal of democracy, the new South Africa aimed at providing equal educational opportunities for all so as to abolish the stratified education system of the apartheid period. The aim of the apartheid system was to provide the black population with an education that was inferior to the education received by white learners (Dolby, 2001). Consequently, the turnaround to a desegregated school system in the early 1990s led to an influx of non-white learners from working class communities to HWSs. Mpisi (2010) contends that literature is depleted with perceptions such as "that blacks have no initiative", "that they will always say yes when they should have said no", "that they are emotional and have the innate habit of not keeping time and talking around the point". Regarding these perceptions, the authors argue that there may be traits which blacks had developed, because of exposure to an unfriendly and threatening environment over a period. The opposite may have held true, if blacks had been exposed to a more amicable environment, such as that of people of European descent.

Furthermore, several media reports highlight the tendency of some HWSs to continuously engage in exclusionary practices. One such example is where a school in the Gauteng province in South Africa formulated its language policy in such a fashion that it excluded black learners, because they were not proficient in Afrikaans (Macupe, 2018). Another example is the incident reported in The Guardian (2016), where a historically white school passed a policy declaring black school girls' hair styles "untidy". Furthermore, protests held in 2016 by learners in HWSs, such as Pretoria High School for Girls, highlighted their experiences of racism, school rules that stipulated hairstyles and the ban on the speaking of African languages. This protest snowballed to other HWSs in Cape Town who supported this protest and brought to light learners' experiences of discrimination. Christie and McKinney (2017) describe these protests as the "peak point in years of struggles against discrimination" (p. 2) in HWSs that still exist in South Africa. To be more specific, discrimination is embedded within the school rules and policies for uniform, hair, and religious attire and customs other than those of Christianity. These are clear examples of how the norms of the past are still deeply engrained within the HWS spaces as some of these institutions continue to uphold allegiance to an apartheid legacy.

The Northern Cape province in South Africa is not excluded from the abovementioned developments. In the Northern Cape province of South Africa, where the research reported in this chapter was conducted, the white teacher component represents the overwhelming majority, while the black educator component constitutes the minority of the overall teaching component in HWSs (Northern Cape Department of Education, EMIS, 2020). Although the racial composition of learners was changing due to learner migration, the teaching staff in the previously racially homogenic schools (HWSs), remained overwhelmingly unaltered (Fiske & Ladd, 2004; Pathlane, 2017). However, failure by HWSs to maintain a healthy balance between enculturation, acculturation and de-culturation may prove to be confusing to the black learner. This confusion may in turn hamper the development of a positive social identity formation for the black learner, (Ntuli, 1998; Kieran & Anderson, 2019). November (2010) argues that transforming an education

system means encouraging citizens to be critical, so that they are able to function within a democratic society. Sayed (2004) and November (2010) advance similar arguments, and support the view that schools should be prepared to understand and function in multicultural classroom settings that operate according to the values and ideals of a democratic South Africa. A racially diverse teaching staff is invaluable for transformation, as well as a school culture which reflects healthy human relations and social interactions between teachers and learners, and amongst learners.

In conclusion, one can deduct from this background that all citizens and multicultural schools in South Africa have a crucial role to fulfil in developing the social identity of all learners.

3. OBJECTIVE OF THE CHAPTER

This chapter explores the issues influencing the social identity formation of black learners attending multicultural schools, more specifically HWSs in the Northern Cape province of South Africa. The authors report on aspects relating to social identity formation, which was one of the components of an extensive doctoral study questionnaire completed by black learners enrolled at HWSs in the Northern Cape province of South Africa. The objective of this chapter is not to deride race relations in HWSs, but to extrapolate the findings of this small-scale study to historically black, coloured and Indian schools, based on 10 selected items from an extensive questionnaire used for a doctoral study. The aforementioned schools are also open to all race groups, hence future research of the phenomenon, as it presents itself in HWSs, may assist the authors in acquiring rich and in-depth understanding of issues associated with learners' social identity at these institutions.

4. RESEARCH METHODOLOGY

This section provides a synthesis of the methodology, presentation, and discussions of findings on the 10 selected items, which were part of an extensive questionnaire used for a doctoral study conducted with 832 black learners (grades 10-12) from 27 HWSs in the five educational districts of the Northern Cape province. This research was based on the probability sampling method, in which stratified random sampling was employed. A self-designed, four-point Likert scale questionnaire distributed to 269 white teachers and 832 black learners, probed aspects pertaining to characteristics, issues and challenges that both learners and educators are confronted with, as well as the scholastic experiences of black learners in multicultural high schools in the Northern Cape. For the purpose of this chapter, the authors report on the data component of one aspect of the extensive questionnaire, namely the social identity formation of black learners attending HWSs in the Northern Cape province of South Africa (see table 1). In other words, the authors used a data segment confined to the social identity formation of black learners. Permission to conduct the empirical study was sought from the Northern Cape Education Department, school principals and learners of these specific schools. The methodology, presentation of data and discussion of findings therefore present a snapshot of a certain part (10 items) of the questionnaire which has bearing on the social identity formation of black learners in HWS contexts (see table 1 below).

Table 1.
Summary of learners' responses in relation to questions about social identity formation in HWS contexts.

Questions	χ² Value	p-value	Strongly Agree	Agree	Disagree	Strongly Disagree
			%	%	%	%
1. I experienced no difficulty in adapting to my school.	1	0.486	41.8	40.3	13.5	4.4
2. In our school, all learners, irrespective of their cultural background, are treated the same.	1	0.565	27.5	38.2	25.8	8.5
3. Enrolling black learners in former white schools has led to a drop in standards.	1	0.477	15.1	33.7	32.8	18.4
4. Educators have higher academic expectations of white learners than of black learners	1	0.523	25.7	28.8	26.7	18.8
5. Black learners tend to be more withdrawn than white learners during group work and other class activities.	1	0.524	20.0	30.5	32.9	16.6
6. The failure and drop-out rate tend to be higher among black learners than white learners.	1	0.539	27.8	36.4	22.9	12.9
7. I am more comfortable to be taught by educators belonging to my own culture.	1	0.489	18.5	42.6	20.5	18.4
8. I sometimes experience conflict between what I am taught at school and what I am taught at home.	1	0.475	18.6	42.5	23.3	15.6
9. My friends who are not attending historically white schools still accept me as a friend and have not changed their attitude towards me.	1	0.623	57.8	31.6	7.2	3.4
10. If I could choose, I would prefer to attend a historically black school.	1	0.518	18.0	16.5	29.1	36.4

Note: The difference is statistically significant if P < 0.05

In terms of the demographic data of the learner participants, the majority (54%) of learners in multicultural FET (grades 10-12) schools in the Northern Cape were female, whilst 45.9% of the learners were males. With regards to race, most (57.5%) of the learners were coloured, 36.5% were black and only 4.8% and 1.2% were other and Indian respectively. The majority (64.0%) of the learner participants' home language was Afrikaans, followed by English (10.0%). Most of the learners (39.1%) were living in historically coloured areas. A total of 21.2% of learner participants resided in the vicinity of their school, 20.8% resided in townships, 18.3% lived in historically white areas, and 0.6% in former Indian areas.

Most of the learners (82.1%) indicated that they had no difficulty in adapting at their school – this is contrary to views held by Cross and Mkwanazi-Twala (1998), who opine that black learners' social identity formation is adversely affected because of the difficulties they experience in adapting to the historically black school context. The fact that learners indicated equitable treatment, in spite of their cultural background, may bode well for the social identity formation and enhancement of these learners. This finding concurs with that of other researchers, such as Kieran and Anderson (2019), who state that all learners should be treated equally, while still considering their diverse background. The latter authors further highlight the potential influence and negative perceptions held towards certain cultural groups at schools, as these may influence the social identity formation of learners. The cultural background of all learners is an important consideration in the teaching and learning process (Conklin, 2015). Learner participants (50.5%) seemed to concur with the literature in that they believed that black learners tended to be more withdrawn than white learners in class. HWSs dealt with integration in a manner that has been characterised by asymmetry, in which white people are the bearers of preferred knowledge and blacks, by contrast, as the embodiment of inferior understanding of the world (McKinney, 2010). This state of affairs is hardly conducive for the formation of a positive identity. A total of 54.5% of learner participants indicated that their educators held higher academic expectations for white learners and that the failure and drop-out rates tended to be higher amongst black learners – this according to 64.2% of learners. These findings concur with the recent foregrounding of social justice and equity in educational discourse (Cho, 2017; Arsal, 2019). To this effect, Świdzińska (2019) advises that teachers could assist learners by understanding their culture and supporting them in adapting to their new environment. Scholars in the field, such as Mampane (2019), found that when teachers understand the culture of learners, learners experience a sense of belonging. The majority (61.1%) of learners indicated that they were more comfortable to be taught by educators belonging to their own culture. An overwhelming percentage of black learners experienced conflict between what they were taught at school and home, respectively. These findings echo the sentiments of Erasmus and Ferreira (2002). They argue that children cannot be treated as learners in the normal sense without considering their immediate background and family history, as well as the impact of these factors on their reaction to the learning environment. Moosa (2018) supports this notion by insisting that the aim of initial teacher education (ITE) programmes is to prepare student teachers to teach efficiently in diverse school settings.

In conclusion, although the literature suggests rejection of black learners by their peers who attend township schools, the findings revealed the contrary. Correspondingly, the findings of the study dispute the argument presented by Erasmus and Ferreira (2002) who postulate that, when given a choice of schools, black learners would choose a school where all race groups are equally represented. The findings suggest that the majority (65.5%) of black learners prefer attending HWSs.

5. LIMITATIONS OF THE STUDY

The sample only included white teachers teaching in HWSs in the five education districts of the Northern Cape, and the situation in relation to social identity formation may differ in other provinces of South Africa. The chapter, which forms part of a broader PhD study, only focused on the perceptions of black learners in HWSs and not on the perceptions of learners of other racial identities.

6. FUTURE RESEARCH DIRECTIONS

- The implementation and monitoring of cultural awareness programmes that permit learners to learn about their classmates' cultures and practices in less-threatening spaces should be promoted in HWSs. In these settings, learners can interact with one another and learn about each other's cultures, languages, traditions and heritage.

- Teachers in HWSs need to embark on a journey of self-transformation towards effectively teaching diverse and inclusive classes. Teacher self-transformation is cardinal in advocating for social justice and equity in multicultural school settings. The development of learners' social identities can be improved and advanced if teachers, the school management team, and the parent community make a concerted effort to effectively respond to and eradicate various forms of subtle and institutionalised racism, biases, prejudices, discrimination and stereotypes. Culturally Responsive Teaching could be used as a tool to connect learners' cultures, languages, life experiences and world views with what they learn and are taught in multicultural school settings, such as HWSs.

- In terms of pre-service teacher training, consideration by education authorities should be given to empower future teachers in dealing effectively with diverse classroom dynamics in HWSs. Pre-service teacher trainers should model, by means of practical examples, how social justice, equity and inclusive practices could be applied in the classroom during lesson presentation. Through certain life skills training/education initiatives, certain competencies (intercultural communication, interpersonal skills, decision making, problem solving, conflict management, critical and creative thinking, constructive relationships, and health promotion) could possibly be directed at developing learners' social identity. The findings suggest the need for further investigation into the reasons why there is a lack of proportionate representation (appointed of black teachers) in the HWS settings of South Africa.

7. CONCLUSION

In conclusion, this chapter was meant to examine the complexity of social identity formation of black learners attending HWSs in the Northern Cape province of South Africa. Findings from the literature and empirical investigation indicated that some situational experiences encountered by black learners at these schools may well curtail the development a positive social identity formation. The display of adverse effects, such as general adaptational challenges, unreceptive and unkind teacher behaviour influence the social identity formation of black learners. Teachers are inherently responsible for assisting learners in developing or enhancing their social identities. Hence, it is crucial that the

critical pedagogical imperatives, such as low educator expectations (of black learners), the disjuncture between home and school education, as well as mitigating the high failure and drop-out rate, be addressed, both in teacher education and continuous professional teacher development programmes. While most studies on social identity formation provide the perspective of education planners and administrators, this study focused on the perspective of the learner. This implies that teachers teaching black learners in HWSs should be cognisant of the aspects impacting on their learners' identity formation in future.

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Section 2
Teaching and Learning

Chapter #8

LEARNING NON-EUCLIDEAN GEOMETRIES: IMPACT EVALUATION ON ITALIAN HIGH-SCHOOL STUDENTS REGARDING THE GEOMETRIC THINKING ACCORDING TO THE VAN HIELE THEORY

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ABSTRACT

This paper aims to explore the impact of a non-Euclidean geometry course on Italian high-school students regarding the assessmentof geometric thinking. To accomplish this, we analyse the results of the van Hiele levels test. We slightly modified and translated to Italian the van Hiele test, originally designed by Usiskin, and we used it to detect possible changes of the students' levels of geometric thinking after we taught a non-Euclidean geometries course of our design. The students involved in the test (N=56) span ages 15-18 and all attend the "Liceo Scientifico" high school type. The results show that there is a statistically significant (p-value < 0.05) improvement in the median level of understanding in geometry if we consider the so-called modified van Hiele theory. Since we observe this improvement only for classes with an entering van Hiele level of at least 3, we suggest our non-Euclidean geometry course only for these classes of students, regardless of the grade.

Keywords: non-Euclidean geometries, geometric thinking, van Hiele theory, high school.

1. INTRODUCTION

Geometry is an essential part of the education of secondary school students and it usually focuses on the Euclidean geometry. The study presented hereby is part of a broader project on the teaching and learning of non-Euclidean geometry at Italian high school (Benvenuti & Cardinali, 2018) (Cardinali & Benvenuti, 2020) which deals specifically with "Liceo Scientifico", one of the most common and long-lived high-school types. Such curriculum provides the student, along with several human-related subjects, a broad vision of past and present human knowledge. Specifically, it provides analytic means to shape the student's ability to understand scientific knowledge, the progress of scientific thought and all the tools to develop an open mind for scientific studies if enrolled in a university program. Current "Liceo Scientifico" national recommendations introduced in 2010 (MIUR, 1996) suggest that the student should be able – at the end of her/his studies – to understand the historical context of several mathematical theories and their conceptual meaning. The recommendations also suggest "a clear vision of the axiomatic approach in its modern conception and of its specificity with respect to the classic Euclidean approach". To achieve this goal, we believe that the teaching of non-Euclidean geometry is useful, if not indispensable. In fact, as stated in (Magnani, 1978), non-Euclidean geometries are a fundamental link in the transition from classical to modern Mathematics. Furthermore, concerning non-Euclidean geometry, Toth writes that without it, the development of so-called modern mathematics would be hardly conceivable (Toth, 2003), Zheng discusses how it bears on problems of the nature of mathematical truth and modes of thought (Zheng,

1992), Kline refers to its creation as "the most consequential and revolutionary step in mathematics since Greek times" (Kline, 1972, p. 879). Despite this, the current Italian recommendations do not include teaching of non-Euclidean geometry among the suggested topics. For this reason, the study we have conducted on the impact of an elementary non-Euclidean geometries course for high-school students is of an experimental type.

The goal of this work is to assess the impact of a short non-Euclidean geometry course on the development of geometric thinking according to the van Hiele theory. To reach that goal, we designed an elementary non-Euclidean course which we provided to high-school students, and we evaluated its impact by means of the van Hiele test formulated by Usiskin in (Usiskin, 1982). The test was translated to Italian and, as a slight modification to the original test, we clarified in the items, when necessary, that the question was referred to a Euclidean plane. The test was provided before and after the course, to assess the initial van Hiele geometry levels of the students, and to compare these with the final ones.

1.1. The van Hiele Model

The van Hiele model is a theory that describes how students reason, when solving geometrical problems or working with geometrical elements (e.g. definitions, classifications). A husband-and-wife team of educators, Pierre van Hiele and Dina van Hiele-Geldof, developed it in their thesis at the University of Utrecht in 1957 (Usiskin, 1982). They postulated five levels of thought in geometry, each level indicates how individuals think over geometrical concepts. Hoffer summarizes – and Usiskin proposes again – general descriptions of the van Hiele's levels as follows (Usiskin, 1982) (Hoffer, 1979) (Hoffer, 1981):

Level 1 (recognition): the student can learn names of figures and recognizes a shape as a whole (e.g.: squares and rectangles seem to be different).

Level 2 (analysis): the student can identify properties of figures (e.g.: rectangles have four right angles).

Level 3 (order): the student can logically order figures and relationships but does not operate within a mathematical system (e.g.: simple deduction can be followed, but proof is not understood).

Level 4 (deduction): the student understands the significance of deduction and the roles of postulates, theorems, and proof (e.g.: proofs can be written with understanding).

Level 5 (rigor): the student understands the necessity for rigor and can make abstract deductions (e.g.: non-Euclidean geometry can be understood).

Like Usiskin, we point out that van Hiele number these levels 0 through 4, not 1 through 5. Moreover, Dina van Hiele-Geldof associates different names to the levels with respect to the levels 2 through 5 indicated above: "the aspect of geometry" (level 2), "the essence of geometry" (level 3), "insight into the theory of geometry" (level 4), and "scientific insight into geometry" (level 5) (Hiele-Geldof, 1957).

Pierre M. van Hiele identifies four properties of the levels (Van Hiele, 1958-59), to which Usiskin assigned names (Usiskin, 1982):

Property 1 (fixed sequence): a student cannot be at van Hiele level n without having gone through level $n–1$.

Property 2 (adjacency): at each level of thought what was intrinsic in the preceding level becomes extrinsic in the current level.

Property 3 (distinction): each level has its own linguistic symbols and its own network of relationships connecting those symbols.

Property 4 (separation): two persons who reason at different levels cannot understand each other.

The van Hiele theory explains – and Usiskin's study confirms – why many students have troubles learning and performing in geometry classes: the weak performances of many students are often associated with being at a lower van Hiele level with respect to the level of the teaching.

1.2. Usiskin's van Hiele test

Usiskin designed a test ("van Hiele test") to detect the level of thought in geometry according to the van Hiele theory (Usiskin, 1982). There are 25 questions, 5 questions for each level.

There are two criteria to assess if a student satisfies a certain level ("fits"): the "3 of 5 criterion" and the "4 of 5 criterion". The first one considers the level as passed if the student answers correctly to at least 3 of the 5 questions of that level. The second one, called "strict criterion", considers the level passed only if the student answers correctly to at least 4 of the 5 questions of that level. Usiskin suggests that the choice of the criterion is done based on the wish to reduce Type I (false positive) or Type II error (false negative).

Usiskin observed that sometimes level 5 items turned out to be easier for students than items at levels 4 or even 3, and that the reliability of the test for the fifth level is discussed. For these reasons, Usiskin considers two different theories: the classical one and the modified one. The so-called modified theory differs from the classical one for the fact that level 5 is not considered. Thus, for example, if a student satisfies (according to a certain criterion) level 1, 2, 3, and 5 (but not level 4), he/she is classifiable only under the modified theory. Specifically, the student fits level 3 of the modified theory. The assigning of levels in either the classical or modified case requires that the student at level n satisfy the criterion not only at that level but also at all preceding levels (Usiskin, 1982).

2. MATERIALS AND METHODS

2.1. Participants

Currently, non-Euclidean geometries are not considered by Italian high-school guidelines, therefore their teaching is not compulsory. To ensure a collaboration with teachers, we proposed our course to high-school teachers that had already expressed their interest in conducting a course in non-Euclidean geometry.

The high schools involved were two "Liceo Scientifico" high school type. Several curricula of "Liceo Scientifico" exist. One of the four classes that took part in the study follows the traditional curriculum of the "Liceo Scientifico" already discussed in the introduction, two classes are involved in the "Scienze Applicate" (Applied Sciences) curriculum, while another one is involved in the "Cambridge International" curriculum. "Scienze Applicate" curriculum renounces some of the aspects of humanistic culture, those linked to the study of Latin classicism, in favor of more scientific oriented programmes. The "Cambridge International" curriculum allows to learn the English language at high levels of competence by supporting the English teacher with a native speaker, and teaching two disciplines, generally of a scientific nature, in two languages. In their first two years all the curricula of "Liceo Scientifico" deal with the study of Euclidean geometry from the axiomatic point of view.

Students from two classes for each school took part in the project. Specifically, 18 students from a second-grade class, 25 students from a third-grade class, and two sets of students from two fifth-grade classes (a set of 10 students and the other set made of 24 students). No one of the students had learning disabilities identified.

Table 1.
Subjects involved in the study.

	Set 1 (II SA class)	Set 2 (III CI class)	Set 3 (V SA class)	Set 4 (V LS class)
High school	Liceo Scientifico School A	Liceo Scientifico School A	Liceo Scientifico School B	Liceo Scientifico School B
Curriculum	"Scienze Applicate"	"Cambridge International"	"Scienze Applicate"	No special curriculum
Students	Students from a single II grade class	Students from a single III grade class	Students from a single V grade class	Students from a single V grade class
Number of students who attended the course	18	25	10	24
Number of subjects *	14	20	8	14

*Students who attended the course and answered all the questionnaires

The inconveniences created by the Covid-19 pandemic reduced the number of classes involved in the study and forced us to conduct the course outside school hours. To avoid dispersion, the teachers strongly encouraged their students to attend the course and demanded from them to justify their eventual inability to participate (i.e. students who practice sport at a competitive level have mandatory afternoon workouts and have therefore been justified).

Table 1 shows data on the subjects involved in the study. Note that the number of subjects involved is minor that the total number of students who attended the course. This because we consider as subject of our study only those students who attended the course and answered not only to the van Hiele test but to all the questionnaires planned for our main research.

2.2. Class activities

The course consisted of five two-hours sessions, a session every week. It was conducted between mid-October and the end of November 2020 (during the Covid-19 pandemic), after school hours, by the first author. The restrictions imposed by the anti-pandemic plan forced us to conduct the course in online mode (we used the software "Cisco Webex Meetings"). We chose to conduct the course in synchronous mode because all students involved in our study were used to this lesson mode. The alternative could have been to conduct asynchronously a part of the course, using podcasts, with the flipped classroom method. We did not choose this method because it was not a well-known and common practice among all groups of students. Moreover, the synchronous mode allowed us to have immediate feedbacks on the topics covered from the students. Nevertheless, it would be interesting to re-propose our study using the flipped classroom mode. The better mode to conduct our course – we believe – is the one in presence. In this case, we also suggest conducting the activity on the Poincaré disk model in group work mode.

Before starting the course, we ensured that all students had the necessary materials for the workshops. Among these, the following material: polystyrene hemispheres that can be written with markers or pinned; sewing cotton and pins to draw straight lines on the polystyrene hemispheres; rulers; protractor; and compass. The teacher (the first author) was provided with the same materials as the students and more: a globe; a tiny toy car with no steering; 3D-printed hemispheres, pseudospheres and flexible ruler. All the material used in the workshops is shown in Figure 1.

Figure 1.
Some material used for class activities.

The activities proposed to the students were planned as shown in Table 2. Five meetings of two hours each, beginning with an interactive session whose main objective was to understand what a circle and a straight line look like on a spherical surface, during this session we also deal with the definitions of segment, angle, polygon, and triangle on a spherical surface. At the beginning of the second session, the teacher of the course assigned the students to groups based on their results at the pre-test, in such a way as to minimize the chance that high ability students will huddle together leaving others out. Each group was of four students, exception for some groups of three students. The teacher also created a virtual room for each group on the Cisco Webex platform, virtual rooms in which she could log into to monitor the work of the groups. During the second session, the students, divided into groups, tried their hand at tasks to be carried out on polystyrene hemispheres. These tasks allowed each student to explore the spherical surface and to observe that there exist geometric figures' properties that hold on a plane surface while they do not hold on a spherical surface. We deduced that we were dealing with a geometry different from the one we already knew (the Euclidean geometry). The third session revolved around the following question: "Why, are there geometric figures' properties that hold on a plane surface and that does not hold on a spherical surface, and vice versa?". We refreshed the basic elements of the Euclidean geometry and discussed on the eventual validity of the five postulates of Euclid on a spherical surface. We observed that there are interpretations that allow us to consider the five postulates, formulated by Euclid, also valid in spherical geometry (Carroll & Rykken, 2018). Afterward, we analysed the Proposition 31 of the first Book of the Euclid's *Elements* ("Through a given point to draw a straight line parallel to a given straight line"), and its proof that relies on Proposition 16 (*Exterior Angle Theorem*). We understood that there is a flaw in the proof of Proposition 31. This led the teacher to mention the Hilbert formalization of Euclidean geometry (specifically, the third axiom of

order and the axiom of parallel), and the meaning of consistency, completeness, and independence of an axiomatic system. Connecting to the concept of independence of an axiomatic system, the fourth session focused on the controversy surrounding Euclid's fifth postulate, on the birth of the hyperbolic geometry, and on the importance of having models for an axiomatic system. The teacher used a 3D-printing models of pseudospheres to show geometric figures' properties that hold on a plane surface but that does not hold on a pseudosphere and vice versa. The fourth session ended with a discussion on the loss of meaning of the question "Which geometry is the true one?", and contextualizing non-Euclidean geometries from an application point of view (linking e.g. to relativity in physics or the global positioning system in engineering). Finally, the last meeting consisted of a workshop on the Poincaré disk model and on a final discussion to resume the all course. The aim of the workshop on the Poincaré disk model was to let the students become more familiar with hyperbolic geometry, understand that there can be more than a model for a geometry, and avoid the misconception of identifying a geometry with one of its models.

Table 2.
Plan of the class activities.

	Topic	Working format (online)
I session (2 hours)	Circle, straight lines, segments, angles, polygons on a spherical surface	Frontal-dialogue lesson/ Workshop
II session (2 hours)	Constructions on a spherical surface	Group work
III session (2 hours)	Euclidean geometry and the eventual validity on a spherical surface of the five postulates formulated by Euclid	Frontal-dialogue lesson
	Euclid's flaw on Proposition I.16 and mention to the Hilbert formalization of Euclidean geometry	
	Introduction to the meaning of consistency, completeness, and independence of an axiomatic system	
IV session (2 hours)	The independence of the fifth postulate of Euclid	Frontal-dialogue lesson
	Hyperbolic geometry	
	Models for an axiomatic system	
	"Which geometry is the true one?"	
V session (2 hours)	Poincaré disk model	Workshop with "NonEuclid" software
	Final discussion	Frontal-dialogue lesson

2.3. Data collection

As discussed above, we used the van Hiele test to assesses the students' levels of geometric thinking according to the van Hiele theory. The test was translated to Italian and one clarification was added to some items. Specifically, some questions now clarify that they refer to the Euclidean plane, to avoid confusion with other non-Euclidean surfaces that the students encountered in our course.

We distributed the tests (pre-test and post-test) via Google Form. We clarified with the students that: only the researchers involved in the study would see their answers; there would be no evaluation; the researchers involved in the study could contact them to discuss their answers.

3. RESULTS

In the present section, we report results regarding the van Hiele levels detected by the van Hiele test before and after the class activities on non-Euclidean geometries, Since, to the best of our knowledge, there are no studies similar to ours, we do not have a comparative term for the effect sizes of our interventions. Nevertheless, we will report the effect sizes because it could be useful for future studies. Indeed, like observed in (Bakker, Cai, English, Kaiser, & Mesa, 2019), findings on effect size should be related to "comparable studies with similar characteristics (research design, sample size, type of measurement, type of variable influenced, etc.)" in terms of "smaller/larger than typical under such conditions," or "comparable with other studies with similar characteristics (research design, alignment between intervention and assessment, sample size, type of variable influenced etc.)".In the next subsection we report results that answer the following question:

Q1. How are students distributed before the class activities on non-Euclidean geometries with respect to the levels detected by the van Hiele test?

Q2. How are students distributed after the class activities on non-Euclidean geometries with respect to the levels detected by the van Hiele test?

We answer the two previous questions considering: case 1) all the 56 students who answered to all the four questionnaires involved by the experimentation, before and after the course; case 2) only the students who fit the classical van Hiele theory both in the pre-test and in the both-test; and case 3) only the students who fit the modified van Hiele theory both in the pre-test and in the both-test. Each of the previous three cases are divided in two subcases: the 3 of 5 criterion and the 4 of 5 criterion. For cases 2) and 3) we state if the differences between the post-test and the pre-test are significative and we report the effect sizes of the non-Euclidean activities on the levels detected by the van Hiele test. For case 1 we cannot report the effect size or whether the difference is significative because there are students that do not fit any van Hiele level in the pre-test or in the post-test or in both the tests.

As stated in (Usiskin, 1969) regarding his van Hiele test, for what concern the reliability, the van Hiele test is considered as 5-item tests. The computed Cronbach's α for the five parts in the pre-test are 0.44, 0.54, 0.56, -0.13, and 0.67, while in the post-test the computed Cronbach's α are 0.58, 0.61, 0.78, 0.52, and 0.39. We observe, as done by Usiskin, that one reason for the low reliabilities is the small number of items; similar tests at each level 20 items long would have the following Cronbach's α: 0.89, 0.91, 0.92, 0.79, and 0.94 in the pre-test, while 0.92, 0.92, 0.96, 0.90, and 0.91 in the post-test.

3.1. Results regarding students who answered to all the questionnaires foreseen by the experimentation (case 1)

The graphs in Figure 2 show the students' distribution with respect to the levels detected by the van Hiele test. All the 56 students who answered to all the questionnaires foreseen by the experimentation are included. Analysing the pre-test, we see that – according to the 3 of 5 criterion and the 4 of 5 criterion, respectively – roughly 23% and 27% of students do not fit the classical theory, while roughly 11% and 12% of students do not fit the modified theory. Analysing the post-test, we see that – according to the 3 of 5 criterion and the 4 of 5 criterion, respectively – roughly 23% and 27% of students do not fit the classical van Hiele level, while roughly the 21% and 4% of students do not fit the modified theory.

3.2. Results regarding students who fit the classical theory both in the pre-test and in the post-test (case 2)

We answer question Q1 and question Q2 written at the beginning of the present section considering only students who, according to Usiskin (Usiskin, 1982), fit the classical theory, both in the pre-test and in the post-test.

Figure 2.
Distribution of the 56 students with respect to the levels detected by the van Hiele.
(a) Classical theory - 3 of 5 criterion; (b) Classical theory - 4 of 5 criterion;
(c) Modified theory - 3 of 5 criterion; (d) Modified theory - 4 of 5 criterion.
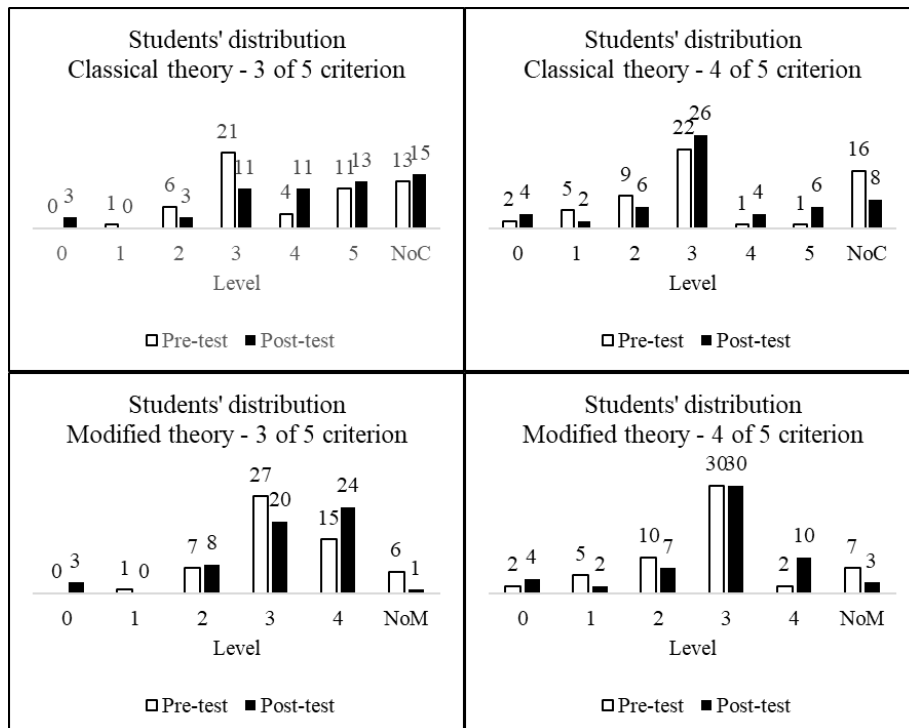
For the 3 of 5 criterion, the mean levels are 3.45 (standard deviation: 1.18) and 3.76 (standard deviation: 1.35), respectively in the pre-test and in the post test. For the 4 of 5 criterion, the mean levels are 2.43 (standard deviation: 1.01) and 2.71 (standard deviation: 1.25), respectively in the pre-test and in the post test. In both cases (3 of 5 criterion and 4 of 5 criterion), the levels for the post-test seem to be, on average, slightly higher than the ones for the pre-test but the difference is not statistically significant. Indeed, we conducted the Wilcoxon Signed-Rank test to understand whether reject the following hypothesis h_0: "the median level before and after the workshop is identical" and its results does not allow us to reject the null hypothesis with a high confidence (p-value > 0.05). We also computed the effect size for each case: the Cohen's d computed value is 0.24 in the case of the 3 of 5 criterion, while it is 0.25 in the case of the 4 of 5 criterion.

3.3. Results regarding students who fit the modified theory both in the pre-test and in the post-test (case 3)

We answer question Q1 and question Q2 written at the beginning of the present section considering only students who, according to Usiskin (Usiskin, 1982), fit the modified theory (i.e., the theory if level 5 is removed from consideration), in both the pre-test and the post-test.

Figure 3.

(a) Changes on the average levels for each group of students (modified theory - 4 of 5 criterion); (b) Number of students who shift from a van Hiele level in the pre-test to another one in the post-test (modified theory - 4 of 5 criterion).
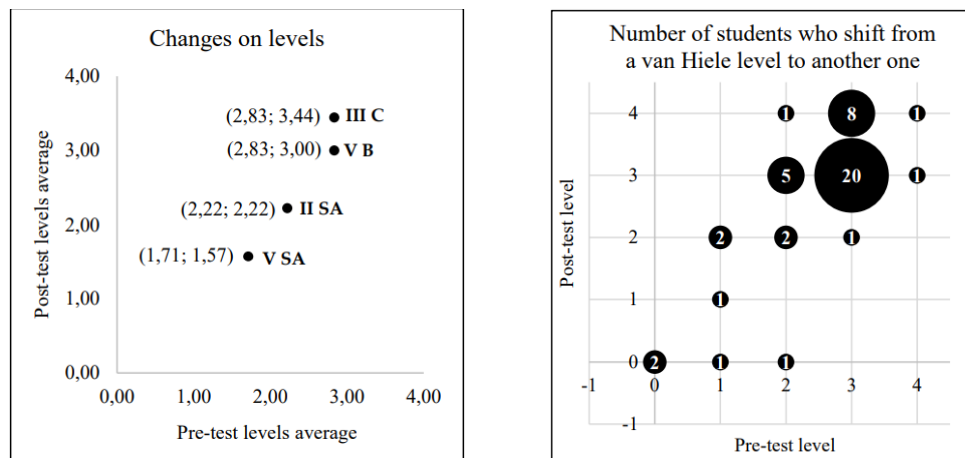
For the 3 of 5 criterion, the mean levels are 3.12 (standard deviation: 0.73) and 3.22 (standard deviation: 0.98), respectively in the pre-test and in the post test. The levels for the post-test seem to be, on average, slightly higher than the one for the pre-test but the difference is not statistically significant: the Wilcoxon Signed-Rank test we conducted does not allow us to reject the null hypothesis h_0 (h_0: "the median level before and after the workshop is identical") with a high confidence as p-value < 0.05 (p-value = 0.36). The Cohen's *d effect size* we computed is 0.12.

For the 4 of 5 criterion, the mean levels are 2.54 (standard deviation: 0.89) and 2.80 (standard deviation 1.09), respectively in the pre-test and in the post test. The level for the post-test is, on average, higher than the one for the pre-test and the Wilcoxon Signed-Rank

test we conducted let us conclude the difference is statistically significant (p-value < 0.05) so we can reject the null hypothesis h_0 (h_0: "the median level before and after the workshop is identical") with a high confidence as p-value < 0.05: p-value = 0.03. In this case, the Cohen's *d effect size* is 0.26.

Since the changes in last case (modified theory - 4 of 5 criterion) are the ones with the highest effect size and since changes are statistically significant, we give some more quantitative details on it.

We show in Figure 3a the changes between the average levels resulted from the pre-test and the ones from the post-test for each set of students (II SA: 9 students; III CI: 18 students; V SA: 7 students; V SC: 12 students). Changes are positive only for those classes whose starting level is roughly 3, these classes are V SC and III CI. The Wilcoxon Signed-Rank test we conducted let us conclude the change regarding set III C is statistically significant (p-value < 0.01). Set V SA worsen it result while group II SA does not change its average. We can conclude that changes do not depend on the grade but on the starting level of thought in geometry.

Figure 3b shows in detail how many students improve, worsen, or do not change their level of thought in geometry (according to the modified theory – 4 of 5 criterion). About the 34,8% of students improves, about the 8.7% of students worsens and about the 65.2% of students does not change their level.

4. DISCUSSION

From the gathered results we observe (Figure 3a), that changes do not depend on the grade whereas it depends on the starting level of thought in geometry. This should let us conclude that the class activities on non-Euclidean geometries - at least in the way we designed them - should be conducted after having tested students' level of thought in geometry. Non-Euclidean geometry seminars in Italy are often conducted with V grade students (the last grade before university), assuming that their level of thought is high enough to learn non-Euclidean geometries. However, this seems to be not necessarily the case. On the other hand, we have seen that the set of students from III grade class involved in our study have sufficient abstraction level to learn basic concept of non-Euclidean geometries and correctly express concepts of axiomatic geometry. Considering this, we may recommend conducting non-Euclidean geometry seminars only to classes that have a high overall geometry thought, at least 3 according to the van Hiele test. This may reduce the applicability of our method since, previous study show that many students do not reach level 3. As an example, in a recent Czech study (Haviger & Vojkůvková, 2015), the number of students reaching level 3 on a sample of 215 students was 39%. The same result was achieved by Usiskin (Usiskin, 1982) in the USA. It must be noticed that our study is aimed at "Liceo Scientifico" high school, therefore our data cannot be directly compared to the Czech study, where three types of high school are addressed but no disaggregate data is given.

5. CONCLUSION

We hereby reported results from an experimental evaluation of the impact of a non-Euclidean geometry course for different classes and starting with different knowledge levels. We described the method, which was adapted to synchronous online teaching due to the restrictions imposed by the anti-pandemic plan and discussed the changes on the student's levels of thought in geometry. We detected these changes analysing the van Hiele

test filled out by the students before and after the non-Euclidean geometries course. Results were reported, showing that the course had an impact depending on the students' abilities, rather than their grade. Assessing their level with the van Hiele test is, therefore, a necessary step, should this course – or similar other non-Euclidean geometry courses – be taught in school.

The extent of our analysis has been somewhat limited by the rise of the Covid-19 pandemic. The inconveniences it created forced some teachers, who already got engaged in the study, to give up on participating. Therefore, the number of subjects involved in our study dropped dramatically. The results collected in this work should be extended in the future by repeating the experiments on a larger statistical base.

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Chapter #9

FACTORS INFLUENCING THE PHYSICAL SCIENCES PRE-SERVICE TEACHER'S PEDAGOGICAL ORIENTATIONS IN ONE OF THE UNIVERSITIES IN SOUTH AFRICA

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ABSTRACT
To effectively teach sciences, science teachers require content knowledge of the science subject and know how to teach such content better. The purpose of this paper was to determine factors influencing the Physical Science pre-service teachers' pedagogical orientations. Orientations refer to teachers' knowledge and beliefs about teaching science at a particular grade level. Pedagogical orientations are classified into two approaches: direct approaches and inquiry approaches. A mixed-method approach was adopted, where a quantitative method was used to determine Physical Science pre-service teachers' pedagogical orientations and a qualitative method was used to establish factors influencing their pedagogical orientations. A questionnaire of ten items was administered to forty-five final year Physical Sciences pre-service teachers, and they were requested to select the most appropriate pedagogical orientation and then justify their choices. The questionnaire justifications and interviews were used to generate themes. This study's findings indicate that Physical Sciences pre-service teachers' preferred pedagogical orientations were between Direct Active and Guided Inquiry, and factors influencing their pedagogical orientations were: school resources, class size and teaching time.

Keywords: pedagogical orientation, pre-service teachers, inquiry-based learning.

1. INTRODUCTION

South African universities attract most student-teacher cohorts from impoverished schools, mostly in townships or rural areas. In their first year at university, these student teachers bring along images about teaching construed from their previous secondary school teachers. Their images of teaching sciences do not encompass learning through inquiry and are often teacher-centred (Cross & Ndofirepi 2013), while the modern science teaching standards worldwide require teachers to change their ways of teaching to include learner-based activities (National Research Council, 2011). It was found that in-service and pre-service teachers face critical challenges in aligning their classroom practices with the standards of scientific inquiry since such reform-based classroom practices require professional skills, knowledge and pedagogical content knowledge (PCK) (Gess-Newsome, 2015; Harris & Rooks, 2010). Therefore, pre-service teachers at university need to know how to translate such content to benefit learners at school. Furthermore, in-service and pre-service teachers do not always translate their teaching science beliefs into their science teaching practice due to factors influencing their teaching (Friedrichsen & Dana, 2003).

These factors dishearten teachers from teaching sciences using inquiry-based learning methods, which can be grouped into intrinsic and extrinsic factors.

Bronfenbrenner's ecological theory of development (1979) explains the influences of extrinsic and intrinsic factors. Extrinsic factors are contextual aspects comprised of the physical, social and cultural features of immediate settings in which people live. The commonly cited contextual factors include lack of resources, school culture, classroom management and content coverage (Ramnarain, Nampota, & Schuster, 2016; Lewthwaite, 2006). Intrinsic factors represent the individual aspect and are associated with personal attribute factors such as science teaching efficacy, professional science knowledge, science teaching interest and motivation, and teacher content knowledge (Ramnarain et al., 2016; Lewthwaite, 2006). This paper focuses on extrinsic factors influencing the pedagogical orientations of Physical Sciences pre-service teachers since they are perceived as common factors and are easier to diagnose than intrinsic factors. There are various empirical studies about factors influencing in-service teachers. The most cited factors from the literature include teacher's beliefs about learners and learning, prior work experiences, time constraints, classroom context, professional development, class size, availability of resources, teacher competence and confidence, student ability, school culture, parents' expectations and IBL requirements (Ramnarain & Schuster, 2014; Volkman, Abell, & Zgagacz, 2005; Friedrichsen & Dana, 2005). Even though South African teachers grapple with some of the factors mentioned above at school, the newly designed curriculum demands them to adopt learner-centred teaching pedagogies, irrespective of their diverse culture and context.

2. DIVERSE SCHOOLS IN SOUTH AFRICA AND INQUIRY PRACTICE

Since the dawn of democracy in South Africa, the educational system has experienced several changes to redress the previous government's wrongdoings concerning education to promote and provide quality education to all citizens. The school curriculum was changed to make it relevant, address skill shortages, and mirror education that exposes the needs of South African citizens (Mouton, Louw, & Strydom, 2012). However, the changes failed to consider issues of diversity, which contributed to curriculum reform implementation problems, and these disadvantaged schools were situated in the township and rural areas (Rogan & Grayson, 2003). As mentioned before, South Africa is a diverse country in terms of school context and culture compared to other countries worldwide. Some schools are located in the most affluent areas, and these schools have all the resources to aid learning. Some schools are located in the most impoverished areas without proper infrastructure and learning resources. To address the issue of diversity and inequality, the South African Department of Basic Education categorised the schools into five groups, known as quintiles. Public schools in South Africa are grouped under quintile one, two and three, which are comprised of 60% of the schools, while the remaining 40% are the elite schools that fall under quintiles four and five. Quintile one to three schools has a higher teacher-learner ratio than quantile four or five schools. For example, in 2017, quintile five schools had an average teacher to learner ratio of 1:40 in Physical Science class, compared to 1:69 teacher to learner ratio in quintile one to three schools. Quintile one to three schools experience different challenges compared to their elite counterparts since they have limited science resources, large numbers of under-qualified or non-qualified Physical Sciences teachers and overcrowded classes. When adopting inquiry-based learning activities, these factors influence teachers' pedagogical orientations (Ramnarain & Schuster, 2014).

The National Research Council (1996) defines inquiry-based learning (IBL) as activities where learners develop knowledge, understand scientific ideas, and understand how scientists study the natural world in their everyday lives. IBL in a science classroom allows teachers to act as facilitators while learners become more self-directed. Learners are expected to discover new knowledge independently, formulate hypotheses, test the results; therefore, IBL promotes autonomy and encourages learners to construct knowledge (Pedaste, Mäeots, Leijen, & Sarapuu, 2012; Ramnarain & Hobden, 2015). Ramnarain and Schuster (2014) assert that South African science teachers embrace inquiry approach perception as there is a belief that inquiry-based learning can help learners develop practical skills and make science more engaging. Therefore, based on the importance of inquiry-based learning in the new South African science curriculum and the diversity in the schools in which this is implemented, it is important to assess the pedagogical orientations of pre-service teachers towards their classroom teaching and identify factors influencing their pedagogical orientations. In order to establish the pedagogical orientations of pre-service teachers, the following research questions were formulated:

i.   What are the preferred pedagogical orientations of Physical Sciences pre-service teachers towards their teaching?

ii. What factors influence the pedagogical orientations of Physical Science pre-service teachers when they are at school?

3. PEDAGOGICAL ORIENTATIONS

The underlying theoretical framework of this study is pedagogical content knowledge (PCK), and the underlying conceptual framework is pedagogical orientations (PO). PCK is a blend of pedagogical and content knowledge that formulates the transformation of the two mentioned knowledge into the most powerful, teachable forms to express the subject and make it comprehensible for learners' understanding (Shulman, 1987). PCK emphasises the significance of representation and understanding of emphasised knowledge. Within PCK, Grossman (1990), Magnusson, Krajcik, and Borko (1999) extended the PCK model by adding a key construct known as teaching orientations. The construct 'orientation' refers to teachers' knowledge and beliefs about the purposes and goals of teaching science at a particular grade level (Magnusson et al., 1999). Anderson and Smith (1987) referred to teaching orientations as various approaches to teaching science and general teachers' behaviours. There are different teaching orientations, ranging from teacher-centred presentation 'Direct Didactic and Direct Active modes' to learner-centred presentation 'Guided Inquiry and Open Inquiry modes' (Cobern, Schuster, Adams, Skjold, Muğaloğlu, Bentz, & Sparks, 2014). Pedagogical orientations as a conceptual framework formed the basis for assessing pedagogical orientations of Physical Science pre-service teachers in this paper. Below is a brief description of each of the four pedagogical orientations used in this paper.

i.   **Direct Didactic:** a teacher presents and explains the science concept or principle directly to the students and illustrates with examples and demonstrations. Students apply this knowledge to questions and problems. There are few student practical activities in this method, but there are usually discussions and problems with the content.

ii. **Direct Active:** similarly entails direct teacher exposition, but this is followed by a student activity based on the presented science content, for example, hands-on practical verification of a law.

iii. **Guided inquiry:** the teacher plans an activity where students explore a phenomenon or idea, and from this, the teacher guides them to develop the desired science concept or principle.

iv. **Open inquiry:** students explore a phenomenon or idea on their own, devising ways of doing so, minimally guided, after which they report what they did and found. The teacher facilitates the student activity but does not intervene more than necessary.

The first two orientations are direct approaches, referred to as teacher-centred, and the last two orientations are inquiry approaches, referred to as learner-centred. The four orientations were used to establish Physical Sciences pre-service teachers' pedagogical orientations through a questionnaire comprised of POSTT items. Figure 1 shows an example of the POSTT item used in this study (Cobern et al., 2014).

Figure 1.
Example of the POSTT item.

Finding the density of a mystery substance

Mr. Cobb's 8th grade students have learned the concept of density, through examples of solid objects whose mass and volume could be measured. Mr. Cobb next sets students an 'application' experiment where they have to *apply* their knowledge of density. He provides a 'mystery element' in granular form as shown. The students' challenge is to devise a method of finding the volume of this substance, take the necessary data, calculate density, and hence suggest what the mystery element might be. (They will have to use a water displacement method to measure volume since there are air spaces between granules).

Thinking about how you might teach, which one of the following approaches would you suggest that Mr. Cobb use for this lab activity?

A. Provide students with lab worksheets giving the experimental method and procedural steps. Students follow this and enter their experimental data in blank tables on the worksheet. They then calculate density and give their result and conclusion.

B. Provide students with an instruction sheet which outlines the experimental method. Students follow this and record data in a way of their choosing in their lab notebooks. They then calculate density and give their result and conclusion.

C. Do not provide method or instructions but have students first propose and develop a method they intend to use. Before going ahead they discuss this with Mr. Cobb, get feedback, revise if necessary, and then go ahead with their experiment, calculations and result.

D. Leave students to their own devices as much as possible; they should figure out a method on their own and decide what measurements to take and how. They then do their experiment their own way, and write up their method, result and conclusion.

Give reasons for your preference, and say why you did not choose the other options.

Figure one illustrates the nature of the POSTT item, and all the items have the same format, namely, vignette, pedagogy question and four options. However, they involve different facets of science and science instruction. Even though the items had different facets of science, the commonalities, like the pedagogy response options, were the same. The question structure was based on instructional scenarios allowing the pre-service teachers to make decisions and provide possible pedagogical reasons (Ladachart, 2019; Cobern et al., 2014).

4. PRE-SERVICE TEACHERS' PEDAGOGICAL ORIENTATIONS IN PRACTICE

The review is based on empirical studies that employed pedagogical orientation as a conceptual framework and used POSTT items to investigate pre-service teachers' pedagogical orientations. Sahingoz and Cobern (2020) used POSTT to gain insight into how taking a science methodology course correlates with pre-service science teachers' science teaching pedagogical preferences. Education students enrolled in American public university were used as participants, some of whom had completed a science methods course, and some were not. The findings indicate that many pre-service teachers' orientations were towards inquiry science teaching orientation even if they did not take a methodology course. However, their reasons often varied where pre-service teachers who took a methodology course think more broadly about factors that should influence choices of instructional practice (e.g. grade level, prior knowledge, interest areas) than those who did not. Ladachart (2019), Güven, Muğaloğlu, Doğança-Kücük, and Cobern (2019) studies revealed that fresh-man pre-service science teachers' orientations leaned towards Guided Inquiry and were not influenced by their earlier science learning experiences. Their orientations were largely related to their conceptions about the roles of teachers and students, students' grades and nature of subject matter rather than their immediate experiences as learners. Nyirenda (2019) examined Zambian pre-service science teachers' pedagogical orientations and factors influencing their pedagogical orientations. The findings show that Guided Inquiry was the preferred pedagogical orientation. Factors influencing their pedagogical orientations include curricula, time constraints, resource availability, and educational background (Nyirenda, 2019). The review based on pre-service teachers' pedagogical orientations and POSTT items indicate pre-service teachers preferred Guided Inquiry orientation, and the results were similar irrespective of context.

5. RESEARCH APPROACH

This study employed a sequential explanatory mixed methods design, and this design enabled the researchers to collect quantitative and qualitative data, then merge the data, and use the results best to understand the research problem (Creswell, 2005). A quantitative method was used to determine the pedagogical orientations of the Physical Sciences pre-service teachers, and a qualitative method was used to establish factors influencing their pedagogical orientations. The questionnaire comprised ten POSTT items developed at the Western Michigan University by Schuster et al. (2007) and Cobern et al. (2014). The POSTT item portrays an actual teaching scenario for a particular Physical Science concept, and the pre-service teachers were required to select the most appropriate teaching approach

from the four options given and justify their selection. Eight pre-service teachers were purposefully selected for interviews based on the quantitative results.

The data were analysed at different stages; for quantitative data, a similar data analysis method used by Ladachart (2019), Ramnarain and Schuster (2014), Ramnarain et al. (2016), Cobern et al. (2014) and Schuster et al. (2007) was adopted in this paper. The data analysis is based on a scoring system, where 1 point was given for each option representing a Direct Didactic, 2 points for Direct Active, 3 points for Guided Inquiry and 4 points for Open Inquiry. A Cronbach's alpha reliability was calculated to prove the reliability of the scoring system, and the result was 0.62, which can be considered low compared to the normal standard in educational research (≥ 0.7). This instrument also yielded weak inter-item correlations in the study conducted by Cobern et al. (2014). Therefore, this value should not be considered the result of a poor instrument.

A Saldana (2009) coding method was adopted to analyse the qualitative data to gain insights into the quantitative results. The qualitative data from the questionnaire was based on the Physical Sciences pre-service teachers' reasons behind their choices, and the conducted interviews formed part of the qualitative data. The qualitative data were first transcribed, coded and analysed using basic techniques for thematic analysis. In the process of thematic analysis, both deductive and inductive reasoning approaches were used to establish factors influencing their pedagogical orientations.

6. RESEARCH FINDINGS: QUANTITATIVE

The analysis of quantitative data collected through the questionnaire is presented below, together with the qualitative findings, enabled understanding factors influencing the pre-service teachers' orientations. The overall Physical Sciences pre-service teachers' most appropriate pedagogical orientations results are presented in figure 2.

Figure 2.
The overall preferred pedagogical orientations of Physical Sciences pre-service teachers in percentages (%).
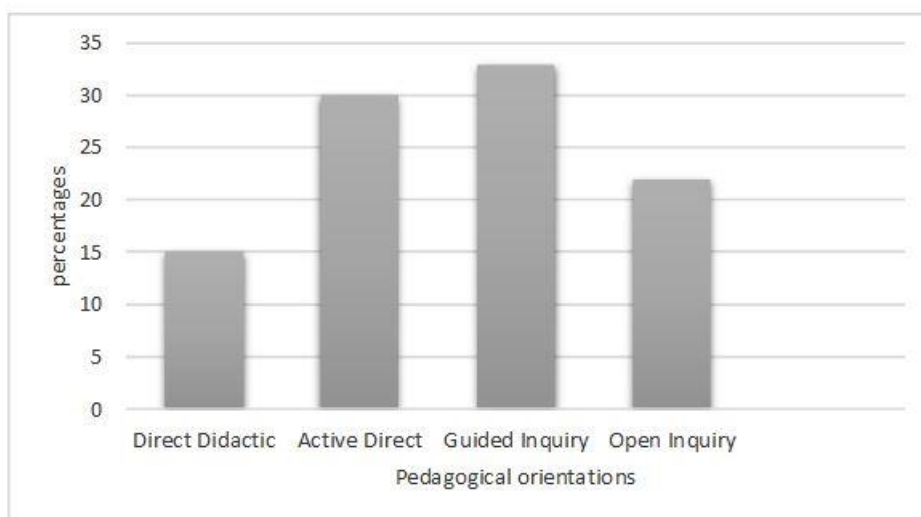
The results show that Guided Inquiry (33%) was selected as the appropriate pedagogical orientation followed by Direct Active (30%). The overall mean score, 'an average score for items', was 2.61 (i.e. responses were centred between Direct Active and Guided Inquiry) with a standard deviation of 0.8 'spread of the mean scores'. The figure above also reveals that the pre-service teachers' had multiple pedagogical orientations ranging from Direct Didactic to Open Inquiry. A One-Way ANOVA was used to compare the relationship between the four overall mean scores, and there was a significant difference between the mean scores of the most appropriate pedagogical orientations where [F (2.340, 102.976) =15.917 p<0.000, $\eta p2 = 0.266$] (equal variances are not assumed).

7. QUALITATIVE FINDINGS

The questionnaire responses were recorded, transcribed, coded, analysed using Saldana (2009) coding method, and codes were assigned to different statements. After the coding process, codes that shared similar characteristics were grouped to develop categories, then different assertions emerged from different categories and themes were generated. The factors influencing the Physical Sciences pre-service teachers are presented below.

7.1. Theme one: Resources at school influenced the preferred Physical Sciences pre-service teachers' pedagogical orientations

The availability of resources and many learners per class emerged as factors influencing the Physical Sciences pre-service teachers' pedagogical orientations since these factors had an impact on the teachers' autonomy to adopt a learner-centred teaching approach. These factors often led the pre-service teachers to opt for a teacher-centred orientation. A teacher who adopts a traditional orientation believes in conducting a whole-class demonstration or direct teaching method where learners cannot work independently in small groups. One of the Physical Sciences pre-service teachers, Mr Motsapi, mentioned there was a laboratory with few resources to conduct experiments at his school that was why he preferred a traditional teaching method. In one of the POSTT items responses, 'A lesson on force and motion', Mr Motsapi mentioned he would prefer a teacher demonstration. In this lesson, a teacher prepares an experiment where she/he plans to introduce learners to the relationship between force and motion. He/she used a small loaded cart to pull a force, and the force can be applied to teach the concept where a net force will either cause an object to speed up or slow down (Newton's 2nd Law).

> *The school had a laboratory, but it did not have many resources, for example, the station wagon. So, as a teacher, I will bring a homemade wagon and load it with books to show the whole class.*

Mr Motsapi indicated few resources at a school where he was placed during teaching practicum, which led him to opt for teacher-centred lessons or class demonstrations. Another pre-service teacher, Ms Faltein, also indicated that there were no science laboratories in her school, and she opted for teacher-centred methods.

> *They did not have resources or laboratories for sciences in my school, and there were so many learners in all my classes.*

The lack of laboratory resources and many learners per class led Ms Faltein to opt for teacher-centred orientations. She further elaborates even though there were no laboratories at her school, she was willing to adopt a learner-centred method, but she usually reverts to a teacher-centred approach. In summary, the lack of laboratory resources and many learners per class influenced the Physical Sciences pre-service teachers' preference for a teacher-centred pedagogical orientation.

7.2. Theme two: Insufficient teaching time influenced the preferred Physical Sciences pre-service teachers' pedagogical orientations

The Physical Sciences pre-service teachers' responses revealed that time was another factor that precludes them from conducting practical work or engaging in a learner-centred approach, which led them to opt for teacher-centred approaches. At the secondary school level, to come up with the school timetable is the responsibility of the School Management Team (SMT). The school curriculum guides schools when it comes to time per subject a week, Physical Sciences as a subject is assigned four hours per week, and the school has the prerogative to allocate the four hours in a way they think would be appropriate for their school. Some schools in South Africa prefer a double period for Physical Sciences lessons at least once a week, and each period is either forty-five minutes or one-hour long. The four hours per week are for the actual teaching and laboratory experiments. Therefore, limited time was another factor influencing pre-service teachers' pedagogical orientations. For example, Ms Sibeko, in one of the POSTT item responses, the 'Volumes and displacement' item, preferred a Direct Didactic orientation. She claims that there was inadequate time to teach using learner-centred approaches at her school. The volume and displacement POSTT item is based on the teaching scenario where the teacher plans to teach Volume and displacement. In the lesson, a part involves using a graduated cylinder partially filled with water to determine the Volume of small irregular objects. Below is Ms Sibeko POSTT item response, where she indicates the influence of time on her practice.

> *Most of the inquiry lessons are time-consuming because other learners may not find the correct equipment or resources to conduct experiments on their own, and it might seem impossible to find another way of measuring the Volume of objects without measuring the objects themselves.*

Her response suggests inquiry approaches or letting learners conduct a practical themselves have a negative impact on the lessons since they are time-consuming. In the interviews, she further explains:

> *The reason is that other options are time-consuming require more skills from the teacher. There is nothing wrong with using a direct teaching approach to ensure effective teaching and learning.*

The issue of skills or exposure to inquiry approaches surfaced in the interview because the pre-service teachers were reluctant to adopt learner-based activities due to their limited skills of handling learner-centred lessons. Ms Sibeko claims inquiry approaches are time-consuming and time specification in the curriculum played a role in limiting her teaching styles. Mr Jacobs shared similar sentiments as Ms Sibeko, and he argued that time to teach Physical Sciences subjects was not enough.

> *The time given to Physical Sciences lessons is not enough to follow the learner-centred approach in class. Therefore, I used my teaching method because we are expected to cover so much content with little time.*

Mr Jacobs also complained about the limited time given to teaching Physical Sciences, and his assertion is similar to Ms Sibeko's. They both claim that insufficient time for Physical Sciences lessons influenced their pedagogical orientations. In summary, the results show that contextual factors such as resources, class size and teaching time at school influenced the preferred pedagogical orientations of Physical Sciences pre-service teachers to opt for a teacher-centred approach.

8. DISCUSSION

This study used a questionnaire comprised of adapted POSTT version and interviews to establish factors influencing the Physical Sciences pre-service teachers' pedagogical orientations in one of the universities in South Africa. The Physical Sciences pre-service teachers' overall results for the most selected appropriate pedagogical orientations were in the following descending order: Guided Inquiry (33%), Direct Active (30%), Open Inquiry (22%) and Direct Didactic (15%). Therefore, their pedagogical orientations varied from Direct Didactic to Open Inquiry. The overall mean score was 2.61 (i.e. responses were centred between Direct Active and Guided Inquiry). The findings of this study resonate well with other studies both locally and internationally; for example, Ladachart (2019) and Nyirenda (2019) indicate pre-service teachers preferred Guided Inquiry compared to other orientations in their respective countries. Ramnarain et al. (2016) compared the Malawian and South African Physical Sciences teacher's pedagogical orientations, and the collective responses from both countries lean towards inquiry compared to direct instruction, which means they preferred a Guided Inquiry approach.

In the responses and interviews, the pre-service teachers tend to select a teacher-centred approach due to numerous factors, including school resources, the number of learners per class, and teaching time. Therefore, the pre-service teachers at township schools tend to select either Direct Active or Guided Inquiry approaches in the POSTT because of the many learners per class and the lack of resources in those schools. Schools in impoverished areas experienced difficulties in pedagogy compared to their counterparts in urban or semi-urban areas due to limited science resources, a limited number of qualified Physical Sciences teachers, and overcrowded classes (Ramnarain & Schuster, 2014, Makgatho & Mji, 2006). Nyirenda (2019) and Ramnarain and Schuster (2014) studies mentioned that the lack of resources, large number of learners per class, and limited teaching time influenced in-service and pre-service teachers' pedagogical orientations in their countries. In order to respond to research question two, the Physical Sciences pre-service teachers' pedagogical orientations were influenced by several factors such as school resources, teaching time and class size.

9. FUTURE RESEARCH DIRECTIONS

This study sheds light on the nature of pedagogical orientations and factors influencing the pedagogical orientations of Physical Sciences pre-service teachers, where the questionnaire and interviews were used to collect data to address the research questions. The questionnaire comprised POSTT items in standardised multiple-choice questions

whose options were restricted to only four pedagogical orientations. I recommend future studies to use open-ended questions so that pre-service science teachers can give the pedagogical orientations. The results of this study reveal that science pre-service teachers are inclined towards Guided Inquiry pedagogical orientations. However, the study did not determine whether the Physical Sciences pre-service teachers project the same pedagogical orientations in practice. Therefore, future studies must consider following pre-service teachers into the classroom for observations to determine whether their pedagogical orientations in the questionnaire aligned with their classroom practices.

10. CONCLUSION

With science education reforms in South Africa and worldwide, inquiry-based learning has been recommended to promote scientific literacy among school learners. However, it was found that science teachers face challenges in aligning their classroom practices with the standards of inquiry-based learning (Harris & Rooks, 2010) since such reform-based classroom practices require high levels of professional skills and knowledge (Gess-Newsome, 2015). The purpose of this explanatory sequential mixed-method study was to establish the pedagogical orientations of sciences pre-service teachers towards their instructional approaches and to determine factors influencing their pedagogical orientations. The findings of this study indicate the Physical Sciences pre-service teachers' preferred pedagogical orientations were between Direct Active and Guided Inquiry, while factors influencing their pedagogical orientations were contextual: school resources, class size, and teaching time. Based on the findings presented, this study's significant contribution is that pedagogical orientations are a dynamic construct, and context plays an important role in influencing teachers' PCK and pedagogical orientations.

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Chapter #10

4th IR – THE IMPACT THE USE OF MOBILE TEACHING DEVICES WILL HAVE ON HIGHER EDUCATION

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ABSTRACT

Students and lecturers use mobile devices more and more and within a few years they will become indispensable tools in the classroom. Recent research clearly indicates that mobile devices such as smartphones, laptops and tablets are the tools of choice for students, scholars, teachers, and lecturers. It is playing a major role in teaching and learning, especially in higher education. It is therefore indisputable that the development of artificial intelligence and new ways of communication take their place in the classroom during the 4th IR. The integration of these new technologies into the teaching and learning experience in the classroom will be dependent on effective pedagogical implementation and planning to be successful. Taking this into account, this paper explores the effect that mobile devices have in the classroom on the teaching and learning experience of the student as viewed from the student's perspective. The advantages of the implementation of mobile devices must be weighed against the negative influence they may have. All the participants in the study reported that they have access to and use mobile devices to use the internet to source information.

Keywords: mobile technology, 4th IT, 4th industrial revolution (4th IR), higher education.

1. INTRODUCTION

During the 4th industrial revolution (4th IR) the world will see the emergence of a new form of higher learning institutions. These institutions will have no classrooms, no library, and no on-site lecturers. The institutions will be inter-disciplinary, will have virtual classrooms and laboratories, the library will be online, and the lecturers will either be virtual or located anywhere in the world. Higher Education in the 4th IR is creating an exciting but complex opportunity which has the potential to transform society for the better. Artificial intelligence is driving the 4th IR and the needs of the workplace will be transformed from task-based orientation to human-centred characteristics. Due to the merging of "man" and machine, the distance between social sciences and humanities as well as between technology and science will be reduced. This will necessarily require more interdisciplinary teaching, research, and innovation. All the components of the "new" higher education system will be inter-dependable of each other but will also remain independent of each other.

2. PURPOSE

The purpose of this study is to explore and assess how mobile devices affect students' learning, participation, and engagement in the classroom. Mobile devices are an indispensable part of everyday life and therefore the devices are in the classroom every day. The main purpose of higher education will always remain the same, namely, to ensure quality

of learning via teaching; to enable the students to be exposed to technology and the latest knowledge through research, and innovation to sustain the development of societies by means of service. One of the foremost tasks of every university is to educate and prepare the youth. Therefore, it is necessary to use the most appropriate, current, and innovative teaching strategies and to organise the teaching experience in a way that promotes learning. These have implications for learning programmes, better learning experience, and the cultivation of lifelong learning attitudes. The impact of the 4th IR and the utilisation of mobile teaching devices on higher education need to be researched and understood. The question is what the impact of the 4th IR will be on higher education.

Numerous opportunities are created today with the rapid advancement of information technology to take advantage of technology in the "new" world where boundaries and borders do not exist anymore, and in which communication has become instant and immediate. A mobile device is defined as "*a portable computing device such as a smartphone or tablet computer*" (Fasae & Adegbilero-Iwari, 2015) and has become one of the best innovations of the 3rd IR, but will still have a major role to play in the 4th IR. iGen (people born between 1995 and 2013) has developed the ability to multi -task and not only multi- task but to switch between different tasks. However, Greenhow and Askari (2017) state that individuals who multitasked performed poorly on tasks in comparison to those who performed the tasks one after the other. This view is shared by several researchers who have proposed that human beings are truly not adept at multitasking but do have the capacity to change efficiently from one action to the other (Kirschner & De Bruyckere, 2017). They also mentions that the students' increased access to new technology and the Internet advocates the need for schools to give more attention to the impact of mobile technology on multitasking, learning, and student engagement. Because students will have mobile devices with them, they will be talking, downloading information, browsing, chatting, uploading, or even recording the lecture in class: ALL at the same time. This will have a huge impact on the classroom dynamics and therefore needs to be investigated and the influence thereof determined (Kearney,Burden, & Rai, 2015).

3. LITERATURE REVIEW

Our society has been transformed by technology which has changed our lives irreversibly over the last 25 years. In the education and training environment, technology and especially mobile technology has become an essential tool for the modern student. The digital age caused an upsurge in access to information, as well as increased and immediate interaction between people. Bilbao-Osorio, Dutta, and Lanvin (2013) explain, in their study on the state of global information technology, that the number of mobile subscribers will reach 6.9 billion worldwide in the year 2020. They indicated that the use of mobile technology in the form of tablets, phones and laptops is on the increase at all universities and even schools.

Technology is shaping the way that students learn and think. Students insist on using technology in all aspects of their learning experience and, therefore, prefer to multitask and have non-linear access to information quickly. They rely on technology to acquire information and perform social and business interactions (Henderson, Selwyn, & Aston, 2017).

4. ROLE OF TECHNOLOGY IN LEARNING

Researchers have indicated that student engagement is the aspect of learning that focuses on the activities in which students are involved during their studies and which promote learning and result in their academic achievement (Sidelinger, Frisby, & Heisler, 2016). While researching student engagement, researchers suggest that the main objective of education is for students to construct their own knowledge (Covington, 2017; Sidelinger et al., 2016). Therefore, a research study which examines the influence of mobile devices on learning, engagement, and performance shall be relevant and valuable.

A study done by Greenhow and Lewin (2016) concluded that the use of social media in the classroom supported the students' ability to connect to each other, creating a classroom community that increased engagement and facilitated learning. The study showed a relationship between technology and learning: on a general basis, students with a higher use of Information and communications technology (ICT) have a slightly higher performance compared to their colleagues who do not embrace technology in their study methods. Technology improves student engagement and proves to be effective as an intervention for improving learning (Higgins, Xiao, & Katsipataki, 2012). They also stressed that in any case, technology should not replace normal learning, but rather be used to supplement learning, and this implies that students should be attentive in the way they use technology for learning. BrckaLorenz, Haeger, Nailos, and Rabourn (2013) found that technology facilitates increases in collaboration, engagement, and learning in higher education. Technology has altered the iGen generation's approach to reading, learning, problem-solving, as well as information processing. It became important to allow students to make use of what they are familiar with and what they see as the best way to enhance their engagement on campus while joining forces with their peers to acquire new information and to enhance their learning experience (Howe & Nadler, 2010).

Jones, Johnson-Yale, Millermaier, and Perez (2009) did a survey based on the feedback given by 7,421 respondents from 40 universities and colleges on the familiarity and use of the Internet. The results indicated that 85% of the students reported a positive enhancement of their learning experience because of the Internet. Their research identified some of the ways in which technology is incorporated at those institutions to enhance learning. Course management software is one of the methods that increases the efficiency of course material distribution and offers an opportunity for more online interaction between students and lecturers. Student interaction with technology goes beyond just surfing web pages and email but has increased the opportunities for university students to engage with their faculty, classmates, course material and administrators (Howe & Nadler, 2010). The utilizing of mobile devices for access to and distribution of information in higher education redefined the manner in which teaching, and learning takes place but also presented new opportunities for effective student engagement.

5. MOBILE LEARNING - M-LEARNING

Samad, Ihsan, and Khalid (2021) discuss mobile learning, especially during the Covid-19 pandemic and how it has become an indispensable tool in the hands of educators worldwide. They describe M-learning as a learning method that uses mobile technology applied in teacher teaching and learning. The flexible mobile nature allows this learning to be carried out easily, regardless of time, place, and distance boundaries. M-learning is about using the massive growth of mobile technologies to benefit learners and learning. As computers and the internet become essential educational tools, the technologies become

more portable, affordable, effective, and easy to use. Using portable computing devices (such as laptops, tablet PCs, PDAs, and smartphones) with wireless networks enable mobility and mobile learning, allowing college teaching and learning to extend to spaces beyond the traditional classroom. Within the classroom, mobile learning gives university instructors and learners increased flexibility and new opportunities for interaction (Alam & Aljohani, 2020).

The role of the student and the lecturers regarding m-learning is described as follows:

Students – need to be actively involved in accessing information when needed and they need to take responsibility for their learning.

The lecturer – lecturers need to present the learning material in a form that the students can access on the mobile devices. The lecturer needs to be qualified and able to use the platform, they need to determine the strengths and the weaknesses of the methods and then adapt them to be more productive. They need to act as facilitators and advisors to install trust of the method in the students.

M-learning is a part of e-learning, but according to Samad et al. (2021), there are six characteristics distinguishing the two. The six characteristics are shown in the table 1 below:

Table 1.

Characteristics	M - Learning	E – Learning
Device ownership	Privately owned by the student	Owned by the university or institution of privately owned PCs at home
Knowledge	Created through learning content / material and peer interaction	Gained through cognitive processes and inquiry
Learning Context	Formal and informal learning anywhere and at anytime	Formal learning in the classroom and at home
Forms of learning	Personalized learning, situational learning, and authentic learning, discovery, access, and knowledge creation	Students access courseware and materials online, for learning
Learning materials	Courseware is delivered via LAN or CD ROMs or other storage devices, and learning materials on the internet via learning management systems (LMS)	materials are sent via LMS and the internet or even WhatsApp. Students also generate content through discussion and interaction.
Mobility	Access learning materials without time and place from the internet.	Access learning materials using a Local Area Network (LAN) or a compact disc

M-Learning is the tool that provides the learning material for students and teachers on mobile devices. These devices make the lives of people easy and are already part of people's daily lives. The use of mobile technologies to support, enhance and improve access to

learning is a relatively new idea and while many teenagers and twenty plussers are expert mobile phone users, many lecturers are not. Mobile technologies can support learning experiences at university level that are collaborative, accessible, and integrated with the world beyond the classroom educative learning initiative.

6. THE EFFECT OF MOBILE TECHNOLOGY ON ACADEMIC PERFORMANCE

Radesky, Schumacher, and Zuckerman (2015) argue that mobile devices do have a noteworthy influence on academic performance, mainly by causing distractions. However, several studies found that mobile technology does not have any effect on the students' academic performance (Heflin, Shewmaker, & Nguyen, 2017; Rabiu, Muhammed, Umaru, & Ahmed, 2016). Student performance was linked with cell phone use during class time in a study by Duncan, Hoekstra, and Wilcox (2012). They found an average negative grade difference of 0.36 ± 0.08 (on a four-point scale) for students who reported regular cell phone use in class. Information from the same study revealed that students accessed their phones at a rate of seven times per class period.

McCoy (2016) conducted a study to define students' behaviour and insights regarding the classroom use of digital devices for non-class purposes. A total of 777 students at six US universities took part in the study. The average student used a digital device for non-class purposes 10.93 times during a typical school day for activities including texting, social networking, and emailing. Most respondents did so to fight boredom, entertain themselves, and stay connected to the outside world. More than 80% of the respondents indicated that such behaviour caused them to pay less attention in the classroom and thereby miss instructions. Most respondents indicated that they favoured policies governing digital device distractions in the classroom.

In a study conducted by Sundari (2015), it was found that there was a direct correlation between mobile device use and students' learning skills. Students who used technology performed better than those students who did not use technology. Mobile technology has been the most popular communication channel for individuals in tertiary institutions. However, studies have shown that extensive use of technology such as social networking, chatting, and texting on students' mobile phones during class time contributed to lower grades and overall poor performance. On the other hand, Sundari recognized that students' use of technology improved their learning because it assisted them to exchange information with their peers regarding their studies. While some researchers indicated that technology can negatively impact students' performance when used in class, other studies have shown that technology may have a positive impact on student performance (Radesky et al., 2015; Tindell & Bohlander, 2012). Vázquez-Cano, Gómez-Galán, Infante-Moro, and López-Meneses (2020) agree with them on the negative impact that technology has on the impact of student performance except for their reading ability that declines.

Rabiu et al. (2016) conducted research on the impact of mobile phone use on academic performance. The researchers found that the use of mobile phones had a significant effect on students' academic performance by acting as a source of distraction. However, a noteworthy number of the respondents stated that mobile phone use does not have a notable effect on their performance (Rabiu et al., 2016). Mobile technology provides a platform for interaction and collaboration among students.

Currently during the 4th industrial revolution, researchers are beginning to explore the potential of mobile technologies and devices to support learning (Golenhofen, Heindl, Grab-kroll, Messerer, & Böckers, 2019). Developments in the field of mobile technology are

prompting the design and development of M-Learning projects. In addition, efforts and studies were also taken to design courses and build materials suitable for mobile devices (Hanbidge & Tin, 2020; Utesch, Faizan, Krcmar, & Heininger, 2020)

7. EDUCATIONAL BENEFITS OF MOBILE DEVICES

It is time that we start thinking of cell phones as computers. The description of cell phones seems unclear. Several terms are used by researchers such as cell phones, mobile phones, portable media players, tablet computers or smartphones (Al-Emran, Elsherif, & Shaalan, 2016). In an academic setting there are many effective uses for cell phones, such as supplementing the class experience and getting tutoring assistance from instructors (Tao & Yeh, 2013). They found in their study that using cell phones to augment teaching helped increase the quality and quantity of student feedback. Students use their mobile devices to access other media such as the Internet, Facebook, Twitter, YouTube, and other information communication technology. Bannon, Martin, and Nunes-Bufford (2012) suggest that the use of social media by college students ages 18 to 34 was increasing. Gikas and Grant (2013) explored the process of integrating mobile technologies into teaching and learning. The faculty members at the institutions where they conducted their research incorporated mobile technologies into their courses. They concluded that the use of mobile technologies in these institutions of learning resulted in positive outcomes that would make learning a meaningful and fruitful experience for the students.

Keane, Lang, and Pilgrim (2012) classify the educational benefits of mobile devices into seven categories. One of the benefits is that mobile devices serve as a tool to access multimedia. Students have access to analytical tools or can use the mobile device as an assessment tool in the completion of examinations, questions and quizzes. A second category of educational benefits of mobile devices is their use as a managing tool. Students can manage their personal information such as task lists, calendars, and address books. Students use the mobile devices in the class to conduct research, use the word processor, produce presentations, and complete quizzes or tests. Some lecturers and students have stated that use of mobile devices could increase student engagement and academic performance (Bannon et al., 2012). However, the impact that the various forms of technological innovations may have on students' academic performance remains an issue. Thus, further investigation into understanding students' uses of mobile devices in the classroom and the influence on engagement and learning was needed.

8. METHODOLOGY

An integrated methodology, the FraIM (Framework for an Integrated Methodology) was followed for the research. FraIM integrates qualitative and quantitative methods in a way that is argued will enable a researcher to employ a mixed methods approach with any research project (Plowright, 2011). It is appropriate for carrying out small-scale empirical investigations that are aimed at evaluating, developing, and improving an understanding of practice. It can be applied to research undertaken for a programme of study in a university setting. It can also be deployed to solve problems in a variety of professional, vocational and workplace contexts and locations (Fourie-Malherbe, Aitchison, Bitzer, & Albertyn, 2016).

The main data used in this article stem from interviews and questionnaires with students from the Central University of Technology, Free State, registered for BEd SP & FET, Specialisation: Technology, on their views of the 4th IR's impact on the higher education system and the use of mobile teaching devices.

9. LIMITATIONS

The sample group was small- and the time frame was limited. Another limitation was access to all the new technologies that are available to demonstrate and for students to have hands- on interaction (Rossing, Miller, Cecil, & Stamper, 2011). The target group consisted of 85 students (52 females and 33 males) enrolled in the 3rd year of the BEd (SP & FET) Technology qualification.

10. FINDINGS

This research focused on how the 4th IR impacted on students' engagement and learning in the classroom using mobile devices.

Figure 1 presents the types of mobile devices that the participants in this study owned. According to the data, 100% of the participants indicated that they owned smartphones, tablets, or personal computers and used them often.

Figure 1.
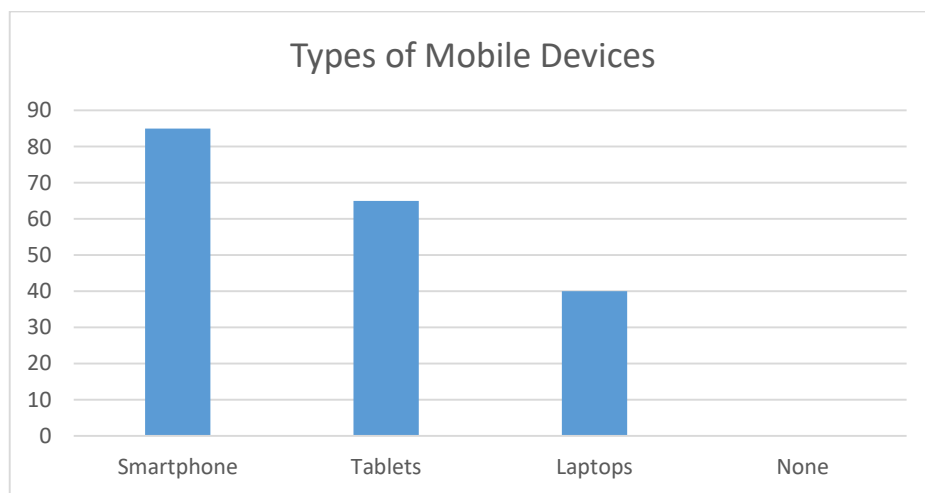
The data clearly show that all students have access to mobile devices with at least 1 of the types of devices, whereas most students own 2 or even 3 types.

Figure 2 presents the comfort level of participants with using mobile devices in the classroom. According to the data, 75.3% of the participants were comfortable or very comfortable using mobile technology.

Figure 2.
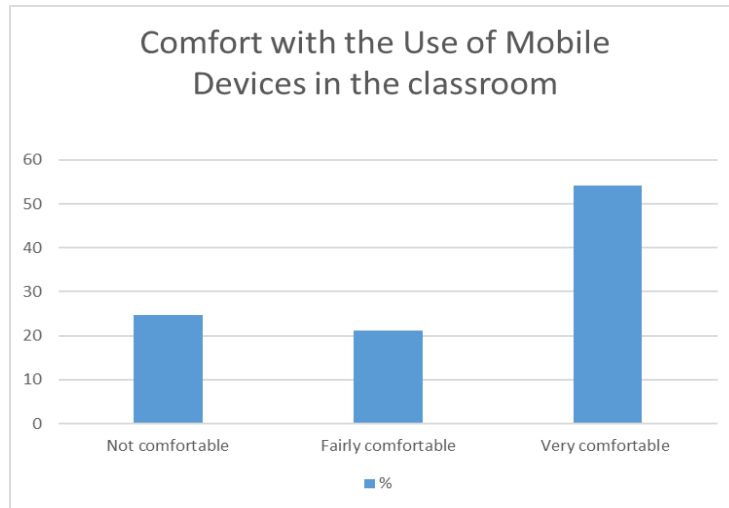
Figure 3 provides a summary of the participants' perceptions of the impact of their use of mobile devices in the classroom on their level of engagement and learning. The findings are presented below:

Figure 3.
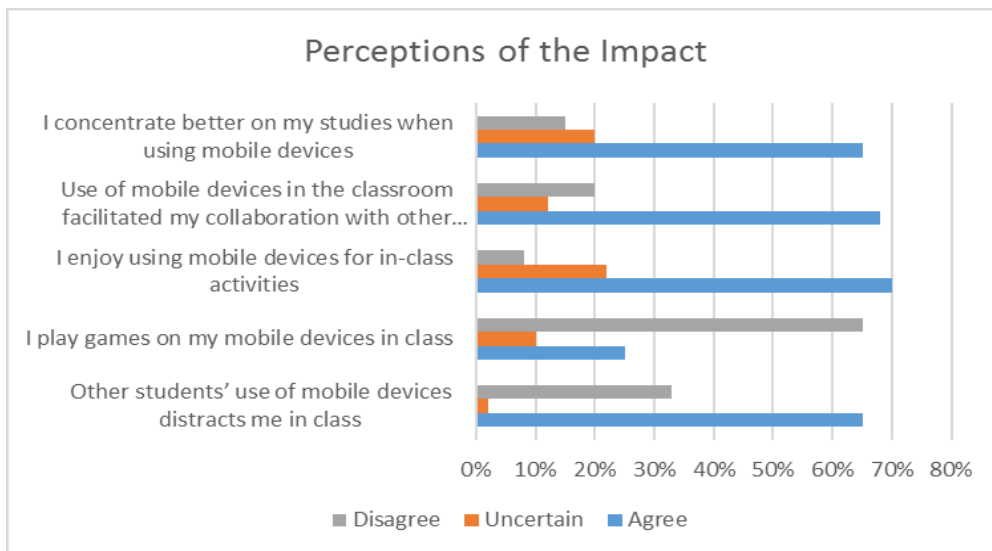
1. 65% of the participants reported that other students' use of mobile devices distracted them from paying attention in class, while 33% disagreed with this notion and 2% of the participants were uncertain. This finding indicates that the use of mobile technology by some students in class distracted other classmates from paying attention in class.

2. 25% of the participants reported that they played games on their mobile devices in class, while 65% disagreed with this and 10% of the participants were uncertain. This finding indicates that a quarter of the participants did not constantly focus on learning in class.
3. 70% of the participants reported that they enjoy the use of mobile devices for classroom activities, while 8% disagreed with this notion and 22% of the participants were uncertain. The participants reported that they enjoy the availability of more information than what is given by the lecturer.
4. 68% of the participants reported that the use of mobile devices in the classroom facilitated their ability to collaborate with other students, while 20% disagreed with this notion and 12% of the participants were uncertain. This finding indicates that many of the participants were able to collaborate with others, using mobile devices in class.
5. 65% of the participants reported that they concentrated better on their studies when using mobile devices, while 15% disagreed and 20% were uncertain. The participants who reported that mobile devices helped them to concentrate more on their studies validated this by stating that they could confirm the validity of the information received while learning, they could easily connect with their peer groups, take notes in the class, and get informed videos for better understanding their studies. Thus, this finding indicates that many of the participants concentrated better on their studies when using mobile devices in class.
6. 48% of the participants reported that they access social media in the classroom during the lecture, while 30% disagreed and 22% were uncertain. This finding indicates that many of the participants do not pay attention in class when using mobile devices.

Figure 4.

119
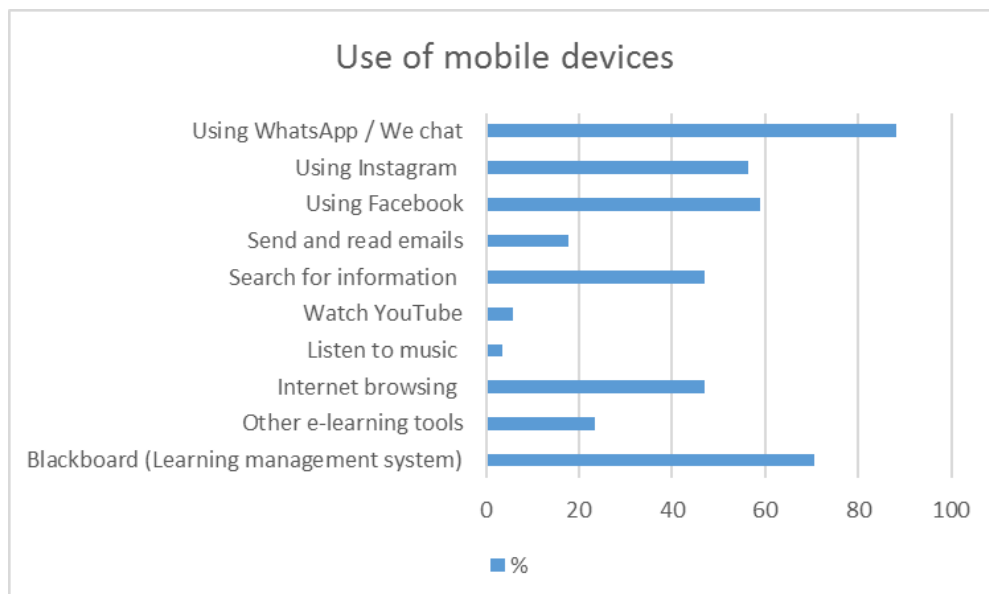
Figure 4 provides data on the use of their mobile devices by participants during class. Participants could mark more than one option.

More than 70% of the participants reported that they do use their mobile devices in class to access learning material online in the classroom during the lecture, but the worrying factor is that up to 75% of the participants use their mobile devices in class for non-academic purposes.

Figure 5 provides data on the type of mobile device used in class by participants. 82.3% of the participants reported that they use their smartphone in class to access the information needed, but the small screen of the smartphone is seen as a problem, and it makes it difficult to read the notes. Only 2.4% use their laptops in class and the main reason for this is the lack of power outlets to charge laptops.

Figure 5.
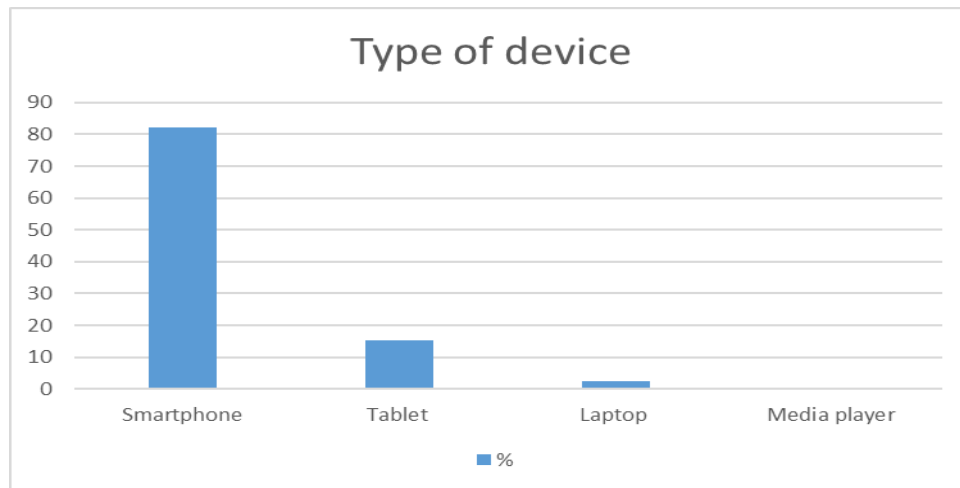
Figure 6 provides data on the type of data connection used by the participants for their mobile devices.

Figure 6.
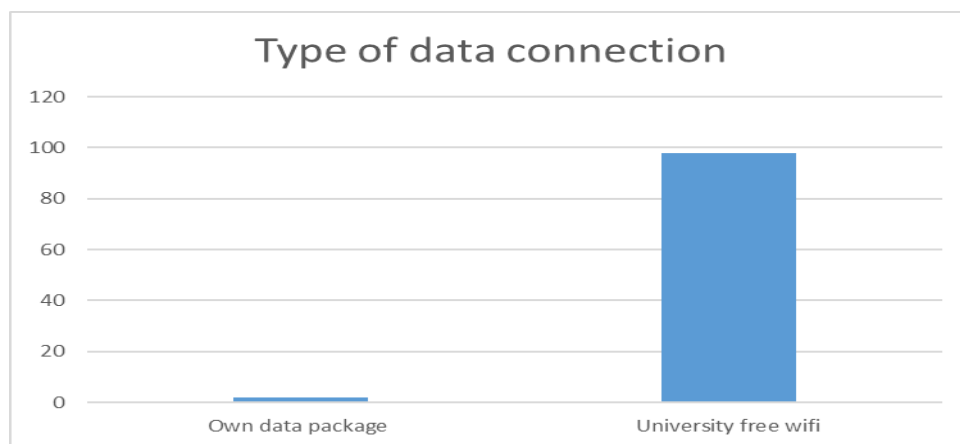
98% of the participants reported that they use the free university Wi-Fi for their data connection even if it is slow. The 2% of participants that use their own data packages were not registered students due to circumstances out of their control, such as bursaries.

10.1. Summary of findings

Based on the data, the beneficial use of mobile technology in the classroom, together with the students' need to use the technology, and the potential for future academic preparation, had a substantial influence on students' learning and engagement. It shows clearly that mobile technology has its place in the classroom and that the advantages far outweigh the disadvantages.

11. DISCUSSION

The findings of this study are in line with several other studies on the impact of mobile devices in the classroom. The 4th IR will only increase the availability of mobile devices; even some that do not even exist today. Over the last few year students have increasingly benefited from electronic technologies, podcast lectures, online courses, educational apps on mobile devices, and cooperative activities through social networking platforms (El-Hussein & Cronje, 2010; Traxler, 2007). Students enjoy the freedom technology provides them in becoming more actively engaged in the learning process. Most of the mobile learning technology devices, like tablets provide students direct access to information, course material, and real- world application of knowledge (Alsaadat, 2009; Martin, McGill, & Sudweeks , 2013). This is evident in the fact that 73% of the participants in this study indicated that they are comfortable with the use of technology in the classroom. Moreover, they all regard this access as indispensable to their learning experience. New technology often evokes feelings of both excitement and anxiety from students and faculty, and the usage of mobile teaching devices proved no different. Students indicated that the novelty of the usage of mobile teaching devices contributed positively to the learning experience. Students also recounted that the instantaneous access to information enhanced in-class discussion because they could easily search for information to share with the class. Cobcroft, Towers and Smith (2006) suggest that students benefit from "flexibility and ubiquity, that is, 'anywhere, anytime, and any device' learner engagement". The use of mobile devices in the learning process can be less effective because the small screen size of mobile devices can limit the ability to display information clearly. In that case, it will be difficult for students to see or read the information because the display screen is small, and students will be uncertain and lack understanding of the information (Hanbidge & Tin, 2020). Students also have difficulty navigating the necessary additional information via buttons. It is because the button is too small and difficult to press (Utesch et al, 2020). As discussed, instructional design and the use of technology predominantly affects student perceptions of learning (Armstrong, 2011). As students gain access to vast amounts of information, educators must provide direction. Educators must support students using mobile information to make better informed assessments and judgments when accessing information on their own. Educators must adapt the technology to specific learning goals and outcomes. Institutions of higher learning need to get policies and regulations in place to govern the use of mobile devices in the classroom. Clear "rules" on the use of mobile devices in the classroom need to be communicated to the students to minimize the distraction of other students by those that are using their mobile devices to access non-academic information such as social media during class time. The findings of this study are not dissimilar to studies reviewed during the research of this paper,

for example Manzoor, Sarwar, and Asim (2020) found that learning with the help of mobile phones makes the learners of today's technological advanced era more comfortable and thus helps them to improve their learning. The shift of electronic era to mobile services has started following the paradigm "anytime, anywhere computing."

12. CONCLUSION

The 4th Industrial Revolution ensures that new technologies are developed rapidly, and the pace is picking up each year. Guri-Rosenblit (2005) perceives that the human capacity to respond to and adapt to the pace of new technologies is meaningfully slower and limited. Therefore, educators using mobile devices in the classroom must be committed to learning how to use devices effectively in classroom. In summary, mobile information and communication technologies such as tablets, laptop computers and mobile phones will feature increasingly in the future of learning and classroom environments. Mobile devices offer benefits such as the apparently unlimited access to information and advantages for collective learning. However, these devices, if not controlled properly, can distract learners, and create frustration in the classroom. When integrated into the classroom experience sensibly and under control, educators will maximize their potential to enhance learning and minimize their interference with learning. Taking in consideration the limitations of this study, generalization is not possible, but this article is a reflection on the current situation in my classroom.

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APPENDIX

Questionnaire:

The purpose of this study is to explore and assess how mobile devices affect students' learning, participation, and engagement in the classroom.

Dear student:

Thank you for your participation in this research. Please complete the survey by answering the questions below. I am researching how mobile devices affect students' learning, participation, and engagement in the classroom.

Please circle your response to the question.

Part A

1. What is your gender?

Male	Female

Part B

Mobile device usage:

1. Do you own a mobile device capable of connecting to the internet?

Yes	No

2.   What mobile device to you own? Circle all that apply.

      a)   None

      b)   Smartphone

iPhone	Android	Windows

      c)   Tablet

Kindle	Android	Windows

      d) Laptop

          Please Specify: _____

3.   How comfortable are you with using your device in the classroom.

Not comfortable	Fairly comfortable	Very comfortable

4.   Please indicate what is your perception on the use of mobile devices in the classroom have on your level of engagement, participation, and learning.

	Perception	Agree	Uncertain	Disagree
1	Other students' use of mobile devices distracts me in class			
2	I play games on my mobile devices in class			
3	I enjoy using mobile devices for in-class activities			
4	Use of mobile devices in the classroom facilitated my collaboration with other students			
5	I concentrate better on my studies when using mobile devices			
6	I access social media on my mobile device in class			

5.   Please indicate what you use your device for during class, you can mark more than one.

Usage	
Blackboard (Learning management system)	
Other e-learning tools	
Internet browsing	
Listen to music	
Watch YouTube	
Search for information	
Send and read emails	
Using Facebook	
Using Instagram	
Using WhatsApp / We chat	

J. Beukes

6.   Please indicate what type of device are you using during class.

Device	
Smartphone	
Tablet	
Laptop	
Media player	

7.   Indicate the type of data connection you are using in class.

Connection type	
Own data package	
University free Wi-Fi	

8.   Describe briefly possible ways that you would like to see the use of devices integrated into the classroom.

Activity	
To access current information during class	
To access alternative online textbooks	
To collaborate with other students during class for group work	
To record lectures	
To submit homework	

Any other suggestion:

…………………………………………………………………………………………
……………………………………………………………………………………..

9. Please write a short comment on any idees or thoughts you may have regarding the use of electronic devices in the classroom.

THANK YOU
FOR SPENDING TIME
ON ASSISTING ME
WITH THIS RESEARCH

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Biographical sketch: Gerhard is a lecturer specializing in Mechanical Technology training for student teachers. He completed his MEd degree focusing on the emotional intelligence of the Student Teachers studying for their Teacher's degree at the Central University of Technology in South Africa. His doctoral research is focusing on using digital devices in the classroom with special focus on using preloaded e-textbooks. He come into the Higher Education System late as het spend more than 25 years in the industry before venturing into the education sector. His passion is bringing the industry to the classroom to introduce the student to more than just theoretical work.

Chapter #11

A VIEW OF SECONDARY TECHNICAL SCHOOL STUDENTS ON THE SUPPORT AND BARRIERS TO THEIR PROFESSIONAL GROWTH

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ABSTRACT
The aim of the paper is to find out how Czech secondary technical schools students evaluate their professional growth in the course of their secondary school studies, what are the barriers to this growth and what are their views on the possibilities of schools to support their interest in the chosen field of study. Qualitatively oriented research focuses on the quality of secondary school studies as regarded by secondary technical schools students in the Moravian-Silesian Region of the Czech Republic. The research outputs provide suggestions for students to improve their professional growth throughout their secondary school studies and suggestions for procedures that may help remove barriers in their educational paths to a technically oriented profession. Respondents - secondary technical schools students - most frequently state the possibilities of their professional growth, comprising the "I-student" and "Teacher and teaching" factors. More than half of the barriers mentioned by students belong to the category of dispositional (personality) barriers. In second place are institutional barriers, and a negligible number of barriers have been included among situational barriers. The most significant number of students' opinions on how the school should deepen their interest in the field was concentrated in the group of factors "I - student". It is followed by opportunities to support interest in the "School" factor group.

Keywords: professional growth, secondary technical school students, barriers in educational paths, students' views on improving professional growth, school strategies of students' support.

1. INTRODUCTION

The current trend in the growth of education is to increase the involvement of students in teaching processes and greater responsibility for the course of education and its results. Greater involvement of students in their education can be achieved not only by using appropriate strategies supporting cooperation, teamwork between students and their teachers and among students but also by using specific evaluation tools that can assess students' satisfaction with the course, their relationship to the school as an institution or to teachers, which is the subject of a PISA questionnaire (Schleicher, 2019). Students' subjective opinions on the stated characteristics of their school education can subsequently influence their learning motivation, relationship to the field of study, interest in the selected profession, or retention.

In this study, the authors' interest focused on three interrelated educational constructs: professional growth factors, the barriers to this growth, and possible ways how the school can facilitate it. All three constructs reflected by the students have the character of subjective individual perception and assessment of educational reality in the defined territory of one region of the Czech Republic and one type of technical education in engineering fields. The

authors formulated individual categories of meaning and included them in the relevant factors after they identified, analysed and gradually generalised specific opinions of students.

The problem of changes in professional growth opportunities, school support of education and their barriers in secondary education can also be reflected in research through approaches applied more commonly in adult education. Secondary technical school students are a borderline between the end of puberty when their own identities with an inevitable transition from the status of a child to an adult (adolescent) are created with a desire to become independent, to organise one's values, attitudes, goals. The self-concept of secondary school students is influenced by the desire to take specific patterns (e.g., from the family, out-of-school context), as well as by anti-identification, postponement of decisions, deeper socialisation, fluctuations in work or school performance, etc.

This study aims to find out, based on empirical research, what opportunities for their professional growth students express, what barriers for this growth they have formulated, and how the school can facilitate the growth. This basis is further used to determine categories saturating each of the constructs, with the categories being included under one of the group of factors and the potential share of other factors affecting the level of the analysed educational constructs being determined.

2. PROFESSIONAL GROWTH AND LEARNING SUPPORT

Recent statistics show that individuals benefit from lifelong learning in various aspects, such as economic, civic, social, and technological. Due to the formation and growth of so-called human capital, it is possible to talk about shifts in the economic growth of today's economies based on knowledge and competencies, e.g., according to the concept (Rizzo & Gallo, 2012; Wawrocs & Heissler, 2013).

Educational sciences in the context of lifelong learning concepts are presently intensifying research of the role of school education in the overall growth of today's young population and the support that schools can provide to their students throughout their education and for further lifelong learning. The research results determine effective educational strategies (Walberg & Paik, 2000; IAE/UNESCO, 2005), correlates of effective schools (Campbell Union High School District, 2020) or signs of a good school (Pol & Lazarová, 2011) or a quality school (Česká školní inspekce, 2020). One of the correlates is the supportive learning environment, characterised by the following features: "The school has a safe, civil, healthy and intellectually stimulating learning environment. Students feel respected and connected with the staff and are engaged in learning. Instruction is personalised, and small learning environments increase student contact with teachers" (Campbell Union High School District, 2020, p. 1). As part of a new initiative on the Science of Learning and growth implemented at the Learning Policy Institute in California (Flook, 2019), a "whole child" approach was formulated based on scientific research, identifying how schools can fully promote child growth. This approach is based on the four main ingredients of school success that allow us to care for and nurture the potential in all children: a positive school climate, productive instructional strategies, social-emotional growth, and individualised support. Putting these ingredients into practice requires four groups of activities: "1. Foster a supportive environment that promotes strong relationships among staff, students, and families; 2. Implement meaningful, engaging instructional practices that develop students' ability to manage their own learning; 3. Develop habits, skills, and mindsets that build students' social, emotional, and academic competence and 4. Create an integrated system of school support, including extended learning opportunities and community partnerships" (pp. 1-4). Students' interest in and motivation to improve their learning

outcomes is related to the call for teaching-learning strategies, which means that students are "given opportunities to participate in the choice of learning objectives and are led to learn different ways to learn" (Kašparová, Starý & Šumavská, 2011, p. 4).

Dynamically applied teaching and learning innovations are also necessary conditions for students' interest in their education. The OECD (2017) introduced the Innovative Learning Environments (ILE) construct to find that OECD spending per student has increased by 20% in the last ten years, but the learning outcomes have only improved little. ILE is based on seven learning principles, stating that learning environment can: lead the student to active learning and engagement; view learning as a social phenomenon frequently entirely done in collaboration with others; be adapted to the emotions of the students; reflect individual differences between students, make all appropriate demands without overburdening students; use broad assessment and formative feedback and promote horizontal links across knowledge areas, subjects, community and the wider world.

These seven principles can be appropriately implemented in practice in conjunction with three main areas, i.e., a) innovation of the pedagogical core of the learning environment, including both the essential elements (students, teachers, content and learning resources) and the dynamics uniting them (methods and formative assessment), b) transformation into a "formative organisation", managing learning based on learning outcomes achieved through diverse strategies and innovations, c) open partnerships and cooperation with families and communities, universities, cultural institutions, media, businesses, especially by other schools and the educational sphere, directly creating a pedagogical core and a leading position in learning. The authors have classified this comprehensive approach to current education and learning as the ILE "7 + 3" Framework (OECD, 2017, p. 42). Innovations of the "pedagogical core" in the field of the curriculum are currently implemented as a competence approach to education, increasing information and digital literacy, shaping financial and business literacy, developing competencies for sustainable or applying integrated thematic instruction (ITI) (Malach, 2020). Several process innovations applicable without digital technologies, including deep learning, tailored learning, inquiry-based learning, CSSC learning, gamification, etc., are gaining ground (Pellegrino & Hilton, 2011). Innovations requiring digital technologies include online learning, blended learning, adaptive learning or learning with robots (Picciano, 2017; Paniagua & Istance, 2018; Ferguson et al., 2019).

Factors in the effective functioning of schools or entire school systems that translate into better learning outcomes have been addressed by Hattie (2009; 2018), who arranged them into six groups: student (child), home, school, curriculum, teacher and teaching/learning approaches. He calculated its effect size for each factor, i.e., the degree (predominantly positive but also negative) to which it affects the individual's educational outcome. By analysing the first thirty factors (which are also presented in the study on learning strategies by Echazarra, Salinas, Méndez, Denis, & Rech, 2016), it can be concluded that most (14 in total) belong to the teaching group, six to the curriculum group, five to the teacher category, three to student groups, two in the school category and none in the home category. There is no doubt that this critical analysis of the benefits or effects of factors influencing learning outcomes can break down certain stereotypes about the effects of some of them, which may have been triggered by the uncritical adoration of particular teaching and learning strategies. This categorisation of school functioning factors was used in processing the results of empirical research in this study.

3. BARRIERS TO EDUCATION

The UNESCO report (2009) identified three major barriers to more extensive participation in education: institutional, situational, and dispositional. Institutional barriers include institutional practices and procedures that discourage or hinder participation in education, e.g., lack of financial support or opportunities (in the right place or at the right time), high fees or entry qualifications. These barriers mainly affect the poor people and people educated in later stages of life. Situational barriers are based on an individual's life situations at a certain point in the family's life cycle (e.g., caring for children or parents) or working life (sufficient time and resources to study). Family-related barriers mainly affect young adults and women. Situational factors are also the place of residence or belonging to a linguistic or ethnic minority. Dispositional barriers relate to psychological factors that may hinder an individual's decision to accept participation in their education (e.g., the assumption of reward or usefulness of participation), self-concept and other attitudes. These barriers are prevalent in poor, low-literate and older individuals. Highly developed Finland assumes that 62% of the adult population have to overcome situational barriers, 54% situational barriers and 49% dispositional barriers.

Del Preto (2013) focused on people without any interest in further lifelong learning and identified the reasons for their demotivation for further education. He found that "gender" is not a barrier to interest in further education. Rubenson (2010) pointed out the educational obstacle in connection with the lack of time to learn. The adult population also shows a high workload (busyness) in relation to a lack of interest in further studies.

OECD (2011) and Kalenda and Kočvarová (2017) state that individual countries differ in the degree of perception of educational barriers. The Czech Republic is in the middle of the barrier rate (Desjardins & Rubenson, 2013). Situational and dispositional barriers to lifelong learning are managed in Nordic European countries with a stronger motivation to learn. There is a lack of influence of institutions with "welfare state" characteristics in the Czech Republic, as pointed out by structuring theory (Rubenson & Desjardins, 2009). Vanhuysee (2006) and Kalenda and Kočvarová (2017) identified a somewhat hybrid Czech model. In adults, it is clear that the structure of barriers to lifelong learning is relatively complex, as it contains situational, institutional, and dispositional barriers. Rabušicová, Rabušic, and Šeďová (2008) explain the motivation of adults for education through their relationship to it and the value they attach to it. They identified internal personality barriers (e.g., fears of failure to study, lack of meaning of further study) and external situational barriers (e.g. workload, health problems, many other interests) motivation in formal and informal adult education. Research Panadero, Jonsson, and Botella (2017) provided an interesting insight into the problem of students' self-esteem as a particular effect of learning self-regulation and students' self-efficacy. The European Union (2009) has set the need to increase participation in lifelong learning for the adult population to 15%. Removing barriers to participation in education, including in secondary schools and universities, or promoting interest in technology across the age, should help achieve this ambitious goal.

Barriers through the lenses of students and teachers at the State University of New York (SUNY) adult student group were addressed by Lee (2017) in order to determine which ones prevent students from fulfilling their study obligations and completing their studies. The research results pointed to the personal non-involvement of students, insufficient quality of the program, work restrictions, family restrictions, professional non-involvement. The category of situational barriers included, e.g., the lack of time, while the institutional category of barriers comprised of, e.g., students' domestic and work responsibilities or the lack of funds. Lack of energy and perseverance to study (30.8% of respondents) and a lack of understanding of teaching materials by students (23.1% of respondents) prevailed in the category of personal barriers.

4. RESEARCH

The research was carried out as part of the Project of the Technology Agency of the Czech Republic, Faculty of Education, University of Ostrava, in cooperation with the application guarantor of the National Engineering Cluster of the Czech Republic. The project focused on supporting innovation in education in engineering for the needs of the current labour market.

4.1. Research methodology

The empirical research aimed to determine what possibilities of their professional growth students consider, what barriers hinder their growth, and how the school can help to facilitate the growth. After the analysis, empirical findings have been categorised and incorporated under one group of the factors. Its potential share of other factors affecting the level of the studied educational constructs was subsequently determined.

The data were collected through a self-constructed questionnaire with a total of 41 items. For this paper, three open-ended items not limited by the number of facts, or the scope, were selected. The items had the following wording:

1. State what you think could improve your professional growth.
2. State what hinders you the most (what barriers) in the professional study.
3. If you have stated that the school is deepening your interest in the field of study, elaborate how.

Data collection took place in 2020 at five secondary technical schools in the Moravian-Silesian Region of the Czech Republic. The research group consisted of 907 respondents.

An interactive data model (Miles & Hubermann, 1994) was used as the data processing and evaluation technique later commented on and extended (Hendl, 2008). The data processing consisted of several phases: in the transcription phase, authentic student statements were transcribed into concise formulations in the form of empirical concepts. In the segmentation phase, factually related concepts were categorised into individual categories using coding. In accordance with the theoretical concept of effective school functioning (Hattie 2009; 2018), the identified categories of possibilities for improving professional growth and the possibilities of its support by the school were grouped into one of six groups factors. Similarly, in relation to the accepted theoretical concept of barriers to education and learning (UNESCO, 2009), the identified categories of barriers to study were classified into one of three types of barriers.

4.2. Research results
4.2.1. Students' opinions on the possibilities of improving their professional growth

Respondents stated a total of 561 options that could help improve their professional growth. Table 1 shows on the example of three categories with the highest response frequency, how the individual categories were formulated based on coding.

Table 1.
The three most frequently mentioned categories for improving students' professional growth including students' answers.

Category	Number of answers (abs.)	Number of answers (%)	Students' answers = Concepts
Increase the number of hours of practical training at school	113	20%	we have little practical training, I want more practical training at school, I miss more practical training at school, there is a lack of practical training, little practical training, there is little practical training
Learn more on my own	107	19%	I want to learn independently, I lack the drive to self-learning, I learn little on my own, I don't prepare for school enough, I have to force myself to learn more frequently
Increase the quality of teaching across subjects - theory and practice	84	15%	improve practice and professional teaching, more clarity in theory and practice, more world news in mechanical engineering (for machines) and technical theory, gain more experience and practice in the field (technology)

As the graph 1 suggests, the most frequent opinion was "*Increase the number of hours of practical training*" (20% of respondents) - which was stated by students (men) across all year of study of secondary schools aged 15-19. The second possibility of supporting students' professional growth was "*learning more on my own*" (19% of respondents), related more to students (men) aged 16-19. The third supportive way was "*increase the quality of teaching across subjects - theory and practice*" (15% of respondents). Other suggestions from the respondents' answers include: "more contact with machines and things that belong to mechanical engineering", "more representation in theory and practice", "improve the diversity of the type of work in practical training", "gain more experience and practice in the field". The fourth factor supporting the professional development of technical school students was "*better didactic and professional skills/competencies of teachers*" (8% of respondents), mentioned more frequently by students aged 17-19. Respondents' answers include: "better preparation of teachers", "more knowledge of teachers, discussions, better approach", "improve the innovative approach to teaching", "use of new terminology by teachers". The fifth factor was "*change in the content of vocational education*" (6% of respondents) and was mentioned by students of all years of study. From the answers of the respondents, we select: "have a possibility to see all parts of machines and think about their function", "use knowledge of the latest technologies", "see more professional things with your own eyes, touch it, connect theory with practice". The sixth factor in supporting the development was "*more school visits*" (5%) and "*better organisation of teaching in relation to the timetable*" (5%) came seventh. These opportunities for improving professionalism were most frequently

mentioned by students aged 17-18. Other student topics to support the growth of their expertise include "*higher quality of curriculum interpretation*" (4%), "*interest in technology", "engineering*" (3%), "*greater contact with the company*" (3%), "*a part-time job in the field*" (2%), "*higher quality of school aids*" (2%), "*different choice of school*" (2%), "*elimination of the student's own laziness*" (2%), "*finance*" (2%), "*higher motivation of teachers*" (1%).

Graph 1.
Students' opinions on the possibilities of improving professional growth.
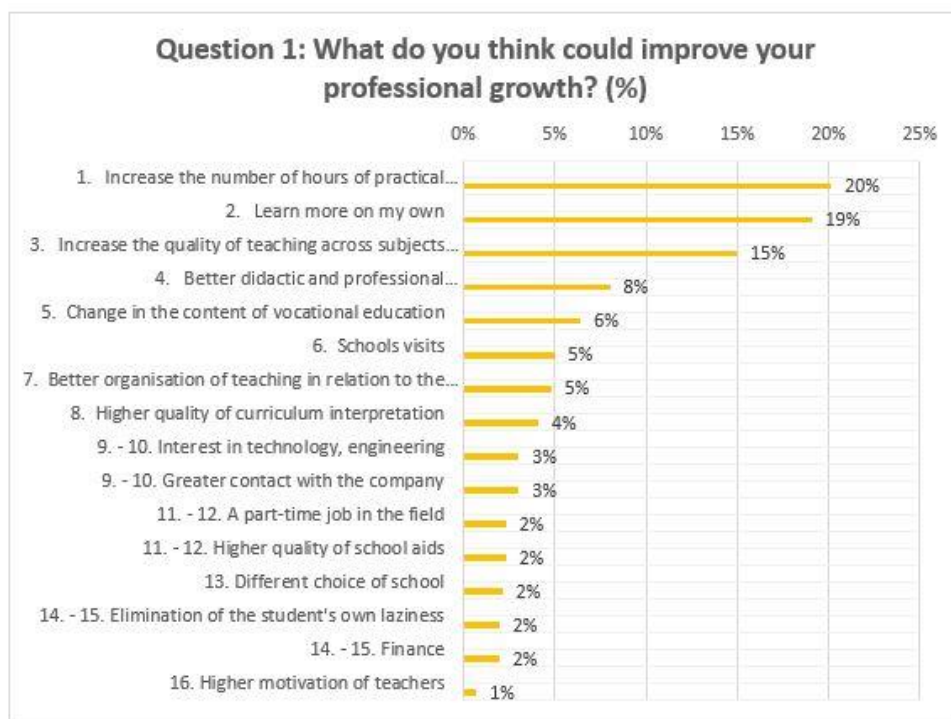
Table 2.
Factors that can improve students' professional growth (according to Hattie, 2009).

Group of factors	Number of concepts (abs.)	Number of concepts (%)	Category
I-student	160	28%	Learning more on their own (19%); interest in technology, mechanical engineering (3%); a part-time job in the field (2%); different school choice (2%); removal of one's laziness (2%)
Content	149	26%	Increase in the number of hours of practical training at school (20%); change in the content of vocational education (6%)
School	96	17%	School visits (5%); better teaching organization and better timetable (5%); greater contact with the company (3%); higher quality of school aids and school equipment (2%); school finance (2%)
Teacher and teaching	156	28%	Increasing the quality of teaching across subjects - theory and practice (15%); better didactic and professional skills of the teacher (8%); higher quality of the teacher's curriculum interpretation (4%); higher motivation of teachers (1%)

Due to the difficulty of differentiating the students' opinions on the possibilities of improving their professional growth towards the teacher's personality and qualifications and his teaching methods, these possibilities of improvement were integrated into one group of factors, "Teacher and teaching".

Based on the above findings (Table 2), the following conclusions can be formulated: Respondents - students of secondary technical schools - most frequently state the possibilities of their professional growth, which belong to groups of factors "I-student" and "Teacher and teaching ", naming both key subjects of education and their activities with "Content" factor group lagging only slightly behind. The students also more sporadically presented the possibilities falling under the "School" category. None of the suggestions for improving professional growth was noted for the group of factors "Family".

4.2.2. Opinions of students on barriers to their professional growth
Respondents mentioned a total of 553 obstacles, which they believe hinder their professional growth the most. Table 3 shows, on the example of the three categories with the highest response frequency, the ways in which the individual categories were formulated with the help of coding.

Table 3.
The three most frequently mentioned categories of barriers to professional growth of students and their saturation by concepts.

Category	Number of concepts (abs.)	Number of concepts (%)	Students´ answers = Concepts
Laziness	107	19%	I'm lazy to learn, laziness and indolence, laziness and procrastination, laziness is my vice, I'm lazybones
Lack of time	90	16%	Insufficient time, lack of time, lack of time to study, I don't have time to devote to school, time is not my friend, I fight against time
Other (unnecessary, non-technical) subjects	54	10%	unnecessary subjects, many unnecessary subjects, subjects not connected with the field, useless subjects, subjects that I will not need in life, meaningless subjects, annoying subjects

Students aged 15-19 most frequently selected "*laziness*" (19%) among the barriers to professional growth. The second barrier to professional growth was "*lack of time*" (19% of respondents), most frequently mentioned by students (men) aged 16-17. The third barrier to development was "*other (unnecessary, non-technical) subjects*" (10%) selected mainly by students aged 15-19. The fourth barrier to professional growth was "*school*" (8%), with the selected answers of the respondents including "my school", "school and self-study", "studying at this school". The fifth barrier to students' professional growth is "*poor teachers - low quality of teaching*" (7%), respondents' statements include "bad teachers", "poor didactic approach of some teachers", "annoying and lazy vocational training instructor in the workshop". The sixth - eighth barrier to development is "*ways of teaching*" (6%). Some of the answers include "everything is very theoretical, and I do not have the opportunity to try how it works", "speed of dictation by the teacher", illogical system of explaining", "a lot of information at once", "insufficient explanation". Other barriers to development include "*other interests*" (6%) and "*little practical training*" (6%). An alarming finding is that students consider "*lack of interest in the field*" (5%) as a barrier to their development. Students stated: " I lost interest in the field during my studies", "lack of interest in studying the field", "lack of interest in the technical field". A total of 5% of students said that they a barrier to their development, a problem called "me". Answers include "my clumsiness", "my brain", "my intelligence", "*myself*". A total of 19 students (3%) considers the "*quality of the curriculum*" to be a barrier to growth, with answers including "uninteresting topics", "information about cars that everyone knows", "lack of information". The twelfth barrier to development is "*I don't know how to do something, I don't understand something*" (3%.), e.g., "because of the amount of theory I don't understand it", "sometimes I don't understand something", "I can't draw". Only 11 (2%) students admitted the barrier of "*learning little*". The list of barriers to growth also includes: "*inattention*" (1%), "*classmates*" (1%), *housework* (1%), *health* (1%). Several students also mentioned barriers: "*transport*", "*money*", "*memory*", "*disruptive digital technologies*".

Graph 2.
Categorisation of barriers to professional growth.
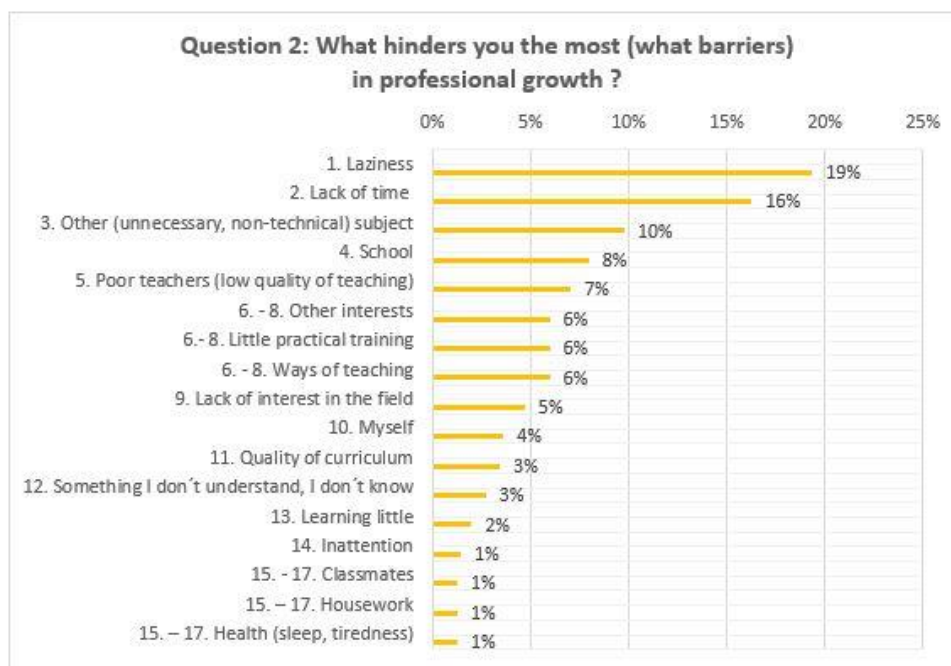
Table 4.
Student-listed barriers by type of barriers (based on UNESCO, 2009).

Type of barrier	Number of concepts (abs.)	Number of concepts (%)	Category
Situational	14	2%	classmates (1%), health, sleep, fatigue (1%)
Institutional	222	41%	other - unnecessary, non-technical subjects (10%), school (8%), bad teachers - low-quality teachers (7%), little experience (6%), way of teaching (6%), quality of teaching (4%)
Dispositional / Personal	317	57%	laziness (19%), lack of time (16%), other interests (6%), lack of interest in the field (5%), myself (4%), something I don't know, something I don't understand (3%), I learn little (2%), inattention (1%), housework (1%)

Based on the above findings (Table 4), the following conclusions can be formulated: More than half of the barriers to study students mentioned belong to the category of dispositional (personal) obstacles. In the second place, students list barriers belonging to the institutional obstacles. Finally, a negligible number of barriers can be labelled as situational obstacles.

4.2.3. Opinions of students on school´s support of their professional growth

A total of 479 respondents (half of all respondents) mentioned 1172 ways they believe the school extends their interest in the field studied. Table 5 shows, on the example of the three categories with the highest frequency of responses, how the individual categories were formulated based on coding to express the ways implemented by the school to expand students' interest in the field.

Table 5.
The three most frequently mentioned categories of school support for professional growth of students and their saturation by concepts.

Category	Number of concepts (abs.)	Number of concepts (%)	Students´ answers = Concepts
Emphasis on practice and its quality	203	17%	at school practice training they show us various aids from engineering practice and real life, I have excellent practice training, I am interested in how things work in practice, which I wanted, practice is a basis of technical field
Motivational factors to study	192	16%	studying engineering is a good and safe job, I want to be good in the field - I make money by studying engineering, I enjoy the world of technology, and it motivates me to work and study with a technical focus, studies support my interest in cars and motorcycles, machines and technologies are the future, machines are my love

School interest in professional growth			the school supports my interest in the field (cars) more than I thought, thanks to the school I understand the professional matter, and I can participate in them, which I suspected, the school is of high quality, in my field it is all as I imagined it, I know more professional things than I did when I started school, the school points out the importance of engineering (e.g. inventor, machine operation), which I expected, I know more professional things than I started school, the school points out the importance of engineering, the school makes me happy, it makes sure that we are good professionals and people
	148	13%	

The most frequently mentioned category of support for interest in the field was "*emphasis on practice and its quality*" (17.3% of answers). The second most frequently mentioned answers fall into "*motivational factors for study*" (16.38%). Category "*school's interest in professional growth*" (12.6%) came on third. Students' fourth most frequently mentioned category is "*excursions to companies*" (11.5% of answers). Students aged 17-19 mainly reported these categories. We state from the answers: "in addition to learning, we deal with things that are not in the curriculum, we have school visits to companies". "They take us on school visits", "school visits combine theory with practice", "I like school visits", "school supports school visits", we enjoy school visits "," I wanted school visits at school, they are here in large numbers ". The fifth most frequent expression of students about the amount of fulfilling the agreement between the ideas about the study and the reality was "*modern (innovative) didactic strategies, methods, forms of teaching*" (8.8%). The answers mostly related to students (men and women) aged 17-19. From the statements of the respondents, we state: "at school, we learn where to find what and how to put it in context", "we have the opportunity to try many procedures in our way", "I can improve, I learn new things, I still want to know more, teaching methods are modern", "learning supports my curiosity and expands knowledge and skills through interesting learning with things that I enjoy", "they show us and explain models and in connection with practice in workshops I learn a lot", emphasis on the functionality of information and finding them", "they actively ask us questions and discuss with us", "the school teaches me and makes me think", "teaching at school takes place through mistake, I learn a lot by learning from mistake, I learn from mistakes".

Graph 3.
Categorisation of school support for professional growth of students.
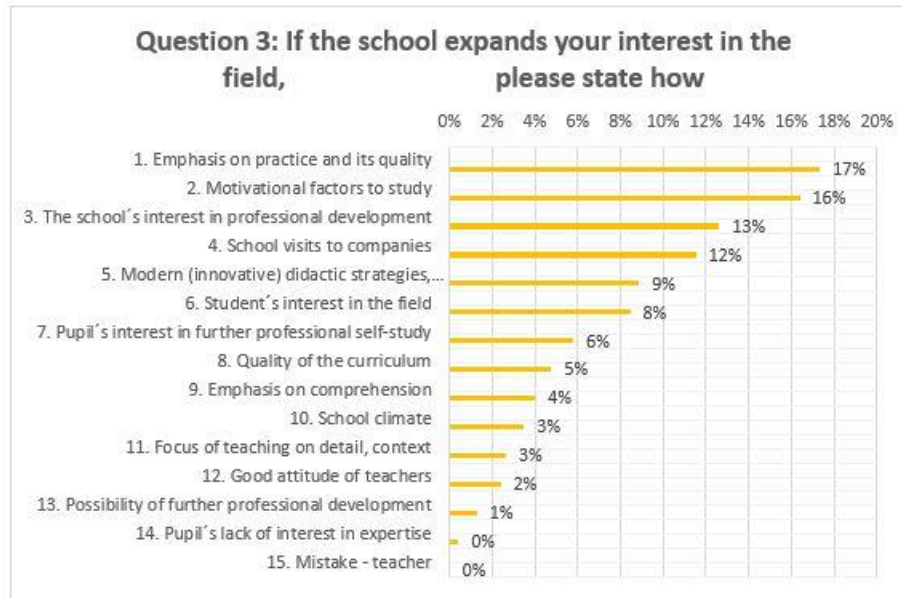
Table 6.
Factors, a school can expand students' interest in professional growth with
(according to Hattie, 2008).

Group of factors	Number of concepts (abs.)	Number of concepts (%)	Category
I-student	364	31%	motivational factors in learning (16%), students' interest in expertise, field (8%), students' interest in further professional self-study (6%), students' lack of interest in expertise, field (1%)
Content	259	22%	emphasis on practice and its quality (17%), quality of curriculum content (5%)
School	339	29%	school's interest in professional growth (13%), excursions to companies (12%), school climate (3%), an offer of further professional growth (1%)
Teacher and teaching	210	18%	modern (innovative) didactic strategies (9%), emphasis on understanding the curriculum (4%), focus on detail, context (3%), good attitude of teachers (2%), error - teacher (0%)

The result of item 3 presented in Table 6 is the following conclusions: The most significant number of students' opinions on how the school should expand their interest in the field was concentrated in the group of factors "I - student". Students also mention possibilities to support interest by means from the group of factors "School". The groups of factors "Content" and "Teacher and teaching " are following with slight differences.

5. DISCUSSION

By categorising students 'views on how to improve their professional growth and incorporating them into the factors, it was found that the most common categories for improvement were to increase the level and quality of internships, increase students' learning efforts and improve teaching. The main improvement factors are students and teachers themselves. Emphasis on professional practice and quality of teaching is currently preferred, among others, by the Hospodářská komora ČR (2021). The emphasis on the fact that students and competent and motivated teachers are key actors in an effective education has also recently been confirmed by a World Bank study (2018).

By categorising students' views on barriers to their professional growth and incorporating them into the types of barriers, it is possible to state that the most frequently mentioned categories of barriers include laziness, lack of time and unnecessary subjects in the study program. Furthermore, the aggregation of categories into types of barriers showed that the most common barriers are dispositional (personality), followed by institutional and situational barriers. An American study came to very similar conclusions (Lee, 2017).

The students' views on the role of the school in extending their interest in the field of the study showed they see it primarily in their motivation to study and stimulate the relationship to the chosen field, which can be included in the group of factors. "I-student". It is followed by a group of "School" and "Curriculum" factors according to the frequency of students' statements. The 30 factors listed according to the educational effect by Hattie (2009) can be, with a certain tolerance, used to compare our findings. While the group of factors "Student" ranks fourth according to the size of the expected effect on his list, in our research, it ranks first. The group of factors "School" is in second place in our ranking, while according to Hattie, it would belong to the fifth ranking. According to our research, the "Curriculum" ranks third compared to the second place on Hattie's list.

6. CONCLUSION

We understand the reflection and self-reflection of educational reality by students as one of the highest evaluation categories with considerable educational potential. Through self-reflection, students can realise the stimulus for developing their personality, facts affecting their knowledge growth, or barriers hindering their professional growth. Therefore, effective educational communication of the school with the students' parents and the students themselves about barriers to education and the offer to develop plans for solving selected educational barriers (INEE, 2010) is a necessary educational support for students 'professional growth. The presented results of research based on reflections and self-reflections of high school students allow us to state that current students of the examined age cohort can think critically about their approach to education, barriers to study and school opportunities to support their interest in the field as a critical component of their study motivation and commitment.

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A View of Secondary Technical School Students on the Support and Barriers to their Professional Growth

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Chapter #12

ANALYSING LESSON-BASED INTERVIEWS WITH PRE-SERVICE GENERALIST TEACHERS WHO LEAD CLASS SINGING

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ABSTRACT

In pre-school and primary schools, teaching songs and leading class singing are often entrusted to generalist teachers. During their training, they are expected to attain and/or consolidate subject-specific skills. Research has yet to explore how generalist teachers make sense of their song-leading lessons and become familiar with subject-specific knowledge and skills. Using interviews based on video-recorded lessons from 10 pre-service generalist teachers, this study examines how each teacher experienced and managed leading class singing in their three-year training. The analysis includes the use of the visual tool Lesson Activities Map (LAMap), which is a graphical system for the organisation of lesson activities and is valuable for ensuring consistency in the interpretation of lesson-based interview analysis. This chapter presents a case study and offers implications both for the dissemination of new visual analytical methodologies in education and for understanding the teaching experiences of generalists involved in the professional development of teaching songs and leading class singing.

Keywords: generalist teacher, pre-service teacher, song teaching, professional development, reflexive thematic analysis, lesson activities map.

1. INTRODUCTION

Singing is one of the key musical activities, along with listening activities and school performances, undertaken by generalist teachers. Teachers generally integrate singing into the supporting aspects of classroom practice, such as discipline and concentration, social inclusion, relaxation and information memorisation (e.g., King, 2018). However, singing as a musical activity on its own is an unexplored field in generalists' practice. In the context of formal song transmission, we consider it important to make explicit the didactic relationship between the song, teacher, and children. Songs are very complex, structured models that conform to cultural norms and musico-linguistic rules. The teacher is the mediator between the song, as the cultural content, and the children. When teaching songs, teachers convey both musico-linguistic rules and cultural feelings. The purpose of singing in school is often the transmission of cultural heritage and the representation of collective and national identity. Therefore, we empirically explore how teachers teach songs, focusing on their self-evaluation regarding professional and aesthetic norms (Stadler Elmer, 2021).

2. STATE OF THE RESEARCH

Many studies have transversely investigated music education delivered by generalists, but few have explored class singing on its own, including the comparative studies by Liao and Campbell (2014, 2015). Some researchers have addressed the generalists' strategies to

increase confidence in their music skills, while others have studied their self-efficacy to teach music (e.g., De Vries, 2013; Collins, 2014; Jeanneret & Stevens-Ballenger, 2013; Nethsinghe, 2017; Barrett, Zhukov, & Welch, 2019). During training, teachers encounter difficulties with developing and furthering their skills across all subjects set by the curricula. They have limited time for their own music preparation, and when they are in-service, they have difficulty fitting music lessons into their weekly schedules because they must prioritise other subjects (e.g., Russell-Bowie, 2009; De Vries, 2014). It is important to complement this static view of problems with a dynamic view, considering the development of knowledge and skills in terms of changes over time.

How generalists comment on, reflect on, and understand their practice of teaching songs in relation to the development of specific knowledge and skills is still an underexplored field in music education research. In one of the only related studies, Russell (1996) examined generalists' reflections on their professional music skills using excerpts from the diary of a pre-service teacher in primary education. This chapter contributes to the research and knowledge of the professional development of generalists when teaching songs and leading class singing, both in terms of music education content and the development of new analytical methodologies in this field.

3. OBJECTIVES

As a research team, we aim to describe and understand how pre-service generalist teachers develop professional skills and knowledge to teach songs in class. To this end, this chapter presents a longitudinal case study involving a teacher named Ruth. We focus on the analysis of interviews based on three internship lessons to reconstruct how Ruth's statements about her leading of class singing changed over her three-year training course.

4. DESIGN

All ten participants in our study had been attending their three-year generalist training. According to national ethical requirements, they voluntarily took part in one recording and interview session per year. We asked the pre-service generalist teachers to carry out a class singing lesson lasting about 30 minutes with children aged between four and eight years old. After the lesson, we conducted an interview while watching the video with the teacher. Lesson-based interviews allow teachers to distance themselves from the lesson they just led by looking at the event and themselves from a different perspective. Teachers were asked to pause the recording whenever they wanted to comment on, reflect on or explain something. Two of the research team members were there during the lessons and moderated the interviews. This research is part of a team research project. The case study presented below was analysed by the author of this chapter.

5. METHOD

The interviews were first audio-recorded, transcribed by our team using conventions suited to the purposes of the analysis (Edwards, 1993) and examined inductively with a reflexive thematic analysis (Braun & Clarke, 2006). The analysis was framed within the epistemological approach characterised by the didactical paradigm "teacher-content-children" (e.g., Stadler Elmer, 2021). The generation of themes was guided by a semantic interpretation based on the relationships between experience, meaning and language (Wooffitt & Holt, 2011). The level of abstraction was orientated towards video

analysis performed in conjunction with the analysis of the interviews. As each interview was conducted by watching the video-recorded lesson, the teachers' statements were often triggered by the activities they observed in the recorded lesson. We transcribed the video-recorded lessons using the Lesson Activities Map (LAMap) methodology (Savona, Stadler Elmer, Hürlimann, Joliat, & Cavasino, 2021). The LAMap transcriptions are visual analysis tools that allow us to systematically describe the lesson. In this way, we gained a reliable coherence within the themes of the reflexive interview analysis, and in addition, we gained corresponding evidence with the actions observed in the videos. We then combined the LAMaps with the reflexive thematic analysis of the interviews. Indeed, in the interviews, "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon" (Boyatzis, 1998, p. 63) is often the lesson activity that can be visualised with the LAMap. We particularly combined the LAMap with phases 2 (generating initial codes), 3 (finding themes) and 4 (reviewing themes) of the reflexive thematic analysis, as outlined by Braun and Clarke (2006). The LAMap serves to systematically locate the initial codes of the interview sections throughout the lesson (phase 2), contextualise interview extracts relating to the same code to check their consistency before nominating them for potential themes (phase 3) and to create a mind map of the initial themes generated (phase 4) (Savona, 2021).

6. DATA ANALYSIS

I led the analysis of Ruth's case study and began by immersing myself in the data by repeatedly listening to the recorded interviews to transcribe them and reading them to become familiar with the structure and content. Then, I identified analytically relevant features and assigned initial codes. I was aware that my professional experiences could influence and potentially constrain the way I interpreted the data; therefore, I recoded the transcripts a second time (November 2020, March 2021). The recoding generated some new codes and revised existing ones. Then, I searched for coherence with the initial codes and began to generate preliminary themes. I redefined the themes and sub-themes and assigned them names and definitions (see Figure 1). From this procedure, I reconstructed Ruth's stated perspectives while watching her three video-recorded lessons. All analysis phases were discussed by the research team. Figure 1 shows an example of how to read the results of the reflexive thematic analysis.

Figure 1.
An example of how to read the results of the reflexive thematic analysis.
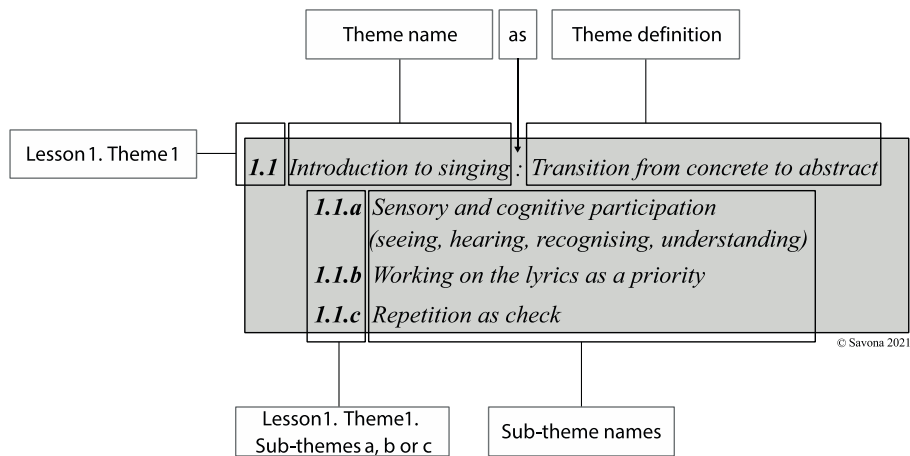
Figure 2.
A, B and C show the combination of the thematic maps developed from the interview analysis with the respective LAMaps of Ruth's three lessons. The lower part of the figure displays the LAMap key.
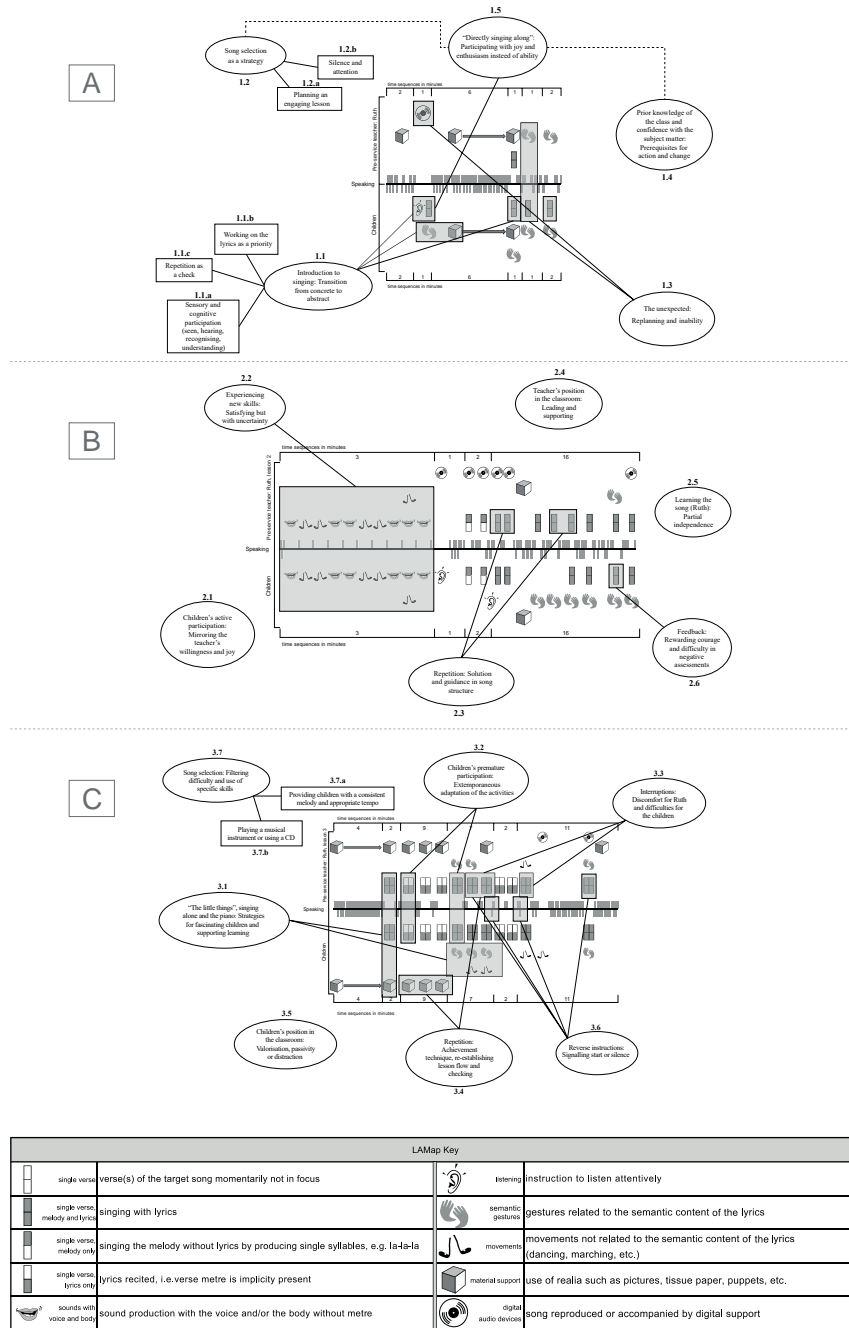
Figure 2 shows the analysis of the interviews with the respective LAMaps (first-, second- and third-year lessons). Some themes and sub-themes are anchored on the LAMaps because I generated them from Ruth's comments about certain lesson moments. On the LAMaps, Ruth's moments of interest are highlighted with grey fields. I developed the themes and sub-themes that are not anchored on the LAMaps from the interview extracts in which Ruth distanced herself from the lesson while watching the video and talked about related topics in dialogue with us moderators. In the next three sections of this chapter, I report on the themes and sub-themes and how I generated them. Finally, I discuss the changes in Ruth's statements about her moments of interest while watching her song-leading lessons in her internship.

6.1. First-year lesson-based interview

The first-year lesson-based interview with Ruth lasted 12 minutes and 14 seconds. The analysis produced five interrelated themes. Some have sub-themes (see Figure 2A).

Introduction to singing: Transition from concrete to abstract

    a   *Sensory and cognitive participation (seeing, hearing, recognising, understanding)*

    b   *Working on the lyrics as a priority*

    c   *Repetition as a check*

I generated the theme *Introduction to singing as a transition from the concrete to the abstract* from Ruth's statements on the lesson moment in which the children listened to the song and simultaneously arranged pictures according to the content of the lyrics. A song is a complex, abstract entity, and for Ruth, it was necessary to find step-by-step transformations to make it learnable for the children. According to Ruth, the transition from the concrete to the abstract begins with "seeing" and "hearing". If children "recognise" what they can "see" and "hear", they can "understand" a song even if it is not something material. Ruth prioritised the teaching of the lyrics because she considered them to be the link between visual information (pictures or semantic gestures) and listening. By saying "alongside listening", it seems that Ruth considered listening as the main activity, but it was not sufficiently concrete enough to be performed independently of visual activities; thus, "alongside listening" was used. Ruth wanted to give the children a holistic experience by "linking together" pictures and semantic gestures with the lyrics. These activities are important "at the beginning of the lesson" because the lyrics allow the children to figuratively imagine the song and make it a more concrete entity. According to Ruth, lyrics are a song component that guarantees the transition from the concrete to the abstract, and for this reason, working on the lyrics was a priority. To ensure that everyone understood the lyrics, Ruth recited them and repeatedly played the CD version of the song. She asked the children to arrange pictures according to the content of the lyrics, then check the order while listening to the song repetitions. I generated the sub-theme *Repetition as a check* because the pictures were the means by which Ruth could ensure that the children understood the relationship between them and the song lyrics.

Song selection as a strategy

    a   Planning an engaging lesson

    b   Silence and attention

In lessons prior to her first song-leading lesson, Ruth had already sung with the children but only "songs they already knew". For this lesson, Ruth chose a new song (i.e., one the children did not know); she wanted to try teaching a new song for the first time. My analysis generated the theme *Song selection as a strategy* because Ruth not only had goals but also expectations about teaching something new. Her goal was "for the children to learn a new song that is not the usual one". Based on this, I generated the sub-theme *Planning an engaging lesson*, as Ruth wanted to fascinate the children with something unusual. The sub-theme *Silence and attention* was generated by Ruth's expectation that "the children would be quieter and more attentive if they did not know the song because they would be unable to sing directly with me or to make the semantic gestures". When she played the CD at the beginning of the lesson, the children immediately started to sing. At that moment, Ruth's expectations of her strategy were shattered by the fact that – unbeknownst to her – her supervisor had introduced the song to the children in a previous lesson. Ruth was irritated. Thus, I generated the theme *The unexpected: Replanning and inability*, which I explain in the next paragraph.

The unexpected: Replanning and inability

In the first year's LAMap (see Figure 2A), we can see that Ruth and the children worked first with pictures and then with semantic gestures. Ruth had planned two activities: first, the children had to arrange the pictures and "check by themselves if they were in the right order" and second, "sing again and collect ideas for semantic gestures in the second part of the lesson". Since she found that the children already knew the song, Ruth had to adapt her planning extemporaneously. The result was as follows: instead of letting the children check the pictures themselves, Ruth helped them both to arrange the pictures and to check their progression; she thought it was no longer necessary to continue working on the song lyrics, as they already knew the song. Additionally, asking for the children's suggestions for semantic gestures "was kind of missed out because the children had learned the gestures with the other teacher", according to Ruth. In the first year's LAMap we can see that at the end of the lesson, Ruth only performed the semantic gestures while the children were singing. The event began with the children's spontaneous initiative, and thus without Ruth's instruction, because they already knew the song.

This unexpected circumstance also had consequences for both her classroom management and her song-leading skills. Some of the children wanted to show Ruth that they already knew how to sing the song, so they took a few steps ahead of the rest of the group and arranged themselves in front of her. For Ruth, "it was difficult to listen to everyone". Yet, she did not notice that the children were singing the song incorrectly. As soon as she watched the video, however, she noticed that the children were mainly reciting the lyrics; she commented on the melody she heard that "they don't know it well". Ruth said she felt like she had been "thrown into cold water" because, in other lessons she had attended, she had "always just listened". According to this comment, listening was a passive activity for Ruth. However, I generated the next theme.

Prior knowledge of the class and confidence with the subject matter: Prerequisites for action and change

In lessons where she "always just listened", Ruth noticed the enthusiasm with which the children participated in singing. This helped her become familiar with the class and confident in her ability to teach a new song for the first time on her own. After those lessons, Ruth thought that "it will go well with the children anyway" and commented that it was encouraging because it "took away some of the fear". In her first-year lesson, Ruth used a CD because she did not want to sing unaccompanied in front of the children. Familiarity with the subject matter and the class seems to be necessary when trying out specific skills, such as singing a cappella. In the interview, Ruth said that this was "what I will do next time". This is significant for her professional development, as it is a sign that she had set her sights on her future lessons.

"Directly singing along": Participating with joy and enthusiasm instead of ability

In the lessons Ruth attended in which her supervisor led class singing, Ruth had never experienced the children's learning a new song because they worked only on songs that were part of the class's repertoire. Ruth noticed that each time they "sang directly with the teacher". Why did the children "directly sing along"? How did Ruth interpret this occurrence?

Ruth had no way of knowing whether the children sang at the beginning of the lesson because they knew the song already, sang intuitively or sang by habit, despite not knowing the song correctly yet. In section *1.2 Song selection as a strategy*, we saw that, for Ruth, "singing directly" resulted in classroom noise. Her expectation was that if the children did not know the song from the beginning, they would be quieter and more attentive because they would not sing directly with her or make semantic gestures from the beginning. Yet, while watching the video, she noticed that the children knew "only the lyrics and semantic gestures but not the melody". As a result, Ruth's understanding of "directly singing along" shifted from the idea that the children would sing along only if they had learnt the song to the idea that, regardless of whether they were singing correctly, they express their joy and enthusiasm simply by participating.

6.2. Second-year lesson-based interview

The second-year lesson-based interview lasted 47 minutes and 6 seconds. The analysis generated six themes (see Fig. 2B).

Children's active participation: Mirroring the teacher's (Ruth's) willingness and joy

What Ruth liked most about this second lesson was that the children showed "joy in singing". She attributed this to the "willingness" she had to sing with the children, which made the lesson seem less like a "duty". The children's active participation showed Ruth that she had achieved her goal of involving them in singing. In addition, Ruth experienced singing at school outside of music lessons. Her supervisor told her that she – herself as teacher – does not often sing with the children because she believed she was "not musical"; thus, she asked Ruth to sing from time to time in other lessons. In these situations, Ruth experienced the joy the children had when they sang with her.

Experiencing new skills: Satisfying but with uncertainty

Ruth commented that vocal warm-ups are "important to prepare the voices of teacher and children" and should be done "always at the beginning". As we can see on the LAMap, Ruth tried it "for the first time" at the beginning of the lesson and was satisfied with the result. However, she was not sure how long the activity should have lasted to be "really effective".

Repetition: Solution and guidance in song structure

I generated this theme from Ruth's statements about parts of the lesson where she stopped the song and started again from where they had stopped. For Ruth, "it was difficult to start in the middle of the song" and it would have been easier to "repeat it from the beginning".

Teacher's position in the classroom: Leading and supporting

Throughout the lesson, Ruth and the children were positioned in a circle. Ruth always stood and the children sat on the floor. The analysis generated a pattern of shared meanings about Ruth's physical position in relation to the children. For Ruth, if she were standing and the children were sitting, "there [was] more tension"; if everyone was standing, it was "better for singing". Ruth was still very uncertain and unsure which decision is the right one as she noticed that some children watched her lip movement and thought it would be easier for them if she sat in their line of vision.

Learning the song (Ruth): Partial independence

About the song she wanted to teach, Ruth said "I knew this song from my childhood", but she used musical support software (MuseScore) to prepare herself for the lesson. By entering the notes of the song, Ruth could "listen to the tune separately". With this software, Ruth could learn the song independently, but she said "it was difficult for me to learn the song only from the CD or the sheet music", because it was difficult to "get the starting pitch" which was "the hardest thing" for her. Ruth said she would prefer to work on the song with the singing teacher in her training course and planned to do so for future lessons.

Feedback: Rewarding courage and difficulty in negative assessments

During an episode in the lesson in which a child started to sing before the others did, Ruth commented that she should have "rewarded" him at that moment because of his courage to sing alone. Based on this and other statements, I generated shared meanings concerning her ways of giving or avoiding feedback. For example, Ruth found it difficult to give negative feedback. In fact, Ruth commented "I didn't know how to tell the children that they were singing wrong".

6.3. Third-year lesson-based interview

The interview about the third-year lesson lasted 1 hour, 34 minutes and 36 seconds. The analysis generated seven themes (see Fig. 2C), one of which has two sub-themes (theme 3.7).

"The little things", singing alone and the piano: Strategies for fascinating children and supporting learning

Ruth considered "singing alone" to be the "most noticeable change" in her training. For her, "it [was] not difficult, but it takes courage to be audacious"; in this lesson, she felt "more confident". Experiencing this skill at the beginning of the lesson, Ruth noticed that the children were "quieter and listened more" than when she used a CD. Furthermore, when she used a CD, there was generally less singing and the children "dared to participate more even though they were reciting more than singing". Ruth said that she can play the piano but there was no instrument in the classroom. Playing the piano was something she would have done, "more for the children" than for herself, because such things fascinated them, as did "the little things" like puppets, pictures and semantic gestures, according to Ruth. Aside from being tools used to create a narrative frame for the song, Ruth commented that using them helped the children learn the lyrics because they could say "longer sentences and more words".

Children's premature participation: Extemporaneous adaptation of activities

This theme was generated by the shared meanings of Ruth's comments about two lesson episodes. In one episode, Ruth wanted the children to recite lyrics after her, and in the other, she wanted them to sing after her. According to Ruth, the two activities did not work because the children "recited and sang directly along" with her. For Ruth, the children sang along earlier than expected because they already knew the song. Ruth had chosen an "old song" – a no longer commonly taught one – and was surprised that some of the children already knew it. This unexpected situation no longer seemed to irritate Ruth as it did in the first lesson, though. This time, she adapted the activities extemporaneously.

Interruptions: Discomfort for Ruth and difficulties for the children

In several lesson episodes, Ruth needed to stop the singing because some children were being disruptive. Ruth gave meaning to these uncomfortable moments because "it [was] difficult to get back into the flow of the song". For her, interruptions are "sometimes necessary to get the attention of children who do not participate" but also are as a "punishment" for children who sing and participate enthusiastically. During other teaching experiences, Ruth learned from her supervisor to be "stricter" and, if necessary, interrupt the lesson flow. However, interruptions can indicate that the children are having difficulty, according to Ruth. For example, in another episode commented on by Ruth, the speed of the song increased as they sang, and Ruth noticed that some children lost synchronicity and stopped clapping when they could no longer keep time. This made them stop participating in the flow of the song.

Repetition: Achievement technique, re-establishing lesson flow and checking

The analysis generated three shared meanings for the theme *Repetition*. For Ruth, repeating the song balanced out the distraction caused by the interruptions and re-established the order and flow of the lesson. Ruth's explicit aim for this lesson was for "all the children to participate actively". Repetition gave them the opportunity to participate at their own learning conditions. After the children arranged pictures according to the meaning of the lyrics, repeating the song allowed them to check if the order was correct.

Children's position in the classroom: Valorisation, passivity, or distraction

At a moment in the third-year lesson, some of the children were told to sit and listen and clap their hands while others stood on the chairs and sang. Ruth noticed that the children "sang more" when standing on the chairs, as they seemed to feel valorised, and expressed how much they appreciated being in the spotlight through energetic singing. In contrast, Ruth said that "sitting and watching was difficult" for the other children and that some stopped participating. Free movement reduced eye contact between her and the children, and when they moved, the children "[got] euphoric" and it was difficult for Ruth to ensure that they would "focus on the essentials". In the lesson, Ruth and a group of children sang and clapped their hands on their legs while sitting in a circle. Another group of children had to move like penguins within the circle. Some of the seated children did not clap their hands because they could not see Ruth through the moving children. Hearing Ruth clap her hands was not enough for the children to do the same. Ruth herself could not see that they were not clapping and regarded the lesson as "chaotic" because of the difficulty of not being in control of the children's participation.

Reverse instructions: Signalling a start or silence

Ruth "unconsciously" counted "1, 2, 3" to start singing. That reminded her of the fact that her supervisor always said "3, 2, 1" to quiet the children when they got too loud. According to Ruth, counting "1, 2, 3" to start singing countered the children's learnt habit of quieting down when the teacher said "3, 2, 1".

Song selection: Filtering difficulty and use of specific skills

    a   Providing children with a consistent melody and appropriate tempo

    b   Playing a musical instrument or using a CD

Ruth told us that she had initially chosen a different song, but she changed it because she did not want to use the CD available. Ruth noted that the song's version on the CD was "extremely fast" and "not properly" sung; thus, she neither could provide the children with a consistent melody nor slow down the song's tempo. In her training, Ruth learned to play the piano but had not yet experienced using it in the classroom. Ruth said that if she could have used a piano, she would have played the "pure melody" for the children and "slowed down the tempo". For Ruth, a CD is a useful tool "more for me" than for the children; she can learn the song as she listens to it while "preparing for class".

7. DISCUSSION AND CONCLUSION

In this section, I discuss the results of the analyses of Ruth's three interviews, based on her video-recorded internship lessons. By summarising a comprehensive analysis of Ruth's case study, I created a narrative reconstruction of her professional development regarding leading class singing. Using reflexive thematic analysis (Braun & Clarke, 2006), I aimed at obtaining an overview of the changes in her practice from her own perspective. The results show common patterns in the three interviews as well as differences between them.

The first persistent theme was Ruth's interest in the children's participation. The analysis of the first-year interview revealed that "singing directly together" meant that the children participated regardless of whether they knew the song, were able to perform it correctly, or were listening to it for the first time. Ruth realised that the children expressed joy and enthusiasm when singing. Indeed, singing is a cultural practice that affects children positively because they usually associate it with pleasant affective states (Stadler Elmer, 2015). In the second year, Ruth developed her ideas about this with a focus on her own teachership. One of her lesson goals was to actively engage the children, and she felt she achieved this by conveying to them her joy and motivation to sing.

The second persistent theme was about song repetition. When teaching and learning songs, repetition is crucial: the teacher should present the song repeatedly as a whole and segment it into parts, and the children should likewise repeat it in parts and as a whole to adopt it. In the first-year interview, rather than being a tool for song segmentation, Ruth saw repetition as a double control tool. On the one hand, the children could check that the picture sequence corresponded to the song lyrics. On the other, Ruth could check that they all understood the lyrics because they put the pictures in the right sequence. In the second year, repeating the song overcame the difficulty Ruth had with restarting it when she and the children stopped singing. This indicates the difficulty Ruth had with segmenting the song, both for her and for the children, at this stage of her professional development. In the third year, repetitions of the song gave each child the best opportunity to learn it; that is, they could listen to the song as many times as necessary to fit their individual learning conditions. Furthermore, repeating the song restored the flow of the lesson after interruptions and chaos were settled.

The analysis also generated themes about general teaching skills and subject-specific skills for teaching songs and leading class singing. Ruth responded differently to unexpected situations. Whereas in the first year she was unable to improvise lesson activities when the unexpected happened, in the third year, Ruth was much more flexible and adapted her plans. For example, when the song speed increased as they sang, some children stopped singing and clapping because they could no longer keep time. Ruth noticed this and stopped singing to allow the children to come together again.

The themes generated by the first-year interview were more theoretical, such as the idea that a song is abstract content that becomes concrete when presented in picture form. The themes generated in the second- and third-year interviews showed that Ruth's interests during video watching became increasingly specific. In the second-year lesson, Ruth paid attention to her position in the classroom. She wondered about the advantages and disadvantages of standing versus sitting while the children were sitting in a circle. Ruth noticed that standing communicated leadership but thought that sitting in the children's line of vision might help them learn the lyrics by lip-reading. In the third-year interview, she focused on three different positions the children took: standing on chairs, sitting and moving freely. Ruth's statements focused on the levels of attention relating to these positions. Standing on chairs to sing was valorising and therefore desirable; sitting was passive and moving was distracting. The latter two offered fewer perceived benefits, but were nevertheless important to the variety of the lesson.

Interestingly, it was not until the third year that Ruth showed any interest in the way she gave feedback. Because she had developed specific skills to work on individual components of a song, such as the melody, her feedback could be much more critical in the third year than in the first and second years. However, Ruth stated the difficulty she had dampening the children's enthusiasm with negative feedback.

Ruth's song selection skills changed considerably from the first to the third lesson. The analysis of the first-year interview showed that Ruth selected the song based on rather general considerations, namely, choosing something new to fascinate the children. The analysis of the second-year interview did not generate any theme related to this aspect, but the theme was generated again by the analysis of the third-year interview. There were new, more specific reasons for the song selection: Ruth wanted to use a CD on which the song was sung with a stable melody and an appropriate tempo. Whereas in the first-year lesson Ruth chose a new song to fascinate the children, in the third-year lesson, she stated that a narrative frame can also be created by using musical instruments, puppets and pictures.

The themes generated by the second-year interview prompted Ruth to comment on the development of her song acquisition skills, either through listening to a CD or using the MuseScore software. Analysis of the last interview showed for the first time, statements on a cappella singing, which Ruth described as her "most noticeable change" during her training.

This report on Ruth's development over her three-year training as a generalist teacher was based mainly on her statements about her annual video-recorded lessons. The key activities in each of these lessons were graphically represented by LAMaps, which provided a framework of events to contextualise Ruth's statements during the three lesson-based interviews. The thematic analysis of these resulted in the development of the themes and sub-themes of the lessons. Combined, they demonstrate the complex ways in which Ruth first managed and then talked about her experiences of teaching songs in class during her three-year training. The methodology and results of the analysis presented in this chapter contribute to the knowledge of the professional development of generalist teachers leading class singing. Using the LAMaps, I systematically located and described the moments in the lessons that led to the teacher's statements. This offers a convincing coherence between the observed actions transcribed in the LAMaps and the themes generated by the interview analyses. Using this methodology, I reconstructed the meanings Ruth gave to her class singing lessons during her training.

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Chapter #13

THE DEVELOPMENT, PILOTING AND ADMINISTRATION OF AN INSTRUMENT TO MEASURE NATURE OF SCIENCE UNDERSTANDING

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ABSTRACT
The study describes the development of an instrument to measure the Nature of Science (NOS) understandings in high school Science teachers. The instrument was initially piloted on two high school teachers in South Africa, one teaching Life Sciences and the other Physical Sciences. It was subsequently used to measure NOS understanding in 10 high school Science teachers in South Africa over 6 months in 2021. The objective of the study was to construct a questionnaire that could measure NOS understanding based on the Family Resemblance Approach (FRA) and the Consensus View (CV). The NOS is a construct that has been defined by various scholars and there exist multiple perspectives. For this study, two perspectives that define NOS, the CV of Abd-El-Khalick and the Reconceptualised Family Resemblance (RFN) approach to NOS of Erduran and Dagher were considered. To collect data on NOS understanding, the researcher compared the Views of Nature of Science (VNOS) instrument used to capture NOS understanding under the CV, and the RFN questionnaire used to capture NOS understanding under FRA and compiled an Integrated Family Views of Nature of Science (IFVNOS) questionnaire. The findings revealed that the IFVNOS questionnaire developed can be used as a reliable tool to measure NOS understanding.

Keywords: views of nature of science, family resemblance, consensus view.

1. INTRODUCTION

This chapter describes the development and administration of an instrument to measure Nature of Science (NOS) understandings in Science teachers. The study was carried out in two phases: phase 1, the development and piloting of the instrument; and phase 2, the administration of the instrument to 10 in-service Science teachers in South Africa over six months in 2021. The NOS is a construct that has been defined by various scholars and there exist multiple perspectives. For this study, two perspectives that define the NOS, the Consensus View (CV) (Abd-El-Khalick, 2013a) and the Reconceptualised Family Resemblance approach to NOS (RFN) (Erduran & Dagher, 2014) were considered. Based on these two perspectives, the researcher developed an analytical framework, the Integrated Family Views of Nature of Science (IFVNOS) and then developed a questionnaire based on this framework to assess views of NOS based on IFVNOS. The aims of the study are listed below.

Aims
- To design an instrument to measure views of NOS based on the CV and RFN.
- To pilot the use of the instrument to measure views of NOS of in-service Science teachers.
- To measure NOS understanding of 10 in-service Science teachers.

2. BACKGROUND

2.1. The nature of science

The NOS is a multifaceted construct that cannot be simply defined by one explicit definition. Rather, it is a concoction of attributes and a combination of at least seven aspects as defined by Lederman (1998), known as the tenets of NOS. The tenets are: Empirical; Inferential; Creative; Theory-driven; Tentative; Myth of The Scientific Method; Scientific theories; Scientific laws; Social dimensions of Science; and Social and cultural embeddedness of Science. NOS knowledge has been a goal of Science education reform for decades of years internationally and in South Africa where this study was conducted (Lederman & Lederman, 2019). Research has shown that understanding NOS is necessary for various attributes of an individual, including the promotion of responsible citizenship locally and globally (Smith & Scharmann, 1999), by ensuring that individuals can participate in decision making about socio-scientific issues through their acquired scientific knowledge (Driver, Leach, Miller, & Scott, 1996). Literature has, however, shown that the NOS is a concept that is naively understood globally. Akerson, Abd-El-Khalick, and Lederman (2000) have revealed that regardless of the level of education, there is an international inadequate realization of what the NOS is by Science teachers. Linneman, Lynch, Kurup, Webb, and Bantwini (2003) revealed that South Africa is no exception to the case and proposed that this naïve understanding of NOS can be attributed to a lack of formally acquired NOS knowledge by the teachers. Studies regarding NOS understanding have shown that explicit and reflective teaching is the most effective approach for improving teachers' NOS views (Akerson et al., 2000; Lederman & Lederman; 2019). However, this approach is not necessarily reflected in teacher education programs in South Africa (Ramnarain, 2017). The misconceptions of NOS could possibly be due to the complexity of defining what NOS is.

The NOS tenets defined by Lederman are widely accepted to be a representation of the CV of NOS and have been used as the framework for analysing NOS pedagogical views in Science students and their teachers (Kruse, Easter, Edgerly, Seebach, & Patel, 2017), for a representation of NOS in textbooks (e.g., Abd-El-Khalick, 2013b; Ramnarain & Chanetsa, 2016), and for the analysis of curriculum documents worldwide (Lederman, 2007) to name but a few. Reliable and valid instruments for NOS analysis based on the CV have been developed and used by researchers over decades such as the Views of Nature of Science Questionnaire (VNOS) developed by Lederman, Abd-El-Khalick, Bell, and Schwartz (2002). It is for these reasons of reliability and validity that the CV contributed to formulating the framework used to analyse the views of NOS in this study.

In more recent times, scholars have challenged the CV of NOS and highlighted shortcomings in its tenets as not encompassing economic, political, philosophical, social, and financial systems of Science (Erduran & Dagher, 2014). The Family Resemblance Approach to Science (FRA) has been developed to depict Science in a holistic system with dynamic interactions. This view of Science by Irzik and Nola (2010) adopted the generic definition of family resemblance coined by Wittgenstein in 1958. They proposed four categories of the FRA that reflect NOS as: a) activities; b) aims and values; c) methodologies and methodological rules; and d) products, which they substantiated had none of the shortcomings of the CV of NOS. Dagher and Erduran (2016) added categories of 'social organizations and interactions', 'political power structures', and 'financial systems' to FRA. This addition was made to highlight that Science is impacted by societal and cultural factors. The FRA has several authors but the work of Erduran and Dagher, who developed RFN, was considered in this study as their terminology appeals to science

education and applies to the Science curriculum. The RFN defines NOS using categories of aims and values; methods; scientific practices; scientific knowledge; social certification and dissemination; scientific ethos; social values; professional activities; social organizations and interactions; financial systems; and political power structures.

2.2. Conceptual framework

In designing the integrated aspects of the NOS conceptual framework, the researcher analysed both the CV tenets and RFN categories. Ideally, the framework used in this study should comprise explicit statements such as those in the CV, as the researcher found these to be user friendly in content analysis of textbooks. This study formed part of larger research aimed at improving NOS understanding amongst teachers through the use of textbook analysis. It was found that the CV makes use of explicit tenets descriptive of independent NOS aspects, while the RFN represents a holistic interactive dynamic system of NOS categories. Research on RFN is limited and not widely spread at the time of writing this chapter. There is, however, sufficient evidence and reliable sources to validate the use of its instruments in Science education. Studies have been carried out in pre-service teacher education courses on NOS in Turkey using the RFN approach (Kaya, Erduran, Aksoz, & Akgun, 2019), and findings from this study have contributed to the understanding of how NOS can be incorporated into Science teacher education using RFN. The RFN has also been used in analysing the content of USA and Turkey curricula (Kaya & Erduran, 2016) and in investigating coherence about the NOS in Science curriculum documents of Taiwan (Yeh, Erduran, & Hsu, 2019).

The researcher found that within RFN categories, tenets of the CV on NOS are embedded. In analysing the RFN, the researcher found that two categories of RFN have no CV tenet representation, that is, in the scientific ethos category and social values category. Scientific ethos is defined as the norms that scientists employ in their work as well as in interactions with colleagues, while social values are values such as freedom, respect for the environment, and social utility. In the framework that was developed, it was necessary to represent these two RFN categories using keywords in order to match the format of the CV. Keyword analysis was the approach used by the authors of RFN when they conducted content analysis of Turkish curriculum statements (Kaya & Erduran, 2016). Keyword analysis involves the selection of indicative words from the descriptors of categories. From the two categories of scientific ethos and scientific values not represented in the CV, the researcher developed the keywords "ethical practices" derived from the definitions provided by the two categories. Ethical practices as keywords were thus included in the conceptual framework for this study. This framework was termed the IFVNOS and comprises (from the CV tenets): empirical, inferential, creativity, tentative, theory-driven, methods, scientific knowledge, social dimension of Science, social and cultural embeddedness of Science, Science vs pseudoscience and derived from RFN, ethical practices.

2.2.1. IFVNOS questionnaire

To collect the NOS views of the participant teachers, the researcher made use of the VNOS questionnaire version C, VNOS(C) developed by Lederman et al. (2002). The VNOS(C) has been validated by its authors and there exists a high level of confidence in it, thus making it an instrument of choice in this research. It has undergone an intensive validation process and revisions from VNOS(A) to VNOS(B) to this version of VNOS(C). The authors have provided crucial logistical and conceptual issues for consideration by researchers using VNOS(C) to ensure its correct administration with minimal errors, thus

increasing the validity of the research process. Although the VNOS(C) can be regarded as valid and verified, shortcomings have been identified by the authors due to the aforementioned limitations of the CV. The need then arose to incorporate aspects of the FRA into VNOS(C) that were found to be lacking in the CV.

The authors of the RFN developed a questionnaire to assess views about the NOS (Kaya et al., 2019) reflecting the five RFN categories and incorporated educational applications in the questionnaire. The RFN questionnaire comprises 70 questions with five options of responses, which are 'totally agree', 'agree', 'not sure', 'disagree', and 'totally disagree' from which respondents select one option. One of the limitations of this 5-Likert scale is that the opinion and alternative responses of the respondents are not captured. Kaya et al. (2019) acknowledged the oversimplification of the instrument for the nature of data to be collected and argued that their interest was in developing an instrument for RFN. Given this oversimplification as noted above, the author of this research opted for open-ended questions extracted from the VNOS(C) questionnaire; numbers 1-9 below. Questions relating to family resemblance that were not represented in VNOS(C) were added to the questionnaire; numbers 10-12 below. This formed the IFVNOS questionnaire. These open-ended questions that comprised IFVNOS are:

1. What, in your view, is Science? What makes Science (or a scientific discipline such as physics, biology, etc.) different from other disciplines of inquiry (e.g., religion, philosophy)?

2. Do all scientific disciplines such as physics, astronomy, biology, and chemistry use the same scientific method? Explain your answer.

3. Define what an experiment is. Does the development of scientific knowledge require experiments?

If yes, explain why. Give an example to defend your position. If not, explain why. Give an example to defend your position.

4. After scientists have developed a scientific theory (e.g., atomic theory, evolution theory), does the theory ever change? If you believe that scientific theories do not change, explain why. Defend your answer with examples. If you do believe that scientific theories do change: a) explain why theories change b) explain why we bother to learn scientific theories. Defend your answer with examples.

5. Describe the purpose of theories, laws, and models in producing scientific knowledge.

6. Science textbooks often represent the atom as a central nucleus composed of protons (positively charged particles) and neutrons (neutral particles) with electrons (negatively charged particles) orbiting that nucleus. How certain are scientists about the structure of the atom? What specific evidence do you think scientists used to determine what an atom looks like?

7. Scientists perform experiments or investigations when trying to find answers to the questions they put forth. Do scientists use their creativity and imagination during their investigations? If yes, then at which stage of the investigations do you believe scientists use their imagination and creativity: planning and designing, data collection, or after data collection? Please explain why scientists use creativity and imagination during their investigations. If you believe that scientists do not use imagination and creativity, please explain why. Provide examples if appropriate.

8. It is believed that about 65 million years ago dinosaurs became extinct. Of the hypotheses formulated by scientists to explain the extinction, two enjoy wide support. The first, formulated by one group of scientists, suggests that a huge meteorite hit the earth 65 million years ago and led to a series of events that led to extinction. The second hypothesis,

formulated by the second group of scientists, suggests that massive and giant volcanic eruptions were responsible for the extinction. How are these different conclusions possible if scientists in both groups have access to and use the same set of data to derive their conclusions?

9. Some claim that Science is infused with social and cultural values. That is, Science reflects the social and political values, philosophical assumptions, and intellectual norms of the culture in which it is practiced. Others claim that Science is universal. That is, Science transcends national and cultural boundaries, and it is not affected by social, political, and philosophical values and intellectual norms of the culture in which it is practiced. If you believe that Science reflects social and cultural values, explain why. Defend your answer with examples. If you believe that Science is universal, explain why. Defend your answer with examples.

10. Scientists engage in professional activities such as attending conferences and doing publication reviews. Why do scientists engage in such activities?

11. Scientists work in organizations or establishments such as universities and research centers; how are they organized in these institutions?

12. Teaching epistemic, cognitive, social, and cultural values should be core components of the Science curriculum. Do you agree or disagree with this statement? Provide a reason for your opinion.

3. METHODOLOGY

As mentioned before, the study was carried out in two phases: phase 1, the development and piloting of the instrument; phase 2, the administration of the instrument to 10 in-service Science teachers in South Africa. The pilot study aimed at testing the IFVNOS questionnaire and its readability, and it adopted a structural content analysis approach. In phase 1 two participant teachers, one teaching Life Sciences and the other Physical Sciences were purposefully selected based on availability and access to online teaching of either Natural Sciences, Life Sciences, or Physical Sciences. In South Africa, Natural Sciences is taught in the first two years of high school, following which learners have the choice of taking either taking Life Sciences or Physical Sciences, or neither. Teachers were required to complete the IFVNOS questionnaire and return it via email within two weeks. It was recommended that the teachers take about 45 minutes to complete the questionnaire and that responses had to be their own and not researched. On receipt of each questionnaire, the researcher drafted an interview schedule aimed at clarifying aspects of the respondents' answers that may not have been clear or posed conflicting messages to an understanding of the NOS aspects. In phase 2 of the study, the questionnaire to document the NOS understanding was then distributed to 10 purposefully selected in-service Science teachers based on availability and willingness to participate.

3.1. Content analysis
According to Krippendorff (1980), "Content analysis has been defined as a systematic replicable technique for compressing many words of text (or other meaningful matter) into fewer categories based on explicit rules of coding" (p. 17). The qualitative data collected from the IFVNOS questionnaire and the interview for each teacher were coded for NOS aspects in a technique similar to Saldana's coding technique. According to Saldana (2009), a code serves to summarize or condense data rather than simply reduce it. The NOS aspects were assigned to every response provided by participants; in some instances, responses comprised more than one NOS aspect. IFVNOS responses and interview responses were

assigned NOS aspects independently. The units of similar NOS aspects were then grouped for analysis to allocate a rating describing the degree of explicitness or implicitness of the NOS representation.

3.2. Scoring rubric

Points were allocated by the researcher from a scale of positive three points to negative three points based on Abd El-Khalick's scoring rubric (2013b). The allocation of points depended on the degree of explicitness or implicitness of the NOS represented in the units of analysis. A cumulative score ranging from -33 to +33 was then assigned to the NOS understanding of each teacher. The higher the cumulative score, the more explicit, informed, and consistent the representation of the NOS. The following scoring rubric was used:

- Three points = Explicit, informed, and consistent representation of the target NOS aspect.
- Two points = Explicit, partially informed representation of the target NOS aspect.
- One point = Implicit, informed, and consistent representation of the target NOS aspect.
- Zero points = The target NOS aspect is not addressed.
- Negative one point = Implicit misrepresentation of the target NOS aspect.
- Negative two points = The textbook materials convey mixed explicit and/or implicit messages about the target NOS aspect.
- Negative three points = Explicit, naïve representation of the target NOS aspect
     (Source: Abd-El-Khalick: NOS textbook analysis methods/ UIUC: April 20th, 2013/ Scoring rubric).

3.3. Reliability and validity

To ensure reliability in content analysis, Abd-El-Khalick (2013b) stipulated the use of more than one rater to achieve inter-rater reliability of the findings. Two raters were used in this study, and each one reviewed and analysed the data independently, assigning scores of the NOS understanding to the units of analysis. There was complete agreement between the findings of the two raters indicating a high level of reliability of the findings. Conducting an interview post-evaluation of IFVNOS responses and triangulation of findings from both questionnaires contributed to some level of validity in the findings.

3.4. Phase 1
3.4.1. Findings

Both in-service Science teachers were found to have an inadequate overall understanding of the NOS. The cumulative possible score of NOS understanding of +33 represents an explicit and informed understanding. Although the teachers in some instances displayed an explicit, informed understanding of some NOS aspects, these scores were lowered by mixed understanding or naïve understanding in other instances. The ensuing table displays some quotations from teacher responses and corresponding scores allocated by the researcher.

Table 1.
Excerpts of NOS responses of teachers and score assigned.

Teacher	Cumulative score /33	Example of excerpts	NOS understanding
Physical Sciences	+13	**Scientific theories:** "Theories do change, theories are developed on knowledge that are known, but often limited. Theories cannot always be proven wrong, but they can't be proven right either. The lack of concrete evidence proving a theory right means that a theory can change. Certain models have been adapted and changed, but older models can be useful to explain certain aspects."	explicit, informed +3
Life Sciences	+6	**Social and cultural embeddedness:** "So while *Science* may be affected by cultural practices, the prevailing desire to make it universal results in it being universal. It's not a field occurring in this vacuum, it has to be shaped to some extent by what surrounds those who build this knowledge. The way that we even build the knowledge and the people who build the specific type of knowledge is specific to their context."	mixed, explicit -2

3.4.2. Discussion of findings

The inadequate NOS understanding of the teachers is consistent with findings by other researchers in South Africa (Govender & Zulu, 2017). The small number of teachers used in the pilot does not provide enough indicative findings on the reliability of the instrument. The pilot aimed to test if the IFVNOS could be used to capture views of NOS, and this was achieved. No revisions were made to the questionnaire following the pilot. The pilot provided valuable insight into how data would be analysed to rate NOS understanding. The IFVNOS was then used to capture NOS understanding from a larger number of teachers who participated in the study to improve NOS understanding through textbook analysis. The reliability of the instrument could then be commented on after it had been used on a larger number of teachers.

3.5. Phase 2
3.5.1. Data collection of NOS understanding of 10 teachers

Ten in-service high school Science teachers, purposefully selected based on availability, access to the internet, and being in-service, partook in phase 2 of the study. To distribute the IFVNOS instrument, the researcher created a Google Form on which the questionnaire was loaded. The 10 teachers completed the Google Form online over six weeks and their responses to the questionnaire were automatically captured onto Google Drive. The authors of the VNOS form recommend that the questionnaire be administered

under controlled conditions, such as in a classroom setting, typically requiring 45-60 minutes to complete. Due to the lockdown restrictions imposed because of COVID-19 in South Africa in 2021, researchers were not readily allowed to enter schools to collect data. The participant teachers, therefore, had to respond to the questionnaire in their own unique settings online after being notified by the researcher that completing the questionnaire would take about 45 minutes. The turnaround time from the release of the questionnaire on the Google Form to receipt of responses from the teachers varied from three days to six weeks. Teachers used various gadgets such as cell phones, laptops, and tablets to complete the forms online.

Lederman et al. (2002) recommended conducting follow-up interviews to the questionnaire aimed at establishing the validity of the responses captured by the VNOS instrument and interpreted by the researcher. The authors of the VNOS instrument recommended that many interviews should be conducted until the researcher becomes an expert in analysing VNOS responses. Expertise would be evidenced by a high degree of correspondence between the inferences made by the researcher when analysing VNOS responses and the views clarified during interviews. In this study, most of the respondents (eight out of 10) were interviewed to clarify responses, thus ensuring the reliability of the findings. This was a large number of respondents, and it was necessary to conduct these interviews since the questionnaires were not administered in a controlled environment and under supervision. Interviews were typically conducted within two weeks of the researcher receiving the IFVNOS responses and were conducted online using platforms such as Zoom or Google Meet. These sessions were recorded online for the researcher to transcribe. Interviews typically took 18 to 30 minutes.

3.5.2. Findings

The 10 teachers showed varying levels of NOS understanding with cumulative scores ranging from -4 to +18. A more negative cumulative score represents a more explicit, naïve representation of NOS understanding, while a score of +33 represents an explicit, informed, and consistent NOS understanding across all NOS aspects.

Table 2.
Excerpts of NOS responses of teacher, corresponding interview question, responses and score assigned.

Teacher cumulative score /33	IFVNOS response	Interview question	Interview response	NOS understanding
-4	Scientific theories work within certain boundaries of the variables. If the variables reach extremes the theory may not work. The theory is useful to explain things within limits.	Would the theory ever change?	Yes, I do think it changes, it more develops than changes completely. …all scientific knowledge requires experiments.	Scientific knowledge (theories, laws) -2

	A theory is something a bit broader than a law. A theory still has to be tested. Out of the theory comes testing and out of testing comes laws.	So is there a hierarchy to a law and a theory or are they just different forms of scientific knowledge?	I wouldn't say one is better than the other, I would say something always starts off with a theory. It's probably as much work developing a theory as finding and testing in coming to a law, it's just the process.	

3.5.3. Discussion of findings

The findings of the study revealed a general naïve understanding of the NOS as has been found by other researchers in South Africa (Gwebu, 2015; Govender & Zulu, 2017). The instrument used was reliable in its use and can be used to collect IFVNOS views. Although the data collection process was not envisioned to be carried out completely online, the triangulation of follow-up interviews and IFVNOS responses contributed to making the findings valid. One of the difficulties encountered by the researcher in the data collection process was connectivity issues when carrying out interviews with respondents who were not in areas with strong internet connections. To overcome this challenge, the researcher turned on captions and shared the participant's IFVNOS responses and the interview schedule with each respondent. This aided the respondent to follow the questions that the researcher was asking while simultaneously reminding themselves of the responses they had given. Due to time-lapses and health, mental, and emotional challenges facing participants during the COVID-19 lockdown, some participants could not easily recall the initial responses that they had provided to the IFVNOS questionnaire. Sharing the submitted responses aided in reminding the participants of their initial thoughts and understandings.

4. FUTURE RESEARCH DIRECTIONS

The overall naïve understanding of the NOS presented by the teachers signifies the need for professional development programs to improve the NOS understanding. This study reported in this chapter forms part of a larger study in which the 10 participant teachers would attend a professional development program based on textbook analysis to improve their NOS understanding. Following the training, the IFVNOS questionnaire will be administered to capture their NOS views, and comparisons will be made to track any changes in understanding.

5. CONCLUSION

This chapter reported on the development of an instrument to measure views of the NOS that merged the CV and RFN. The piloting of the instrument, findings of the pilot study, and further administration of the instrument to 10 Science teachers were also reported. The entire data collection process and data analysis were carried out online, from

April to August 2021. This was during the COVID-19 lockdown period in South Africa where it was difficult to gain access to in-service Science teachers in person. Strategies had to be put in place to ensure that the data collection process was credible and valid. It can be concluded after analysing the data from the pilot and the main study that the IFVNOS questionnaire can be used to measure NOS understanding. There is still a need for professional development programs to improve the NOS understanding of in-service teachers. The teachers whose IFVNOS were captured will attend training on NOS to improve their understanding, and the instrument will be used to document any changes in their NOS understanding.

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Chapter #14

PERFORMANCE OF BRAZILIAN MIDDLE AND HIGH SCHOOL STUDENTS IN READING PROCESSES: COMPARATIVE STUDY BETWEEN PUBLIC AND PRIVATE EDUCATION

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ABSTRACT
This chapter discuss the following question: Is there a difference in the assessment for reading processes between students in public or private middle and high school? To answer these questions, this chapter aims to compare the performance of middle and high school students of public and private schools schools using tests from the Brazilian Adaptation of Reading Processes Assessment Battery - PROLEC-SE-R. The Reading Processes Assessment Battery - PROLEC-SE-R, individual version, was applied to 436 students: 221 from public school and 215 from private school, in the following order: 1) Reading Words, 2) Reading Pseudowords, 3) Grammatical Structures II, 4) Punctuation Marks, 5) Reading Comprehension I, 6) Reading Comprehension II, e 7) Oral Comprehension. A cross-sectional study was performed using descriptive and bivariate analysis. Based on these results, the answer to the initial question is affirmative. Private school students do indeed achieve a higher mean score when compared to public school students in word reading, showing that spelling helps in the reading processes. When knowledge of the use of the word in a sentence, extraction of meaning and its understanding is required, the difficulty of accessing the mental lexicon of the population studied becomes evident.

Keywords: education, middle school, high school, reading, comprehension, evaluation, adolescent.

1. INTRODUCTION

The expectation of both parents and children, upon entering school, is to learn to read and write. Every school day they will be asked to carry out activities, which they still do not have all the necessary skills to develop them, but reading will be the essential tool for later learning. Reading is fundamental with regard to school issues, performance in college, in the profession, in participation in society. It also influences the health, financial life and also the next generation of the individual (Azizifar, Roshani, Gowhary, & Jamalinesari, 2015; Denton et al., 2015; Hjetland, Brinchmann, Scherer, Hulme, & Melby-Lervåg, 2020; Okkinga et al., 2018; Sánchez, Garcia, & Pardo, 2012; Ter Beek, Brummer, Donker, & Opdenakker, 2018).

When talking about reading, we talk about two major components, decoding and comprehension, which use different mental operations. Decoding is located in the first mental operation, called the lower level, and concerns the mechanics of reading. It encompasses word recognition and its automatism, which is nothing more than transposing printed words into speech, regardless of their meaning, quickly and accurately. Visual analysis, grapheme-phoneme conversion and vocabulary skills are also involved. The process of word recognition and the attribution of meaning have a strong influence on the final result of

reading, which is comprehension (Holmes, 2009; Hjetland et al., 2020; Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003; Sánchez et al., 2012; Tiffin-Richards & Schroeder, 2015).

In 2015, 23,141 students from state and private schools participated in the Program for International Student Assessment (PISA). Considering the overall panorama, of the three areas evaluated (mathematics, reading and science), Brazil ranked 63rd, while in reading, the Country occupies 59th place. The percentage of students at level 2, considered by the Organisation for Economic Co-operation and Development (OECD) to be the minimum necessary for the exercise of citizenship, is 25%, with 50.99% below level 2. In other words, five out of ten Brazilian schoolchildren have not reached the necessary skills for reading and comprehension (Brasil, 2016a).

The latest international assessment, with data published in 2019 (PISA 2018), revealed that 50.1% of students aged 15 years are below the minimum level of reading necessary for the exercise of citizenship. This means that Brazilian students did not reach the minimum skills necessary for reading (Brasil, 2019; OECD, 2019).

In the National Secondary Education Examination (ENEM), which assesses student performance at the end of basic education and is used as a selection mechanism for admission to Higher Education, it was observed that in 2015, 5,642 candidates failed in at least one of the four objective or essay tests. The graduates, in this case, came from 376 private institutions and 5,266 from state schools. The areas they failed most frequently were mathematics and its technologies by 4,899 students and writing by 3,045 students (Brasil, 2016b).

In the study by Oliveira and Capellini (2010), in which the reading processes of middle school students in state and private educational institutions were evaluated, the students attending private education presented superior performance when compared to state education in the evaluation tests for letter identification, lexicon, as well as syntactic and semantic process. The most outstanding data was the very low average score of students from the state education system regarding phoneme knowledge, which explicitly reveals the absence (or failure) of teaching grapheme-phoneme relationship in state school classrooms.

The gaps generated in literacy hinder the development of basic skills necessary for reading, such as acquisition of the mental lexicon and the decoding process that enables word recognition. This will have ongoing negative repercussions in the teaching-learning process throughout middle to high school.

Based on the above, the following question was raised: Is there a difference in the assessment for reading processes between children studying in state or private sector middle and high schools?

Thus, this chapter aims to compare the performance of students attending middle and high schools in state and private education using tests from the Brazilian Adaptation of Reading Processes Assessment Battery - PROLEC-SE-R.

2. METHOD

A cross-sectional study, approved by the Institution's Research Ethics Committee (resolution no. 1,125,746).

In accordance with the National Health Council resolution CNS 196/96, the Free and Informed Consent Form was signed by the parents or guardians and the Assent Form by participating students.

2.1. Participants

A total of 436 students were evaluated, randomly selected from the reference population, 221 (50.69%) from state education and 215 (49.31%) from private education; of these, 263 were female (145 state education and 118 private education) and 173 male (76 state education and 97 private education). The students were then subdivided into the following groups:

- **State schools** (221 students)
  - **G1**: 6th year middle school (n = 30, mean age 11.2 yrs)
  - **G2**: 7th year middle school (n = 33, mean age 11.9 yrs)
  - **G3**: 8th year middle school (n = 35, mean age 12.8 yrs)
  - **G4**: 9th year middle school (n = 31, mean age 13.9 yrs)
  - **G5**: 1st year high school (n = 32, mean age 14.8 yrs)
  - **G6**: 2nd year high school (n = 30, mean age 16.0 yrs)
  - **G7**: 3rd year high school (n = 30, mean age 17.1 yrs)
- **Private schools** (215 students)
  - **G8**: 6th year middle school (n = 31, mean age 11.1 yrs)
  - **G9**: 7th year middle school (n = 31, mean age 12.6 yrs)
  - **G10**: 8th year middle school (n = 30, mean age 12.9 yrs)
  - **G11**: 9th year middle school (n = 31, mean age 13.9 yrs).
  - **G12**: 1st year high school (n = 30, mean age 15.1 yrs)
  - **G13**: 2nd year high school (n = 31, mean age 16.2 yrs)
  - **G14**: 3rd year high school (n = 31, mean age 17.2 yrs)

2.2. Selection criteria

The inclusion criteria were: 1) signing the Informed Consent Form by parents or guardians; 2) signing the Assent Form by students; and 3) be regularly enrolled in middle school or high school at the participating schools.

The exclusion criteria were: 1) students who refused to participate, even though their parents or guardians had signed an informed consent form; 2) students with an interdisciplinary diagnosis of learning disorder, dyslexia and Attention-Deficit / Hyperactivity Disorder; 4) learning complaint; 5) language or speech alteration; 6) impairment of visual and hearing acuity; 7) diagnosis of genetic or neurological syndromes; 8) history of repeated school year; and 9) low intellect.

2.3. Instruments

Application of the Reading Processes Assessment Battery - PROLEC-SE-R (Oliveira, 2017), individual version, in the following order:

1) Reading Words: The task consists of reading aloud four word lists (RW1 to RW4). Each list contains 24 words, distributed as follows: LW1 short and high frequency words, LW2 long and high frequency words, LW3 short and low frequency words and LW4 long and low frequency words. The time spent on reading the lists is noted;

2) Reading Pseudowords: The task is to read aloud the two lists (RPW1 and RPW2). The pseudowords were divided into short (disyllabic pseudowords – RPW1) and long (trisyllable and polysyllable pseudowords – RPW2). Noting the time spent on reading the lists;

3) Grammatical Structures II: In this test, the task is to identify the drawing that corresponds to the one indicated by the sentence, it comprises 24 stimuli and one example.

4) Punctuation Marks: The task is to read the text aloud. The examiner must pay attention to the correct intonation of the highlighted punctuation marks. The reading time in seconds is recorded;

5) Reading Comprehension I: The task is to read the text aloud. The text is expository type with ten literal and inferential questions. The student can consult the text to answer the questions;

6) Reading Comprehension II: The task is to read the text silently. The text is expository and the ten questions are literal. The student cannot consult the text to answer the questions;

7) Oral Comprehension: In this test, the examiner reads aloud a text to the student twice, then asks ten comprehension questions one at a time.

2.4. Procedures

Data collection was carried out in the school environment, at the students' usual period of attending school and in a single session. The schedule for the assessments having been previously arranged with the coordinators and teachers. The following procedures were adopted:

a) Signing the Free and Informed Consent Form by those responsible for the students;

b) Signature of the Assent Form by the students evaluated;

c) Application of Reading Processes Assessment Battery - PROLEC-SE-R (Oliveira, 2017);

d) Survey of Portuguese grades and all other subjects, except physical education.

2.5. Data analysis

STATA /SE (Version 13) software, was used for statistical treatment. Descriptive statistical tools (absolute and relative frequency, standard deviation and median) were applied to characterize the population. Bivariate analysis was performed in order to identify associations between variables, tested in pairs. For all tests applied, a significance level of $\alpha = 0.05$ was adopted. To compare means, Student t-test (one-tailed) was used with regard to the time variables, according to the school year and type of education. The Wilcoxon test (Mann-Whitney test) was used to compare the performance of students in the PROLEC-SE-R tests, according to education sector (state or private).

3. RESULTS

Regarding the Portuguese grades and the general average of all academic subjects, there is evidence that the average for the Portuguese grade for the 6th year of private education is higher than that of the 6th year of state education (p = 0.009*, state: $\bar{x}$ = 6.70, SD = 1.45, 95% CI: 6.15; 7.24; private: $\bar{x}$ = 7.57, SD = 1.32, 95% CI: 7.03; 8.05). For the remaining years of Middle School and High School, Student t-test did not indicate evidence that one mean is lower than the other for Portuguese grades nor for all the years considering an overall average grade (Table 1).

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Table 1.
Distribution of Portuguese and overall average grades of marks from all disciplines of the
1st semester, 2015.

	Groups	Mean (score)	SD	CI 95%		*p*-Value
	Middle school					
	G 1	6.70	1.45	6.15	7.24	0.009*
	G 8	7.57	1.32	7.03	8.05	
	total	7.14	1.45	6.77	7.51	
	G 2	6.83	1.72	6.22	7.44	0.114
	G 9	7.29	1.27	6.82	7.76	
	total	7.05	1.53	6.67	7.44	
	G 3	7.30	1.39	6.81	7.78	0.112
Portuguese grades	G 10	7.66	0.91	7.32	8.00	
	total	7.46	1.20	7.17	7.76	
	G 4	6.50	1.93	5.79	7.21	0.509
	G 11	6.49	1.27	6.02	6.96	
	total	6.49	1.62	6.08	6.91	
	High School					
	G 5	6.70	1.83	6.03	7.36	0.947
	G 12	6.11	0.69	5.85	6.37	
	total	6.41	1.42	6.05	6.78	
	G 6	7.39	1.32	6.90	7.89	1.000
	G 13	5.80	1.12	5.39	6.21	
	total	6.58	1.45	6.21	6.96	
	G7	8.21	1.20	7.76	8.66	1.000
	G 14	5.82	1.23	5.37	6.27	
	total	7.00	1.70	6.56	7.43	
	Middle school					
	G 1	7.18	1.36	6.67	7.69	0.132
	G 8	7.56	1.30	7.08	8.04	
	total	7.37	1.33	7.03	7.72	
	G 2	7.74	1.21	7.31	8.17	0.952
	G 9	7.19	1.38	6.68	7.69	
	total	7.47	1.31	7.14	7.80	
	G 3	7.24	1.45	6.74	7.74	0.193
Overall average grades	G 10	7.51	0.96	7.15	7.87	
	total	7.37	1.25	7.05	7.68	
	G 4	6.85	1.59	6.27	7.44	0.723
	G 11	6.63	1.37	6.12	7.13	
	total	6.74	1.47	6.36	7.11	
	High School					
	G 5	7.01	1.16	6.60	7.43	0.999
	G 12	5.93	0.90	5.59	6.27	
	total	6.49	1.17	6.19	6.79	
	G 6	7.48	1.19	7.04	7.93	1.000
	G 13	6.18	1.18	5.74	6.61	
	total	6.82	1.34	6.47	7.17	
	G7	7.06	1.02	6.68	7.44	1.000
	G 14	5.52	1.21	5.07	5.96	
	total	6.28	1.36	5.93	6.63	

Student t-test. * Statistical evidence of an association (*p*<0.05)

Evidence was identified that the mean time spent in minutes is higher for private school students from the 2nd year of high school ($p = 0.025^*$, 95% CI state school: 28.79; 33.27/ 95% CI private education: 32.12; 35.29). For the other school years, it appears that there was no evidence that one average is lower than the other, for the execution of the tests.

In Reading Words 1, evidence of a difference for the average of correct answers was identified for the 7th year students ($p = 0.025$) (Table 2); no evidence of a difference in time in seconds was identified for this list.

In Word List 2 (Table 2), the Wilcoxon test indicated evidence of a difference for the 7th year ($p = 0.045$) and 1st year ($p = 0.029$) for correct answers and for the 2nd year (state: $\bar{x} = 19.43$, SD = 5.27; private: $\bar{x} = 16.83$, SD = 3.53, $p = 0.024$) in the mean time in seconds.

For Reading Words 3 (Table 2), evidence of a difference in relation to the mean score of correct answers was not found; however, in relation to the mean time in seconds, there is evidence of a difference for the 6th year (state: $\bar{x} = 25.76$, SD = 7.72; private: $\bar{x} = 22.70$, SD = 9.67 , $p = 0.027$); 9th year (state: $\bar{x} = 20.96$, SD = 4.87; private: $\bar{x} = 17.32$, SD = 3.59, $p = 0.004$); 1st year (state: $\bar{x} = 21.62$, SD = 5.10; private: $\bar{x} = 18.06$, SD = 4.03, $p = 0.005$) and 2nd year (state: $\bar{x} = 18.50$, SD = 4.03; private: $\bar{x} = 16.32$, SD = 3.54, $p = 0.017$).

In Word List 4 (Table 2), evidence of a difference was found for the 7th year ($p = 0.037$) and 9th year ($p = 0.007$) for the mean number of correct answers; and, in relation to the mean time in seconds, for the 6th year (state: $\bar{x} = 41.16$, SD = 14.11; private: $\bar{x} = 35.61$, SD = 15.65, $p = 0.028$); 9th year (state: $\bar{x} = 31.12$, SD = 6.61; private: $\bar{x} = 24.41$, SD = 5.35, p<0.001); 1st year (state: $\bar{x} = 30.46$, SD = 8.28; private: $\bar{x} = 24.10$, SD = 4.12, $p = 0.001$) and 2nd year (state: $\bar{x} = 27.00$, SD = 5.30; particular: $\bar{x} = 22.22$, SD = 4.80, p <0.001).

Table 2.
Description and comparison of correct answers in the tests Reading Words (RW) 1, 2, 3 and 4.

Groups	Mean	SD	Median	*p*-Value
RW 1 - correct				
G 1	23.63	0.61	24.00	0.487
G 8	23.74	0.51	24.00	
total	23.68	0.56	24.00	
G 2	23.54	0.51	24.00	0.025*
G 9	23.87	0.34	24.00	
total	23.70	0.55	24.00	
G 3	23.80	0.40	24.00	0.124
G 10	23.93	0.25	24.00	
total	23.86	0.34	24.00	
G 4	23.64	0.66	24.00	0.439
G 11	23.80	0.40	24.00	
total	23.72	0.54	24.00	
G 5	23.81	0.39	24.00	0.332
G 12	23.90	0.43	24.00	
total	23.85	0.35	24.00	
G 6	23.86	0.43	24.00	0.282
G 13	23.96	0.17	24.00	
total	23.91	0.33	24.00	
G7	23.93	0.25	24.00	0.145
G 14	23.80	0.40	24.00	
total	23.86	0.34	24.00	

RW 2 - correct				
G 1	23.56	0.85	24.00	0.608
G 8	23.54	0.76	24.00	
total	23.55	0.80	24.00	
G 2	23.45	1.03	24.00	0.045*
G 9	23.77	0.92	24.00	
total	23.60	0.98	24.00	
G 3	23.77	0.49	24.00	0.256
G 10	23.90	0.30	24.00	
total	23.83	0.41	24.00	
G 4	23.90	0.39	24.00	0.974
G 11	23.95	0.24	24.00	
total	23.91	0.32	24.00	
G 5	23.71	0.58	24.00	0.029*
G 12	23.96	0.18	24.00	
total	23.83	0.45	24.00	
G 6	23.90	0.18	24.00	0.966
G 13	23.90	0.30	24.00	
total	23.90	0.30	24.00	
G7	23.96	0.18	24.00	0.309
G 14	24.00	0.00	24.00	
total	23.98	0.12	24.00	
RW 3 - correct				
G 1	22.43	2.32	23.00	0.820
G 8	22.77	1.54	23.00	
total	22.60	1.96	23.00	
G 2	22.78	2.21	23.00	0.455
G 9	23.25	1.26	24.00	
total	23.01	1.82	24.00	
G 3	23.57	0.65	24.00	0.154
G 10	23.30	0.87	23.00	
total	23.44	0.77	24.00	
G 4	23.41	0.92	24.00	0.586
G 11	23.51	0.92	24.00	
total	23.46	0.91	24.00	
G 5	23.21	1.66	24.00	0.615
G 12	23.60	0.77	24.00	
total	23.40	1.31	24.00	
G 6	23.56	0.77	24.00	0.261
G 13	23.80	0.40	24.00	
total	23.68	0.62	24.00	
G7	23.76	0.50	24.00	0.398
G 14	23.58	0.84	24.00	
total	23.67	0.70	24.00	
RW 4 - correct				
G 1	21.56	2.71	22.50	0.112
G 8	22.29	2.45	23.00	
total	21.93	2.58	23.00	
G 2	22.06	1.91	22.00	0.037*
G 9	22.96	1.37	23.00	
total	22.50	1.72	23.00	

G 3	22.94	1.32	23.00	0.137
G 10	23.43	0.93	24.00	
total	23.16	1.18	24.00	
G 4	22.96	0.91	23.00	0.007*
G 11	23.48	1.02	24.00	
total	23.22	0.99	24.00	
G 5	22.84	1.95	24.00	0.154
G 12	23.56	0.72	24.00	
total	23.19	1.52	24.00	
G 6	23.53	0.86	24.00	0.436
G 13	23.74	0.51	24.00	
total	23.63	0.70	24.00	
G7	23.70	0.70	24.00	0.232
G 14	23.90	0.30	24.00	
total	23.80	0.54	24.00	

Wilcoxon test. * Statistical evidence of an association ($p<0.05$)

Regarding Reading Pseudowords (Table 3), there was no evidence of a difference between school years by type of education, for the mean number of correct answers. This suggests that the mean performance of students, by type of education, in Reading Short and Long Pseudowords does not differ.

Regarding Reading Time in seconds, for Pseudoword List 1, evidence of a difference was suggested for the 6th year (state: $\bar{x}$ = 32.10, SD = 8.27; private: $\bar{x}$ = 25.45, SD = 6.19, p = 0.002); 1st year (state: $\bar{x}$ = 28.34, SD = 9.01; private: $\bar{x}$ = 21.43, SD = 4.06, $p<0.001$) and 2nd year (state: $\bar{x}$ = 23.73, SD = 5.10; private: $\bar{x}$ = 20.29, SD = 5.23, p = 0.010), and for the 6th year (state: $\bar{x}$ = 52.00, SD = 14.03; private: $\bar{x}$= 43.45, SD = 12.32, p = 0.014); 7th year (state: $\bar{x}$ = 46.63, SD = 13.70; private: $\bar{x}$= 39.45, SD = 5.91, p = 0.031); 9th year (state: $\bar{x}$ = 43.77, SD = 10.50; private: $\bar{x}$= 35.09, SD = 7.44, $p<0.001$); 1st year (state: $\bar{x}$ = 42.71, SD = 11.42; private: $\bar{x}$ = 31.90, SD = 7.20, $p<0.001$) and 2nd year (state: $\bar{x}$ = 38.83, SD = 8.04; private: $\bar{x}$ = 32.83, SD = 5.75, p = 0.002) in Pseudoword List 2.

Table 3.
Description and comparison of correct answers in the tests for Reading Pseudowords 1 and 2 and of the tests for the Syntactic Process Grammatical Structures and Punctuation Marks.

Groups	Mean	SD	Median	*p*-Value
Pseudoword 1 - correct				
G 1	21.90	2.42	22.50	0.639
G 8	22.22	2.02	23.00	
total	22.06	2.22	23.00	
G 2	22.27	2.51	23.00	0.780
G 9	22.41	1.94	23.00	
total	22.34	2.24	23.00	
G 3	22.40	1.81	23.00	0.050
G 10	23.10	1.49	24.00	
total	22.72	1.70	23.00	
G 4	22.93	1.54	24.00	0.430

G 11	22.64	1.74	23.00	
total	22.79	1.64	23.00	
G 5	22.34	2.47	23.00	0.167
G 12	23.03	1.49	24.00	
total	22.67	2.07	23.00	
G 6	22.40	1.97	23.00	0.038
G 13	23.25	1.06	23.00	
total	22.83	1.62	23.00	
G7	23.13	0.93	23.00	0.512
G 14	23.12	1.43	24.00	
total	23.13	1.20	23.00	
Pseudoword 2 - correct				
G 1	19.20	4.45	21.00	0.499
G 8	20.35	3.03	21.00	
total	19.78	3.81	21.00	
G 2	20.60	3.72	22.00	0.956
G 9	20.93	3.16	22.00	
total	20.76	3.43	22.00	
G 3	21.31	2.43	22.00	0.883
G 10	21.43	2.41	22.00	
total	21.36	2.40	22.00	
G 4	21.19	2.74	22.00	0.869
G 11	21.45	2.24	22.00	
total	21.32	2.49	22.00	
G 5	21.09	3.56	23.00	0.333
G 12	22.30	1.85	23.00	
total	21.67	2.91	23.00	
G 6	22.13	2.25	22.50	0.625
G 13	22.06	1.84	23.00	
total	22.09	2.03	23.00	
G7	21.90	2.52	22.50	0.546
G 14	21.61	2.40	22.00	
total	21.75	2.44	22.00	
Grammatical Structures				
G 1	16.00	3.68	17.00	0.782
G 8	16.25	2.73	16.00	
total	16.13	3.21	16.00	
G 2	16.87	2.38	17.00	0.467
G 9	17.58	2.59	17.00	
total	17.21	2.49	17.00	
G 3	17.42	2.35	18.00	0.005*
G 10	19.30	2.38	19.00	
total	18.29	2.52	19.00	
G 4	17.38	2.87	17.00	0.013*
G 11	19.06	2.12	18.00	
total	18.22	2.64	19.00	
G 5	17.15	2.51	17.00	0.032*
G 12	18.66	2.82	19.00	
total	17.88	2.75	17.50	

G 6	17.96	2.05	18.00	0.057
G 13	19.19	2.61	19.00	
total	18.59	2.41	19.00	
G7	18.46	2.64	18.00	0.722
G 14	18.61	3.15	19.00	
total	18.54	2.89	18.00	
Punctuation Marks				
G 1	29.38	2.13	30.00	0.128
G 8	28.18	3.20	29.00	
total	28.85	3.04	30.00	
G 2	28.18	3.20	29.00	<0.001*
G 9	29.93	2.64	31.00	
total	29.03	3.05	30.00	
G 3	27.88	3.44	29.00	0.000*
G 10	30.46	1.16	31.00	
total	29.07	2.93	30.00	
G 4	28.25	3.28	30.00	<0.001*
G 11	30.67	0.54	31.00	
total	29.46	2.63	30.50	
G 5	29.46	1.77	30.00	0.686
G 12	29.63	1.62	30.00	
total	29.54	1.69	30.00	
G 6	29.73	2.01	30.50	0.165
G 13	30.03	2.02	31.00	
total	29.88	2.00	31.00	
G7	29.76	1.75	30.00	0.635
G 14	29.77	1.70	31.00	
total	29.77	1.71	30.00	

Wilcoxon test. * Statistical evidence of an association ($p<0.05$)

Regarding the Syntactic Process evaluation tests (Table 3), evidence of a difference was found in the Grammatical Structures II test for the 8th year ($p = 0.005$), 9th year ($p = 0.013$) and 1st year ($p = 0.032$). In the Punctuation Marks test score signs, average of correct answers, for the 7th year ($p<0.001$), 8th year ($p = 0.000$), and 9th year ($p<0.001$).

As for the assessment of the semantic process (Table 4), in the Reading Comprehension I test, there is evidence of a difference regarding the number of correct answers for the 6th year ($p = 0.045$), 7th year ($p = 0.003$), 8th year ($p = <0.001$) and 1st year ($p = 0.013$). According to the mean score, in the years in which there was evidence of a difference, private school students presented a superior performance in relation to those students at the state schools.

In the Reading Comprehension II test, there was evidence of difference for all school years; a fact that indicated superior performance of students in private education, except for the 3rd year ($p = 0.162$). In the Oral Comprehension test, evidence of a difference was found only among students in the 6th year ($p = 0.004$), 8th year ($p = 0.000$), 9th year ($p = 0.002$) and 1st year ($p = 0.004$). From the mean score, superior performance was verified by students in private education when compared to their peers in state schools.

Table 4. Description and comparison of correct answers in the tests of Semantic Process:
Reading Comprehension I, Reading Comprehension II and Oral Comprehension.

Groups	Mean	SD	Median	p-Value
Reading Comprehension I				
G 1	3.00	1.92	3.00	0.045*
G 8	4.19	2.15	4.00	
total	3.60	2.11	4.00	
G 2	3.57	1.85	3.00	0.003*
G 9	5.06	1.91	5.00	
total	4.29	2.01	4.00	
G 3	3.60	1.78	4.00	<0.001*
G 10	5.36	1.71	6.00	
total	4.41	1.95	5.00	
G 4	4.00	2.08	4.00	0.257
G 11	4.64	2.00	4.00	
total	4.32	2.05	4.00	
G 5	4.03	2.34	4.00	0.013*
G 12	5.33	1.86	5.50	
total	4.66	2.20	4.00	
G 6	4.66	1.88	5.00	0.095
G 13	5.41	1.82	6.00	
total	5.04	1.87	5.00	
G7	4.63	2.00	5.00	0.468
G 14	5.19	1.72	5.00	
total	4.91	1.87	5.00	
Reading Comprehension II				
G 1	2.66	2.30	2.00	0.002*
G 8	4.61	2.33	5.00	
total	3.65	2.50	3.00	
G 2	3.57	2.43	3.00	<0.001*
G 9	5.77	1.82	6.00	
total	4.64	2.41	4.00	
G 3	4.25	2.21	4.00	<0.001*
G 10	6.33	1.86	6.00	
total	5.21	2.29	5.00	
G 4	3.74	2.60	3.00	0.000*
G 11	6.93	2.42	7.00	
total	5.33	2.96	5.50	
G 5	4.46	3.02	4.50	0.015*
G 12	6.43	1.95	6.50	
total	5.41	2.73	6.00	
G 6	5.16	2.73	5.50	<0.001*
G 13	7.41	1.82	8.00	
total	6.31	2.55	7.00	
G7	6.33	2.00	6.00	0.162
G 14	6.74	3.06	8.00	
total	6.54	2.58	7.00	

Oral comprehension				
G 1	2.66	2.32	2.50	0.004*
G 8	4.41	2.23	4.00	
total	3.55	2.42	3.00	
G 2	4.09	2.68	4.00	0.180
G 9	4.96	2.45	5.00	
total	4.51	2.59	4.00	
G 3	3.88	2.63	3.00	0.000*
G 10	6.80	1.84	7.00	
total	5.23	2.71	6.00	
G 4	3.70	2.11	3.00	0.002*
G 11	5.83	2.70	6.00	
total	4.77	2.63	5.00	
G 5	4.06	2.58	4.00	0.004*
G 12	6.03	2.05	6.00	
total	5.01	2.53	5.00	
G 6	5.13	2.99	5.50	0.127
G 13	6.32	2.28	7.00	
total	5.73	2.70	6.00	
G7	5.73	2.25	6.00	0.286
G 14	6.29	2.01	7.00	
total	6.01	2.14	6.00	

Wilcoxon test. * Statistical evidence of an association ($p<0.05$)

4. DISCUSSION

On analyzing the mean age of the students, no difference was identified between the groups, except for the 1st year of high school. This is due to the fact that the variables of repeating a school year and late admission, diagnoses of learning disorders and/or other comorbidities were controlled, which practically eliminates any discrepancy in relation to age and year. The INEP [National Institute of Educational Studies and Research] reports that the age-grade gap represents a serious problem, as many students are not in the appropriate year for their age (Brasil, 2016a; Fritsch, Vitelli, & Rocha, 2014).

Regarding the average grades of Portuguese in the 1st semester and the overall average of grades in all academic subjects, there was a difference between the education sectors only for Portuguese in the 6th year of school. In the study by Oliveira (2017), in which all middle school students were compared with state and private high school students, this difference was not found either, a fact that certainly occurred because the variables were controlled, as described in the inclusion and exclusion criteria.

However, in the study by Sampaio and Guimarães (2009), in which the performance of state and private high school students was compared, it was found that the grades of state school students were lower than those of private school students, as well as the maximum efficiency of students from private schools, followed by students from federal state education and state education. Thereby corroborating this study, regarding the superior performance of students from private education, when considering the mean number of correct answers in the PROLEC-SE-R tests.

National studies, with students from middle school, also reported superior performance of those from private education in relation to state schools, for tests that assess reading and writing skills (Bicalho & Alves, 2010; Gonçalves, Neves, Nicolielo, Crenitte, & Lopes-Herrera , 2013; Oliveira & Capellini, 2010; Oliveira, Germano, & Capellini, 2016; Pontes, Diniz, & Martins-Reis, 2013).

Likewise, studies carried out with middle school students indicated that state school students have difficulties with words that depend on phonological processing for their decoding and with words that depend on knowledge of spelling rules. Thus, indicating that the use of the grapheme-phoneme conversion mechanism is more effective among private school students, and that, from the 4th year onwards, the mental representation of words aids in the correct decoding (Cunha & Capellini, 2010; Oliveira & Capellini, 2010; Oliveira et al., 2016; Oliveira, 2017; Psyridou, Eklund, Poikkeus, & Torppa , 2018; Silva & Pereira, 2019). Despite being students in middle and high school, little is known about their performance in these skills. At the individual word level, it was found that the difference observed between students in state and private education lies in long infrequent words, in which the use of spelling helps reading, and in long pseudowords, in which their length increases the degree of difficulty in reading through the phonological route.

In tasks requiring the syntactic and semantic process, it is necessary to automate the basic reading processes for dedicating cognitive resources to understanding and extracting meaning. However, although fundamental, they are not sufficient. The relationship between the words, the understanding of how they are grouped in the sentence, the interrelationships between the sentences, lexical richness, prior knowledge, knowledge about the topic, macro and microstructure of the text – each of these steps must be taught systematically, including the critical-reflective consideration of the written material. With experience, these skills develop and improve (Capellini, Oliveira, & Cuetos, 2014; Cuetos, 2010; Cunha & Capellini, 2009; 2010; Marques & Marandino, 2018; Sánchez et al., 2012; Silva & Pereira, 2019; Snellings et al., 2009).

Furthermore, the superior performance of students in private education may result from differences between teaching methodologies and educational practices used by the different schools. We also emphasize the influence of family support with better sociocultural conditions, access to information, reading for pleasure outside the school context, stimulating social environment, in addition to better teacher preparation and school facilities. All of these directly affect the students' learning process (Bicalho & Alves, 2010; Gonçalves, et al., 2013; Sampaio & Guimarães, 2009). It is worth highlighting that these factors, added to the pressure from parents demanding quality of teaching and the administration of the school aimed at the market and competitiveness (Demo, 2007), all favor the acquisition of vocabulary, subject to influences and interferences from the environment in which the school is inserted and social relationships established, as well as the student's personal relationship with language (Gaskell & Ellis, 2009).

The superior performance of students from private education, when compared to students from state education in the Oral Comprehension test is in line with poor performance in Reading Comprehension tests. It is known that difficulties in reading comprehension can originate from oral language, in that it has a reciprocal relationship with the development of reading comprehension. General reading comprehension skills increase with reading experience and with spoken language developing reciprocally with reading practice and experience (Cuetos, 2010; Morais, 2013; Perfetti, Landi, & Oakhill, 2013; Sánchez et al., 2012).

Faced with these results, the answer to the initial question – "Is there a difference in the assessment for reading processes between children studying in state or private sector middle and high schools?" the answer is affirmative. Private education students do indeed achieve a higher mean score when compared to state education students in word reading, showing that spelling helps in the reading processes. When knowledge of the use of the word in a sentence, extraction of meaning and its understanding is required, the difficulty of accessing the mental lexicon of the population studied becomes evident.

5. CONCLUSION

The answer to the initial question was confirmed. Private school students do indeed achieve a higher mean score when compared to public school students in word reading, showing that spelling helps in the reading processes. When knowledge of the use of the word in a sentence, extraction of meaning and its understanding is required, the difficulty of accessing the mental lexicon of the population studied becomes evident.

At the individual word level, it was found that the difference observed between students in public and private education in long infrequent words, in which the use of spelling helps reading, and in long pseudowords, in which their length increases the degree of difficulty in reading through the phonological route.

It was found superior performance of students from private education, when compared to students from state education in the syntactic and semantic process and oral comprehension tests.

The differences between the public and private education systems are present in the Brazilian educational reality and this makes the opportunities for social and even educational insertion discrepant, which further aggravates the social inequalities in our country.

In this way, the results of this study reveal the need for an equalization in the education system, regardless of whether it is public and private, and thus, provide students with the same teaching-learning conditions that guarantee them an equal social and professional insertion, arising from a real education and quality for all.

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Section 3
Projects and Trends

Chapter #15

GLOBAL INTERCULTURAL PROJECT EXPERIENCE (GIPE): A Distributed Interdisciplinary Project-Based Learning Framework

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ABSTRACT

This chapter describes a new concept and experiences of a distributed interdisciplinary learning program for students across continents. The aim is to provide students with a truly Global Intercultural Project Experience (GIPE) by working together with peers from around the world and solving real-life client's problems. We have received seed-funding for four annual projects to engage students from Germany (Europe), Namibia (Africa), Indonesia (Asia), and Peru (South America). In 2020 and 2021, 28 and 44 students from four continents engaged in a one-semester distributed interdisciplinary project for a Namibian and Indonesian client, respectively. Despite Covid-19 they successfully completed the project expressing deep appreciation for the learning opportunities overcoming challenges of working across widespread time zones, cultures, changing requirements, and various technical difficulties. Considering the vast learning benefits, we suggest incorporating such projects in all tertiary education curricula across the globe, while streamlining organizational efforts based on lessons learned.

Keywords: project-based learning, collaborative online international learning (COIL), distributed software development, intercultural collaboration, interdisciplinary students project.

1. INTRODUCTION

Globalization requires Higher Education Institutions (HEIs) to provide relevant 21st century skills and knowledge. The ongoing pandemic has fast-tracked a long-awaited educational transformation promoting distributed online learning. Although the idea and successful application of distributed student projects with online collaboration among different HEIs dates back to the late 1990s (Brereton, Gumbley, & Lees, 1998), the focus on international and intercultural aspects only appeared during the last decade (Appiah-Kubi & Annan, 2020). Collaborative Online International Learning (COIL) receives growing interest as an innovative, cost-effective instructional method that promotes intercultural learning through online collaboration between faculty and students residing in different countries or locations within the context of a course (DePaul University, 2017). Moreover, Project-Based Learning (PBL) is a well-established student-centered approach leading to the acquisition of deeper knowledge through active exploration of real-world challenges and problems (Bender, 2012).

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Thus, in this paper we present the GIPE project, which builds on PBL and COIL as a hybrid realization with a short-term physical mobility phase to provide students with highly competitive skills for working in an international, intercultural and interdisciplinary team, while jointly working on one real-life project with a local client. In this chapter we share the GIPE realization and experiences from two concluded project cycles. We discuss necessary student support, organizational issues as well as the impact of Covid-19.

2. RELATED WORK

With an increasing digitalization of education and limitations of mobility the concept of "Internationalization at Home" has gained momentum (Mudiamu, 2020). COIL offers students "an inclusive, international learning opportunity for students and staff who may not be able to or want to have a physical or blended mobility" (Helm & O'Dowd, 2020, p. 3). COIL courses usually entail shared teaching by staff from different institutes and countries; with students from both countries using a problem-based learning approach with local learning outcomes, assessments, and communication tools (De Castro, Dyba, Cortez, & Pe Benito, 2018). The benefits of using COIL courses have been widely recognized (Almeida, Robson, Morosini, & Baranzelil, 2018; Barbosa, Santos, & Prado-Meza, 2020; Duffy, Stone, Townsend, & Cathey, 2020; Mudiamu, 2020). 23 COIL experiences analyzed by (Hildeblando Junior & Finardi, 2018), showed that learners developed intercultural competencies, digital skills, international education experience, and global awareness. A number of Universities have meanwhile implemented the COIL approach with varying levels of complexity. Rauer, Kroiss, Kryvinska, Engelhardt-Nowitzki, and Aburaia (2021) presents a telecooperative Global Virtual teams project concept, which can be adapted to different study programmes. The authors ran a pilot study with 150 students from 5 different universities and different disciplines working on simulated business tasks. Challenges perceived by participants were mostly related to communication and language, lack of subject specific knowledge and coordination, while the entire project experience was rated as valuable by most students (Rauer et al. 2021). Multicultural communication project environments are complex and demand awareness of cultural variations (Ochieng & Price, 2010). However, bibliometric review of research on communication in virtual teams by (Muszyńska, 2021) show that issues linking communication with trust and leadership are least explored areas. As echoed by (Ochieng & Price, 2010), creation and development of effective cross-cultural collectivism, trust, communication, and empathy in leadership is an important ingredient for remote project collaborations success.

3. GIPE REALIZATION

3.1. Background

A quadrilateral partnership was conceptualized, building on long-term individual staff and institutional bilateral collaborations of the Westfälische Hochschule (WH) with its partner universities in Namibia, Indonesia and Peru. The proposed program was modelled on previous successfully completed bilateral student software development projects engaging German and Namibian students in real client projects. Concerned with providing equal learning and traveling opportunities for all students and operating within funding options the program incorporates traveling for all students; turn-taking client selections from the partner countries with an emphasis on interdisciplinary projects. The program offers selected students the opportunity to gain a truly Global Intercultural Project Experience (GIPE) by

working in a multicultural team on an international project. The main objective of GIPE is to provide students with state-of-the art knowledge and skills while working in a distributed multicultural and multidisciplinary team across continents. GIPE also aims at strengthening the collaboration among its partner universities and promoting intercultural exposure in general through 'internationalization@home' activities.

3.2. The overall framework

In an effort to strengthen internationalization efforts at German Universities of Applied Sciences, the GIPE framework program received a four-year (2019-2023) funding. In the beginning representatives of all four Universities congregated in Germany to plan the implementation of the framework. A German representative then visited all partner Universities promoting GIPE at management level to ensure institutional commitment and support.

At the core of the GIPE framework are the annual student projects taking place from February to June/July (subject to different academic calendars and lecturing periods) preceded by a client and project selection, evaluation of students' applications and awarding scholarships as well as requirements gathering and detailed project planning together with the selected client (see Figure 1).

Figure 1.
The Masterplan for the GIPE Framework 2019-2023.
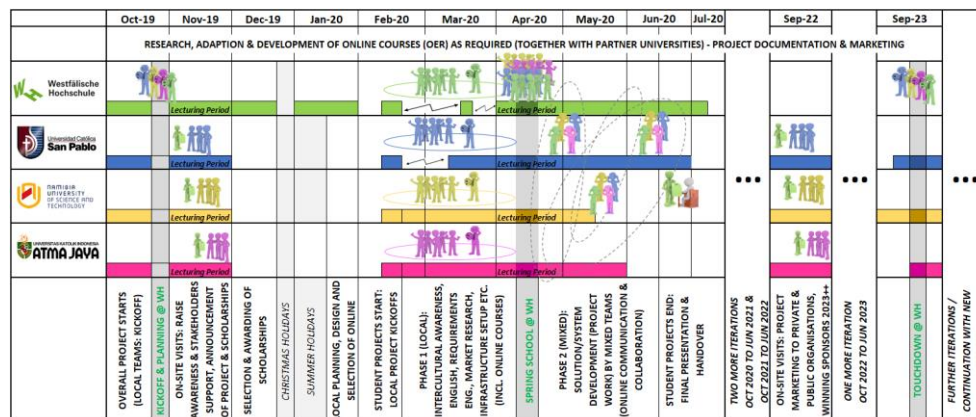
The annual projects consist of four phases:
1. Online collaboration preparation: A virtual global kick-off event brings all stakeholders together. Students then get prepared for the various project tasks through targeted training. Students join the project in intervals depending on the home universities' lecturing schedules.
2. Two-week face-to-face phase: All participating students and one representative lecturer from each university meet in Germany for team-building, intercultural exposure and mixed-team-setup ('Spring School').
3. Online collaboration: The students continue working on their project tasks in mixed teams using various online collaboration tools.
4. One-week project-touchdown and hand-over: The German students travel to the client situated in one of the partner countries.

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3.3. Operationalization of the GIPE Projects

The operationalization is based on a rigorous definition of participants' roles and communication (infra)structures. The 2020 and 2021 projects were of varying complexity and took place entirely remotely due to the Covid-19 situation.

The Project Manager (PM) and Project Coordinator (PC) are responsible for strategic and operational tasks as per funding agreement. Each University appoints a Local Coordinator (LCs) and International Office Representative (IOR) to organize scholarships and team-building, Guides (Stream Coordinators, SC) being faculty content experts, a Stream Lead (SL, one person from this circle) as well as experts, sponsors and external stakeholders and contact persons of the client. It is possible to fill several roles at the same time, for example LC, SC and SL. The number of SC depends on the complexity and number of streams of a project.

The allocation of students to teams is based on their country (mixed teams), their prior skills, and their interest. The students fill in a skill competency survey based on competencies needed for successful project completion. The survey also allows the PC to identify missing skills to plan interventions. Each SC provides performance feedback on each student's contribution to the success of the project. Each University applied its own assessment and grading system. Student feedback is provided voluntarily in the form of videos or text at the end of the project, and formal challenges and reflections from the individual student progress reports by the Namibian students.

Figure 2.
The Roles within GIPE.

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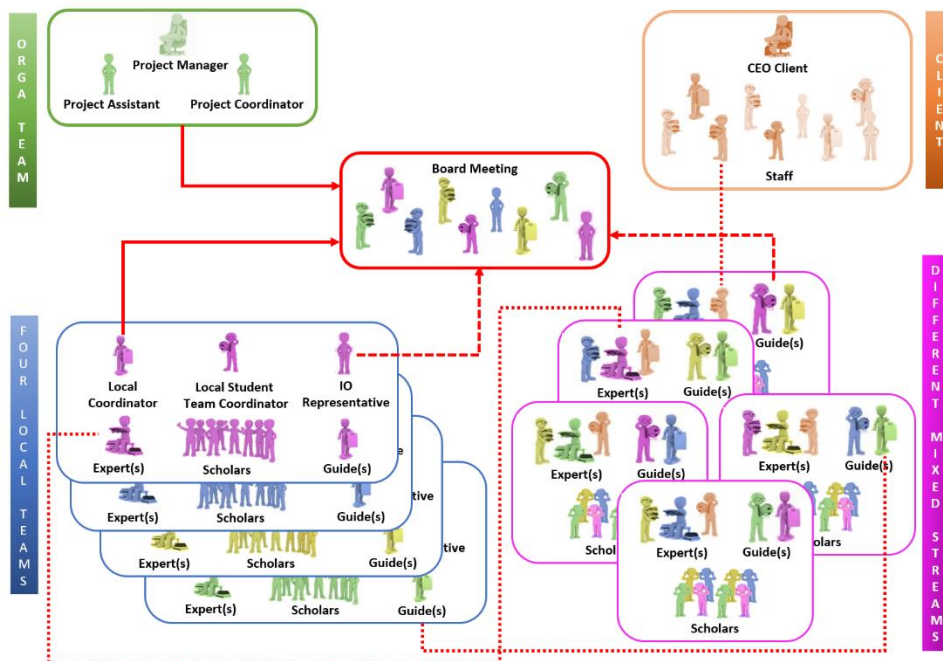
Day-to-day business is based on regular, synchronous project meetings via video conferencing systems. There are a number of regular operational and project-related meetings – starting mostly at 12:00 UTC, the only time accommodating the four time zones. Board meetings (BM) are held fortnightly to discuss general information and decide on common issues (Participants: PM, PC, LCs, SCs). In the Guides meeting (GM), every two weeks (during project phase), SCs coordinate and exchange information and discuss problems with PM and PC. The International Offices meetings (IOM) are held by arrangement, to coordinate local marketing, application procedure and intercultural activities. Weekly stream-specific meetings/workshops ensure project progress and alignment among students and clients. All Students meetings (ASM) are used to answer students' questions, synchronize streams and present results. Local Student's meetings (LSM) address administrative issues and examination matters at the respective partner university. Client meetings (CM) report on the progress of the project and open questions are clarified as needed.

In order to ensure effective and efficient communication, various tools are used. The main platform is Slite, where all important information is stored e.g. minutes of meetings, presentations (maintained by PC). All project members (except for students) have read/write privileges on everything. In the individual streams, information and deliverables are managed via Moodle with general and stream-specific courses. Zoom is the main video conferencing tool with additional rooms provided for 24/7 use. A project calendar is set up on Google accessible for all project members (read-only for students). The primary communication platform for asynchronous communication is Slack where pre-configured channels can be used - general (all-board-experts-guides) and stream specific (with/without students) - or direct messages as appropriate. Finally, Agantty is used for stream-specific project management. However, the two projects have revealed that some platforms are more usable such as WhatsApp. Thus, platforms that cater for different network bandwidths need to be discussed and selected by the participants of each project.

4. THE 2020 STUDENT'S PROJECT

4.1. Participants

A total of 20 scholars were selected locally (see Table 1) before the start of the project on the basis of criteria such as academic performance, English language skills, motivation, previous intercultural/social engagement, and local need-based criteria. 8 additional students joined the Namibian project team later.

Table 1.
2020 project scholars (+ additional students).

Country	Female	Male	Field of study	Level
Germany	1	4	Int'l Management, Business Comp., Software Systems, Mech. Engineering	Bachelor (4) Master (1)
Indonesia	1	4	Electrical, Mechanical and Industrial Engineering	Bachelor
Namibia	2	3+8	Software Development	Bachelor Honours (5+8)
Peru	1	4	Computer Science, Business Administration	Bachelor (4) Master (1)

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4.2. Tasks

The Namibian National Commission on Research, Science and Technology (NCRST) was identified as a suitable client, considering its (1) existing working relationship with the respective partner university, (2) strong commitment of its management for such a "learning project" carried out by students not professionals as well as (3) availability of English-speaking staff at the client-side. High-level requirements were agreed upon with NCRST prior to students joining the project. The task was to develop a national web portal to manage research projects, publications and researcher profiles referred to as the Science Technology and Innovation (STI) web portal. After signing off the requirement specification document and deciding on the most appropriate state-of-the-art technologies to be used, the project was internally divided into five sub-projects, each assigned to one team of students: (1) Object Model, (2) Documentation, (3) Quality Control and Assurance, (4) Frontend, and (5) Business Logic.

4.3. Process

The Object Model team duties were adjusted towards the end of the project to prepare deployment (handing over the application to the client) since their main task was a prerequisite for most of the other teams and already completed. The developed application (see the interface in Figure 3), including its documentation, was handed over to the client with minimal delay. As the client requested assistance with deployment as well as an extension of some functionalities, two Namibian students continued working on the project on the client-side, on a part-time basis.

Figure 3.
The new STI web portal developed for NCRST.

4.4. Student feedback

As pointed out by (Jara & Mellar, 2010), student feedback is essential for quality enhancement especially in online courses. (Williams, Parkes, & Davies, 2013) present word clouds as an innovative qualitative tool to provide fast and attractive feedback enabling educators to adjust their programmes to positive and negative areas of student experiences. Figure 4 shows a word frequency cloud, based on the GIPE students' video transcripts and

written text feedback, illustrating the most prominent topics such as project, experience, time, team, work, and challenge. We further provide supporting statements.

Related to the **project work** itself, the students recognized the professional support provided by the PC and the SC. An Indonesian student commented: "I appreciate this project, and when I go through the trouble, all the guides will help me through many problems." A Namibian student added that "there was always support. It was as much social as it was technical." A German student testified that "Due to the expertise of professionals, a great project manager who kept us on track every week, and the dedication of each team, we were able to do the final product that I am personally proud of".

Regarding their overall **experiences**, students expressed strong emotions. An Indonesian student stated that "this is truly a life-changing experience, although it wasn't smooth sailing all the way." while a German student exclaimed that "that's something you would normally never think of." Students fully acknowledged the learning opportunity the project provided, be it communication, technical or intercultural. For most of them, it was a chance to improve their English professional skills, as mentioned by a German student: "Within the project, I could improve my English skills and learnt how to work with an international team through different time zones."

Figure 4.
Student reflections Word Cloud 2020.

The students appreciated working in a multicultural team and expanding their personal relations over continents. As expressed by an Indonesian student: "We were getting to know each other and even talking about our countries, such as our culture, food and daily life." A Peruvian student said, "I think the most amazing thing about it is the fact that I've worked with a lot of people from all over the world and we have achieved a very wonderful product for our client."

Besides the disruptions caused by the pandemic, the students mentioned a number of challenges with working across **time** zones as the most prevalent. A Peruvian student stated that: "One of the major challenges of the project was coordinating the team because of time zones. For some of us, that day was just beginning, others were about to have lunch and some

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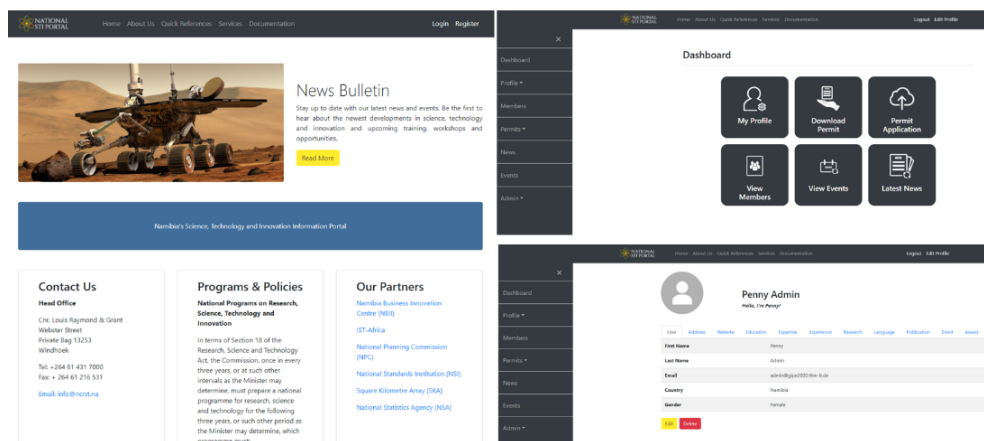others were finishing their day". While another Peruvian student said that "From the beginning, we knew that it would be difficult to reconcile the schedules, since there is a difference of 12 hours with Indonesia, so our weekly coordination meetings and meetings with the students were adapted to that time." This sentiment was further confirmed by one of the German students "I think the most required ability, though, was being agile, adjusting to different time zones, participating sometimes late in the evening, all the morning during the weekends with different time zones and different means of communication." Yet another Peruvian student expressed the challenge of having to deal with multiple issues "I have to manage to overcome the difficulties associated with the pandemic, schedules, language, and, perhaps, specific knowledge of tools, to be able to develop together with students from Germany, Namibia, and Indonesia". One student was concerned with having been the only female in a team and her challenges of being heard and respected.

4.5. Client engagement

The NCRST required a fully functioning platform to support the development of national STI policy and policy instruments effectively. They attended a number of meetings and training yet had insufficient internal capacity. The basic functionalities were implemented, and two students were assigned for deployment at the client-side. The Portal is loaded on the NCRST server yet not accessible for end-users.

5. THE 2021 STUDENT'S PROJECT

5.1. Participants

A total of 32 scholars were selected locally (see Table 2) using the same selection criteria s in the 2020 project. 12 additional students joined later.

Table 2.
2021 project scholars (+ additional students).

Country	Female	Male	Field of study	Level
Germany	5+5	3+1	Mechanical Engineering, Computer Science, Software Development, Business, Molecular Biology, Environmental studies	Bachelor (7+6) Master (1)
Indonesia	3	5	Engineering, Business Administration	Bachelor (7) Master (1)
Namibia	3+1	5+5	Computer Science, Tourism	Bachelor (3) Honours (5+6)
Peru	4	4	Business Administration, Computer Science, Electronics and Telecommunications Engineering	Bachelor

5.2. Tasks

The selected client, Puspanita Eco-Spirit Center, located in Indonesia, is a private institution providing eco-education to learners, students, and the general community. It was agreed to develop three digital tourism platforms, dividing the students into five working groups: (1) Business Model and Strategy, (2) Digital Marketing, (3) Website with Booking System, (4) Educational Games and (5) Smart Farming. Special attention was given to ensure each group has a student from each partner university to maximize the intercultural competence achievement (Burdett, 2014). Additionally, in each group a staff member from the client organization actively participated throughout the project.

The task of the Business model and Strategy stream was to create a new business model using BMC (Business Model Canvas) concept and propose alternative strategies for Puspanita to ensure the client keeps up with the current developments in digital technologies and make optimal use of their resources, as well expanding their market. The Digital Marketing stream was formulating marketing strategies utilizing digital technology and social media. Meanwhile, the Website stream created a website equipped with a booking system. Considering that the client was an educational institution promoting ecological concerns to children, the Educational Game stream implemented an online ecology education game. The responsibility of the Smart Farming stream was to develop innovative farming applications using IoT installations as a medium for learning and study media for visitors and students. Stream outputs are shown in Figure 5.

Figure 5.
Various stream results developed for Puspanita Eco-Spirit Center.

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5.3. Process

Since the first week, the students have been working on each of the streams. Scholars and clients communicated intensively so that user requirements were considered. A virtual spring school was organized replicating activities from the planned yet cancelled physical contact phase. All project streams completed their tasks on time. Each Stream reported its work to the GIPE project plenary and was launched in the Official GIPE 2021 Virtual Launch Event, which internal and external stakeholders attended. This activity was covered and disseminated by local Indonesian media and media in each member country. At the end of the project, each stream team was measured on intercultural competence, project management skills, and three stream-specific competence indicators. Additionally, the educational game stream co-opted six game-design students to improve the output of the apps.

5.4. Student feedback

While some of the feedback is similar to the 2020 project, we observed new terms enlarged in the 2021-word cloud (Figure 6), such as business and model, which reflects the differences in project focus.

Figure 6.
Student reflections Word Cloud 2021.

The high frequency of "**amazing**" relates to the enhanced experiences expressed by the students and confirmed by a separate survey conducted (see results in Figure 7), where it was revealed to be nearly as important as meeting people from other countries as a reason to participate in the project.

Figure 7.
Reasons for participating in the program.

Question: What are your reasons for participating in the program? You can select more than one answer!
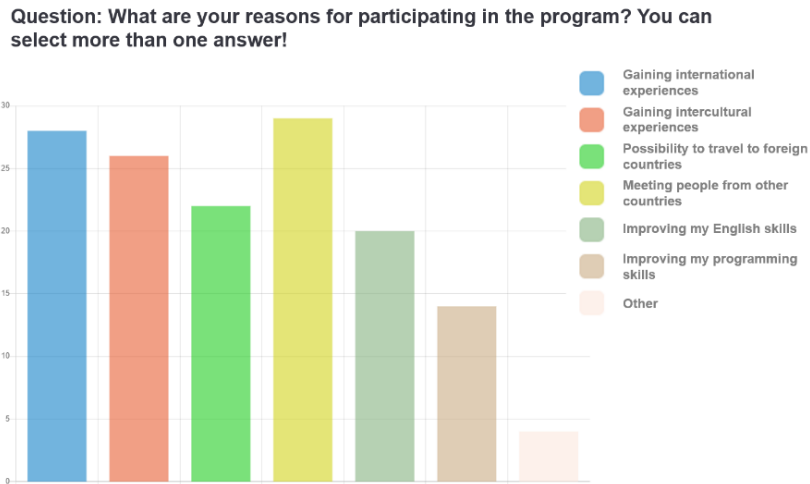
A Namibian student provided a comprehensive summary statement "My GIPE 2021 experience was unforgettable. Besides the fact that I had the chance to work and communicate with students from all over the world, we had a wonderful relationship with our client. It was **amazing** to have an intercultural exchange of ideas and perspectives, and it really allowed me to become more open-minded and learn about the world around me. I would highly suggest any student who has the chance to partake in this incredible project to do so!" An equally strong statement from a student in Indonesia confirms the sentiment "a memorable journey … helped in building solid connections and sharing knowledge, which we shall continue beyond the project 2021… What an extraordinary journey and how I fell in love with the project."

The importance of the Virtual Spring School through the lens of the students as shown in Figure 8 where such reasons as getting a better overview of the overall project e.g. what was happening in other streams, were among such aspects the students had to rate. The concern of not being able to physically participate at the Spring School was raised as confirmed by such feedback as, "It would have been great if we attend it physically" complemented by another sentiment expressed by a student: "I liked the intercultural experience in the Spring school and it was just then when I could meet other streams participants. I think it is good to have a social space for students to interact in the kick-off as well".

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Figure 8.
Virtual Spring School ratings.

Question: The Virtual Spring School was a valuable experience for me.
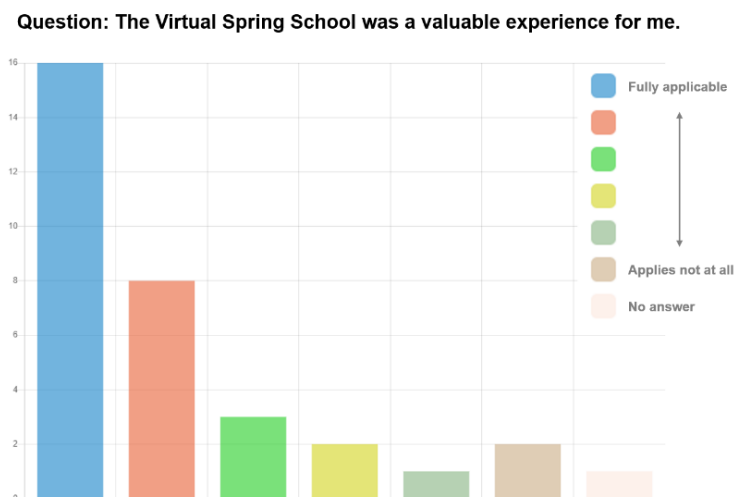
5.5. Client engagement

We captured the client feedback directly and indirectly from the responses during the stream meetings and at the virtual launch event at the end of the project. In general, the client was delighted with the students' work in all streams. The Business Model was a down-to-earth proposal easy to implement. In addition to creating digital content for marketing campaigns through social media, the digital marketing stream also created a new logo for a unique and modern eco-spirit center. The organization was especially grateful for the fully functional well-designed website with booking system. The installation of smart-farming equipment (IoT) to monitor soil conditions in organic crop plots, has convinced the client that it would be helpful for the people to learn how the ecological system works.

6. LESSONS LEARNT

We have identified five themes of interest that need special consideration in such projects.

6.1. Intercultural and interlingual competence development

As noted by (Cummings, 2021), students need cultural competence to make international collaboration work in online spaces. The intercultural nature of GIPE is one of the program's cornerstones, with partner universities located in Africa, Asia, Europe and South America, bringing the average distance between their campuses to more than 11,000 kilometers. The countries neither have a common language, nor much political or economic association, nor similarities in infrastructures or everyday life. Benefits of intercultural project experiences have been the development of transferable communication and management skills (Lycko & Galanakis, 2021), and enhanced multilingual communication competencies needed to navigate changing work contexts (Atabekova, Lutskovskaia,

& Gorbatenko, 2021). In GIPE, English was chosen as the official project language, not being the mother tongue of most students. Feedback from the scholars revealed that not only they needed to adapt to different accents but also to the peculiarities in communication codes of each country and culture. For example, subtle differences in communication forms meant that the Indonesian scholars asked their Western colleagues to turn on their cameras during meetings, as they expressed that face-to-face interaction, e.g. being able to see the other person, was essential for them. As team members grew to know each other, they also learnt to understand their partners. Nevertheless, the use of simpler language, with fewer figures of speech helped to keep a clearer communication channel between the project participants. Corner, Liu, and Bird (2021) postulated that in order to navigate complex interdisciplinary and intercultural projects recognizing perspectives, managing relationships, and navigating uncertainties are essential.

6.2. Team building

Striving to enhance team cohesion, process and performance, Klein et al. (2009) suggest that team building should focus on (1) goal setting, (2) clarifying roles, (3) fostering problem solving and (4) facilitating interpersonal relations. In GIPE (1) and (2) were realized through the project organization and coordination, while (3) was given through the nature of the projects, (4) was fostered through additional activities. Team building and socializing activities are central elements in the GIPE framework, essential for the success of the project and the "fun part" of the experience. Team building was actively pursued at the Global Kick-Off and the Virtual Spring School, but played a recurring role throughout the GIPE projects 2021 and 2020. It was conceived and planned mainly by the IOs. It consisted of three elements: Low-threshold getting-to-know-you games, presentations about cultural & country differences (Country Facts Quiz, Educational System, Working Life, Stereotypes) and Socializing (Escape Game, World Café & socializing breakout-rooms). The games served as ice-breakers, the cross-cultural information was deepened especially during the Spring School to promote cultural understanding while the socializing events took place continuously to foster exchange between project teams. In addition, a friendship book (Fact sheet of all participants) with a playlist available online (favourite songs of each person) was distributed at the start of the project.

The measures were more comprehensive and successful in the second project. The friendship book and the socializing breakout rooms ("coffee kitchen") were particularly successful. Overall feedback was "more activities should be planned, especially at the beginning". Reduced to online only, the team-building was more challenging, in between other tasks and activities. The available time slots between the different time zones are limited and when project work is really needed, socializing activities are hard to be scheduled. In the future, team building activities could be planned in a more streamlined and stringent way and be more aligned with the individual project phases.

6.3. Knowledge and skills support

As students from four different partner universities and from different programs take part in the projects, it's inevitable that they join with different levels of prior knowledge and skills as regards the topics and technologies required in the project. (MacLeod & van der Veen, 2020) suggest a scaffolding approach to prepare students to work in an interdisciplinary team, by equipping students through carefully designed modules with the appropriate technical skills.

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In the GIPE 2020 project, a Web Engineering project (with some business aspects for the few business students enrolled), almost all students needed to familiarize themselves with the state-of-the-art technologies and tools selected to be used. Therefore, in phase 1 tutorial material was compiled and provided to all students for some hands-on training finally also supported by two half-day workshops given by the Peruvian and Indonesian students for the students from Namibia and Germany who joined the project later due to different academic calendars. However, this familiarization phase reduced the time left for the development of the main application resulting in the hand-over of a core but functional web portal to the client.

As the scope of the 2021 project was much broader to attract students from various programs and strengthen the interdisciplinary character, familiarization with technologies, tools and methods did no longer take place separately. Faculty experts on each stream facilitated 'learning while doing'. Although this approach allowed for more time working on the deliverables for the client, students finally gained more project-specific knowledge and skills as needed to solve their particular tasks rather than general concepts.

In future projects, both aspects, (1) the alignment of prior knowledge and skills and introduction of general concepts and methods in phase 1 and (2) their application on the given project need to be carefully balanced to ensure that students are well prepared for the tasks within their sub-project but also leaving enough time to achieve valuable results for the client.

6.4. Project organization

Although a specific unique meeting time was selected considering all time zones, the participants expressed it to be a challenge. In further project implementations, a rotational time slot mechanism could be explored to distribute the burden of early or late meetings for one project partner. While the number of meetings seems excessive, they proved to be necessary to manage the project and ensure cohesion. However, the length of the meetings needs to be strictly controlled with measures such as voting instead of consensus-oriented discussions and use of a slack-channel for discussions could be adopted going forward. Regarding course and project organization, (Guth, 2013), reporting about 24 successful COIL courses, emphasizes that the use of asynchronous tools, real-time communication, course content, etc. is dependent on various factors. One important lesson learnt was the need to be flexible, and trial and error helped teams overcome difficulties of first-time courses. Considering the stream's handling of the projects and keeping the various teams into manageable sizes provides easy to monitor progress checks and identifying call for attention sections. Identifying Subject Matter Experts at the beginning of each project is a necessity to handle the multidisciplinary demands of the project. For this to be successful, however, it requires thorough requirements specification with the client at the onset. If new demands for the project surface, while the project has already kicked off and the required skills were not planned for, that is where complexity is birthed. Another challenge is the differing academic calendars, including student registration and availability.

6.5. Impact of COVID-19

Although GIPE was conceived as an online collaboration project since its inception, Covid-19 measures required a number of adaptations in the organization. Many team members reported a variety of challenges that arose throughout the pandemic that made effective teamwork challenging, as well as communication adjustments in terms of quantity and quality. Some students did not have adequate conditions for online participation at home and needed technical and financial support. Some participants were affected at a personal level either suffering of Covid-19 themselves or close relatives. Challenges are similar to the once reported by (Wildman, Nguyen, Duong, & Warren, 2021), who has analyzed 90

open-ended questionnaires of students who worked on group-projects during Covid-19 restrictions. Besides external factors, they also mentioned communication issues, student performance matters as well as logistics. In GIPE, organizing client meetings was a challenge in different phases of the lockdown in 2020, where the client was not reachable for weeks. Moreover, the postponement, and ultimately cancellation, of both spring schools was one of the most regrettable decisions that the program had to take. These kickoff meetings were intended for scholars, guides and staff to meet in person before starting to work together on each yearly project.

Having learnt from the first years' experience, the partners were able to plan in advance for a Covid-19 scenario. Subsequently, every interaction was scheduled to take place online, including client meetings. There were only a few impediments such as the inability to physically install the sensors for the Smart Farming stream and the impossibility to visit the client's facilities to develop the Mixed Reality platforms.

7. CONCLUSION

In conclusion, the GIPE project experience was enriching in many ways: culturally, academically, and professionally. Reviewing the sentiments expressed by the students confirms that though they experienced many new challenges they equally appreciated the learning and the multicultural context. Working in an interdisciplinary team on a software development project required a steep learning curve in a short time. The students received structured technical training and were exposed to new web programming frameworks, and learned good project management practices using professional tools. An invaluable reward was the creation of new personal and professional relations during a time of "social distancing". The Covid-19 pandemic drastically changed the implementation of the planned GIPE framework, depriving the students from travelling to Germany to experience a two-week team-building workshop, as well as depriving the German students from handing over the project to a client on another continent. Yet the distributed interdisciplinary projects were completed successfully with a multicultural team of students from four continents, serving as a proof of concept.

The encounter from the 2021 GIPE project of working hand-in-glove with the client as part of the project streams, brought alive the experience of participatory design methodology. There were best practices gained from facing head-on the challenges highlighted in this chapter. Being flexible to try new approaches and experiment with alternatives where need is called, will surely be part and parcel of steering the noble endeavour such as bringing the international, intercultural and interdisciplinary experiences to the participants of the GIPE project each successive year of its implementation. Each new project will present its own new challenges but learning from past failures and successes and being ready to adjust and customize accordingly helps in building the desired results without missing the main objective of the project which is to create a Global Intercultural Project Experience (GIPE).

We postulate that integrating such international projects in existing curricula across the globe promotes the acquisition of 21st-century skills for students from all disciplines. Although GIPE received funding for a period of four years only, it is intended to be continued and sustained once the processes have been established and the value for all participating institutions has been recognized. The coordination of such international educational collaborations, however, requires consideration of formal university structures, human resource-intensive project preparations, planning and management, communication dynamics and challenges, technical and methodological aspects. Based on our experiences, we conclude that a refined concept of this interdisciplinary, international project-based learning is a promising approach to support global educational development, even during pandemics.

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Chapter #16

EXPLORING THE EXPERIENCES OF TVET COLLEGE EDUCATORS REGARDING VIRTUAL LEARNING DURING COVID-19 IN SOUTH AFRICA

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ABSTRACT
This study explored the experiences of private TVET college educators regarding virtual learning during the Covi-19 school lockdown. The Kanter theory of change is adopted as the theoretical base in this study. Data collection was done through face-to-face semi structured interviews and non-participant observation with six educators from three TVET colleges in Gauteng Province, South Africa. Collected data was analyzed using content analysis. Findings reveal that though participants have positive attitude toward the process of change required in transitioning from traditional environment to virtual environment, majority of them did not receive substantive training on how to use technology to support virtual teaching. However, educators indicated that the change process comes with several challenges such as technical problems, ineffective communication from management, workload, inadequate training, lack of access to ICT tools and lack of other structural support within the college which impacts their effective implementation of virtual teaching. Thus, teachers should be adequately prepared, supported and empowered to cope with the changes and transition processes involved to continue teaching in a virtual environment. More so, TVET college managers and policy makers should priorities change management programmes designed to prepare teachers for the inevitability of technological change in education.

Keywords: change management, educator, traditional classroom, virtual classroom, TVET college.

1. INTRODUCTION

In virtual learning context Parlakkiliç (2017 p. 640) described change management as the "combination of processes, activities, and approaches that manage the people of the organization through the transition from the old way of teaching to new e-learning". Parlakkiliç (2017) further indicates that it is very difficult to change the behaviours, culture and routine of the educational institutions' users such as the students, educators, school leaders. In agreement with Parlakkiliç, change will be tougher when the change process is sudden and forceful such as what most of the schooling system have to do in order to ensure continuity of teaching and learning during the school lockdown cause by the novel Coronavirus (Covid-19).

The outbreak of the Covid-19 has caused a shift in almost every system or model in the world's civilization and the education model has been no exception to this change. On the 15th of March 2020, the President of South Africa declared a national state of disaster and announces the institution of a nation-wide lockdown, including the closing of schools from the 18th of March 2020 (Haffajee, 2020). The Basic education minister further

announced that various platforms will be used to ensure that learning continues from home, i.e., online, radio and television platforms (Brodie, McFarlane, & Ally, 2020). The introduction of the fourth industrial revolution has since been moving the education system in the virtual learning direction. As a result, integrating technology in the education system requires a significant shift which requires educators to be adequately trained on how to use technology, update their knowledge with current technologies available for instruction delivery, and possess the requisite knowledge required to plan and deliver teaching and learning in TVET institutions (Obwoge & Kwamboka, 2016). Nevertheless, the surge of Covid-19 pandemic suddenly changed the mode of instructional delivery in educational institutions including TVET college from traditional learning to virtual learning. Thus, it is important to understand how educators experience the changing process. Hence, this study aims at exploring and describing the experiences of private TVET college educators in Pretoria regarding virtual learning during the school lockdown. The research questions to achieve this aim are "What are the experiences of TVET college educators when transitioning from traditional learning to virtual learning during Covid-19 school lockdown?" and "what are the factors that inhibit and support TVET college educators transitioning from traditional learning to virtual learning?"

2. LITERATURE

Technical and vocational education and training play an essential role in increasing a knowledgeable and skilled community that will be able to effectively improve the social and economic growth of a country (DHET, 2013 p. 3). Similarly, Boateng (2012 p. 108) described vocational technical education as the educational courses that involve the study of technologies and the gaining of practical skills and knowledge in order to discover and improve labor in various part of economic for the purpose of economy growth. In South Africa, TVET colleges equip students for jobs that falls within scares skills while other learning institutions prepare students towards the transfer of knowledge rather skills. For the TVET colleges to achieve skills development for economy growth, effective management from the relevant stakeholder is vital especially the educators' ability to manage change process that would enhance their performance during teaching and learning engagement with the students.

Change management is the systematic approach to adjusting and transitioning organisational processes, procedures, strategies, attitudes, functions and/or technologies from their existing state to a relevant and desired state to achieve the result of the change. In South African, higher institutions including TVET colleges were compelled to continue teaching and learning during school lockdown, this left them to no other option than transitioning to virtual learning environment. As a result, the educators' ability to manage change (to adjust and change the teaching and learning strategies and technologies to ensure continuity of teaching and learning) is tested. Nevertheless, research indicate that TVET colleges face several challenges resulting from various forms of change that have occurred in the sector over the past decades (Kraak, Paterson, & Boka, 2016). Furthermore, TVET colleges find it difficult to migrate to virtual learning because they focus more on practical skills and work-learning (Yeap, Suhaimi, & Nasir, 2021) This implies that the adapting to change has been a great challenge in the TVET sector. More importantly in situations where TVET college do not have online teaching and learning plartform in place prior to the covid-19 pandemic (Hondonga, Chinengundu, & Maphosa, 2021). Hence, understanding how TVET educators adapt to virtual learning as a result of Covid-19 school lockdown is very crucial.

Technologically, the world is changing so fast. Hence, educators should be in a position to adapt to these changes and still able to deliver quality teaching. The fourth Industrial revolution brought about changes in our teaching and learning environment globally including South African schools. Ramorola (2013) points out that the new focus on use of Information Communication Technology (ICT) in South African schools indicates that educators are expected to use computers and other technologies as tools to adopt the new and evolving teaching methods. For educators to effectively adapt to use of technologies (virtual classroom) in the place of the usual face-to-face traditional classroom, many factors must be put into consideration such as the educators understanding of virtual learning, educators' readiness or attitudes towards technology, digital competence, requisite skills, availability of the relevant tools and training (Núñez-Canal, de Obesso, & Pérez-Rivero, 2022). According to the European framework for digital competence for Educators, the digital skills required for TVET educators to be considered sufficiently prepared for online teaching are classified into 6 categories: professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence (Ferrari, 2013; Redecker, 2017). These skills are briefed below:

- Professional engagement describes teachers' efficient and appropriate use of technologies for communication and collaboration with colleagues, students, parents and external persons, problem solving, safety, in which technologies are integrated into teaching in a pedagogically meaningful way.
- Digital resources focus on the selection, creation, modification and management of digital educational resources. This also includes the protection of personal data in accordance with data protection regulations and compliance with copyright laws when modifying and publishing digital resources.
- Teaching and learning deals with planning, designing and orchestrating the use of digital technologies in teaching practice. It focuses on the integration of digital resources and methods to promote collaborative and self-regulated learning processes and to guide these activities by transforming teaching from teacher-led to learner-centred processes and activities.
- Assessment addresses the concrete use of digital technologies for assessing student performance and learning needs, to comprehensively analyse existing performance data and to provide targeted and timely feedback to learners.
- Empowering learners emphasises the importance of creating learning activities and experiences that address students' needs and allow them to actively develop their learning journey.
- Facilitating learners' digital competence which highlights that a digitally competent teacher should be able to promote information and media literacy and integrate specific activities to enable digital problem solving, digital content creation and digital technology use for communication and cooperation.

In TVET colleges, educators, students, and administrators are used to traditional pedagogy such as face-to-face settings, practical skills training through apprenticeships and work-based training which have been negatively affected by the lockdown and becomes a challenge to move it online (Kanwar, Balasubramanian, & Carr, 2019). However, studies have indicated the possibility of addressing these training challenges through the use of virtual platforms and e-learning materials (Harriden, 2017; World Bank 2020). Nevertheless, educators with insufficient skills and qualification might struggle to easily adapt to change from traditional teaching to online teaching, especially when the necessary

training and ICT tools are not provided. This is supported by Hondonga et al., (2021) who claimed that educators and students lack technical capacity to use online platforms to deliver practical skills training and support work-based learning during the Covid 19 pandemic. According to Mahazani (2015 p. 8) most of the TVET educators are fresh graduates, and they do not possess working experience in teaching and related technical skill which lead to their inability to deliver teaching processes effectively. Similarly, the South African Council for Educators (SACE) (2011 p. 10) indicated that the prevailing challenge facing FET Colleges is the fact that a substantial number of lecturers at FET colleges are either under-qualified or unqualified. On one leg the consequences of not having the essential teaching skills and qualification will be seriously impede the changing process. On the other leg, unavailability of the essential online teaching and learning gadgets will also be a major hindrance for the educators to effectively engage learners virtually. In addition, rresearch report that virtual learning projects are failing to achieve their objectives due to many reasons, more pronounce in the reasons is the user resistance to change (Parlakkiliç, 2017). For instance, a study conducted by Hondonga et al., (2021), on the readiness and prevalence of TVET colleges for using online teaching platforms during the COVID-19 pandemic in Botswana reveal that students were resistant to changing their mode of learning from traditional methods to online methods. Parlakkiliç (2017 p. 642) further states that there are different views about the nature and aims of ICTs in education consequently, diverse behaviours and attitudes are found in the development, use and change management of virtual learning.

According to Hondonga et al., (2021), most TVET colleges did not have online teaching and learning platforms in place prior to the COVID-19 pandemic due to lack of training, adequate infrastructure and resources on the part of students and/or TVET institutions.

Authors point out factors that enhance implementation of online learning in TVET programs to include availability of technology resources and educators' willingness to use (Adelabu, Adu & Adjogri, 2014). The World Bank (2021) expatiate by saying that implementation of ICT in TVET requires high investment on installations and maintenance of ICT tools, technical support and training of educators. Yasak and Alias (2015) argue that before one plan for effective implementation of ICT in TVET there is a need to understand how effective use of ICT implementation is, as well as what need to be done to advance the present situation regarding online teaching and learning. Thus, understanding the movement from the traditional to online teaching and learning becomes significance in understanding the ICT tools that were used during the change process. In addition, provision of technical support by the college management team could enhance the transitioning to online learning and transform educators' perception towards the change process.

3. THEORETICAL FRAMEWORK

The Kanter theory of change is adopted as the theoretical base in this study, given its correlation with the researchers' intentions to explore and describe the experiences of TVET college educators when transitioning from traditional classroom to virtual classroom particularly during the Covid-19 school lockdown. The Kanter theory buttressed this study by highlighting how TVET educators managed the change processes involved, on account of their attitudes and behaviours during transitioning to virtual classroom. While different models and approaches have been developed to better understand the process change in

organisations and educational settings as viewed by Kanter's theory, the particular areas of change that need to be articulated when addressing lecturers' experiences in this study utilizes the ADKAR model to provide a valuable interpretation of TVET college educators transformative efforts during the transition to virtual classroom. The ADKAR model adapted by Hiatt and Creasey (2003) includes five different phases in change management process which are awareness of the need for change; desire and willingness for change; knowledge of how to change; ability to implement change; and reinforcement which involves provision of support towards the change process. These phases of change process in ADKAR model guides this study in understanding the TVET college educators' experiences regarding their attitude and willingness towards the transitioning from the traditional teaching and learning to online teaching and learning as well as the supports and challenges experienced during the transitioning process. The ADKAR model also helps in the aspect of data collection instrument to be engaged in the study and the analysis of data, for example being able to relate the educators' experiences to the five phases of change process.

4. METHODOLOGY

To achieve the objectives of the study, a qualitative research approach was used to obtain first-hand information in the research setting (Neuman, 2011); and to interpret and understand the participants experiences regarding their transitioning from traditional classroom to virtual classroom (Babbie & Mouton, 2015). This study engaged a multiple case study research design as it was deemed most appropriate to obtain multiple information from various perspectives (Baxter & Jack, 2008). The study focused on three private TVET colleges in Gauteng Province, South Africa to provide answers to the research questions. Case studies permits spending time in the setting of the research subject (Hamilton & Corbett-Whitter, 2013). Purposive sampling technique was used to select six educators from the chosen private TVET colleges. The participants were purposively selected based on their knowledge and information that they are privy to regarding online teaching and learning during the covid-19 school lock-down. Table 1 depicts the educators' profile.

Table 1.
Educators' profile.

College	Educators' pseudonyms	Age	Gender	Highest Qualification	Years of teaching experience in TVET college
1	Mr. A	31	Male	National Diploma	6years
	Ms. B	28	Female	Bachelor of science Degree	3years
2	Ms. C	27	Female	Bachelor of science Degree	3years
	Ms. D	35	Female	National Diploma	6years

| 3 | Ms. E | 40 | Female | Bachelor of science Degree | 2years |
| | Ms. F | 40 | Female | Master's degree | 10years |

Data was generated through face-to-face semi-structure interviews and non-participant observation of the ICT tools in the learning environment. The covid-19 restrictions were observed, during the interview sessions. Minimum of 45minutes was spent with the participant at the college in order to understand them from their view. Data analysis was done thematically through analytically coding and categorizing the generated data into themes that emerged from the data. The research questions and conceptual framework also guided the researcher in the systematic analysis of data in terms of sorting it according to themes. It should be noted that the sample size used in this study is not large enough to generalize the findings to the entire population of TVET educators/colleges in South Africa.

5. FINDINGS AND DISCUSSION

The findings are presented and discussed in the three sub-headings below. Participants responses about their experiences in transitioning to virtual are presented in terms of three themes which are attitude of TVET college educators toward virtual learning; supporting factor towards successful virtual learning; and mitigating factor towards successful virtual learning.

5.1. Attitude of TVET college educators toward virtual learning

In the aim of attempting to answer the research questions while analyzing the participants shared experience regarding virtual learning during the covid-19 school lockdown, it was discovered that most of the participants had a mixed feeling towards the changing process from the traditional learning to virtual learning. Majority of the participants have positive attitude about virtual learning however, the circumstances that surrounded their movement negatively affected the change process from traditional learning to virtual learning. Mr. A and Ms. C, E and F described their feelings towards virtual learning as follow respectively –

"It is not that bad, but it is a bit challenging because of the rushing to change due to the national lockdown",

"I think online learning in itself is not a bad idea, but I don't think it can be the main mode of learning",

"I think virtual classroom is essential, I don't want us to go back to the traditional way of teaching"

"it's not boring asides the network issues which are the basic technical issues that we see regarding online classes. Online learning for me is actually more convenient".

The positive attitude displayed by majority of the participants towards the moving from traditional learning to virtual implies that there should be successful integration of virtual classrooms in our TVET colleges. However, the good attitudes displayed by the participants come with some hindrance which would affect the adoption of virtual learning in their colleges. The findings of this present study agree with Nokwali, Mammen, and Maphosa (2017) in their study where they found that teachers have a positive view towards

the idea of using ICTs in lessons. According to Torres and Giddie (2020) teachers' attitudes towards technology, as well as their readiness to accept ICT into their teaching are key factors for the successful integration and use of technology in education. Similarly, Davis, Bagozzi, and Warshaw (1989) in their Technology Acceptance Model (TAM) firmly indicate that attitude that users formed toward a system will actually determine if users will accept or reject it. Invariably educators' attitude towards virtual learning is important but more important are the situations surrounding the use of virtual learning. The following themes below are used to discuss factors that affect virtual learning in the participated TVET colleges.

5.2. Supporting factor towards successful virtual learning

Data collected through the interviews and observation revealed that the educators with background IT skills are in better position to successfully adapt to virtual learning despite the circumstance regarding the change process. For example, Mr A and Ms E said respectively that "*For me I have IT background, I had certificate course in IT engineering, I have adequate knowledge on IT, so the changing from traditional classroom to virtual classroom was easy for me*" and "*Luckily for I was from the IT industry, so I was able to apply my background knowledge by giving them online activities with traditional face-to-face teaching*". Data collection also reveals that the piece of trainings provided to the educators helped them during the moving from traditional classroom to virtual classroom. Although, the training seems not to be sufficient due to the short period that the educators have to change to virtual learning. This was narrated by Ms. E and B respectively "*the institution tries to do some short training where online learning platform was explained*", and "*Immediately the President announced the national lockdown, decision was made to replace traditional classroom to virtual classroom by the college management and little or no form of training could be provided within that period*". This finding suggests that training is necessary to ensure a smooth transition to virtual learning because some TVET educators may lack the pedagogical knowledge, skills, and competencies required to facilitate virtual learning (Yeap, Suhaimi, & Nasir, 2021). The literature attests that educators' prior exposure to virtual learning, technological knowledge, pedagogical knowledge, and the support system influence their level of participation in virtual learning platforms (Lie et al., 2020). Furthermore, educators' involvement in professional trainings creates opportunities for them to collaborate with peers and outside organizations in creating interactive and effective pedagogy that can be used on virtual platforms (Yeap, Suhaimi, & Nasir, 2021). Thus, Cheok, Wong, Ayub, and Mahmud (2017, p. 30) recommend that "room to experiment, to make mistakes, to try again and finally learn must be made part of the school culture if change is expected". This implies that practical and continuous training regarding virtual learning should be provided for the educators.

5.3. Mitigating factor towards successful virtual learning

It was discovered from the analysis of the interviews and the observation of the learning environment of the participated TVET colleges that there is lack of ICT tools such as personal laptops for the educators, and access to Wi-Fi connection to facilitate virtual learning. According to the participants response, Mr. A said that "…*there was not enough time for the school to provide the adequate and necessary materials such as laptops, android phones*". He further stated that "*the students also need the online garget like the phone, laptop, data, so that they can be able to stay online whenever they are having online classes. If students don't have any of these tools, it means that they will not be able to*

connect to the online classes". Similarly, Ms. C shared her experience regarding ICT tools "that is the biggest problem because the ICT gadget is lacking if I can say". Ms. D also added "*in my college, lecturers were given data to work online but it is not frequent and sufficient. No provision regarding laptop or router for the lecturers. The students were also not supported with any resources needed for online learning. The students are on their own because this is a private college"*. The findings of this present study correlate with Nokwali et al. (2017) studies where they found that challenges such as a lack of ICT resources, space, and time compromises the teachers' ability to implement the use of ICT in lessons in an effective manner. This implies that lack of ICT tools would negatively affect the changing process from traditional classroom to virtual classroom. The lack of appropriate ICT tools experienced by the participants of this study made them to conclude that virtual learning has not come to stay but is just used to ensure continuity of learning during school lockdown. For instance, this was mentioned by Ms. D when she said that "*I can say I have good attitude concerning online learning but the essential tools for online learning are not provided. So, we have to move back to traditional learning because the students are expected to write national vocational examination in July"*. This was also reported by Ms. F when said *".... not too much that was invested in the virtual learning, no infrastructure. So now that we are back to traditional learning, I can say that the virtual learning died a natural death"*. Regardless of the issues identified and highlighted, it is believed that the integration of virtual learning into TVET colleges can be improved by providing students with access to the internet and technological resources so that they can connect with one another and lecturers irrespective of their location or difficulties encountered (Mpungose, 2020). In addition to addressing the challenges of internet access and digital tools as mitigating factors for successful virtual learning, TVET colleges could consider using low-technology training solutions that are simple to use for educators and students such as Direct-To-Home TV channels, mobile phones and interactive voice response (The World Bank, 2020).

6. CONCLUSION AND RECOMMENDATION

Existing literature recognized the benefits of virtual learning and adapting ICT tools in learning environment to improve the output of education sector and transform the economy at the long run (Torres & Giddie, 2020; Dlamini, Marais, Mwapwele, & Van Biljon, 2019; Rubagiza, Were, & Sutherland, 2011). However, the adaptation of virtual learning comes with several challenges (Nokwali et al., 2017). This study was an attempt to provide insights about the experiences of educators at TVET colleges regarding transitioning to virtual learning during the school lockdown due to the Covid-19 pandemic. Results illustrated how educators' experiences in transitioning to virtual learning was influenced by educator's readiness for virtual teaching and learning, institutional support provided, educators' technological knowledge and competence. Findings from educators shared experiences revealed that the participated TVET college educators demonstrated good attitude towards virtual learning based on their perceptions on the value and importance of teaching and learning in a virtual environment. In effect, educators favourable attitude ushered them into the acceptance of transitioning to virtual learning amidst the pandemic, making it imperative for them to embrace the inclusion of virtual learning environment as an additional method of instructional delivery in TVET colleges. However, it was also found that the transitioning process to virtual learning at the respective TVET colleges were influenced by factors such as lack of institutional

technological infrastructure, educators and students lack of basic ICT skills as well as lack of access to ICT resources. As a result of these, participants echoed that virtual learning has not come to stay in their colleges. Hence, to ensure successful integration of virtual learning/ ICT in our TVET colleges it is recommended that the educators which be provided with practical and continuous training regarding virtual teaching and learning. It is also recommended that the Government should support the private TVET colleges in South Africa regarding ICT resources to facilitate proper and progressive integration of virtual learning. It is also essential for TVET colleges to collaborate with telecommunication providers to obtain connectivity at a subsidized rate. This will enable the educators and the students to have access to data. In addition, TVET college could consider the use of low assistive technology or low tech-devices in bridging the challenges that students encounter with access to ICT resources.

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Chapter #17

UNDERSTANDING THE CONCEPT OF ENERGY IN HIGH SCHOOL: THE USE OF A ROBOTIC SYSTEM AND VIDEO ANALYSIS AS TEACHING RESOURCES

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ABSTRACT
This article presents a work carried out to improve students' understanding of the concept of energy using a robotic platform and video analysis software. The electronic system made it possible to monitor a movement with characteristics similar to those of a simple harmonic motion, through a looping device, allowing the demonstration of the law of conservation of energy. The monitoring of the experimental configuration was carried out using the Arduino® platform. Demonstrations involving the use of the apparatus as well as the video analysis software were made for Physics students from a high school. The results showed that the automation of a simple experiment can become an interesting tool for both the teaching and learning process, triggering social interactions among students useful to assist in the fixation of physical concepts, even the most abstract ones such as Energy. In addition, the use of video analysis software provides students with experiences of collecting data, analyzing graphs and tables, which supplements the understanding of the nature of science and scientific practice.

Keywords: educational robotics, physics experiments, Arduino® projects

1. INTRODUCTION

Education is the backbone of any developing society and improving its quality is a key factor that defines advancement in a world parameterized by science and technology. Educational researches, especially those aimed at teaching Science, has dedicated special attention to the innovation of methodologies that contribute not only to allow a greater understanding of the concepts by students, but also provides the means to develop skills and competences useful to the exercise of citizenship. In this direction, many researches have drawn attention to the use of so-called digital technologies of "Information and Communication", as well as robotic platforms in the teaching of Physics and Science in general.

It should be noted, in this context, that Physics is a vast field of study involving several theories and concepts that can be represented mathematically and demonstrated through practical experiments. The teaching of Physics in general begins in primary schools and is a matter of great importance. Thus, it is necessary to ensure that it is developed in the best possible way to enhance students' understanding of real-world phenomena.

However, concepts built within Physics to study natural phenomena are extremely abstract and therefore bring many difficulties for students' learning. In relation to this point, the concept of Energy stands out, which, in addition to being very abstract, is of great importance for understanding many phenomena. Therefore, the use of experiments can be

important and is recommended as a resource to facilitate the understanding of knowledge that requires a high degree of abstraction.

In this context, this article presents some results of a project in which an automated looping experiment has been used to help high school students understand the types of energy as well as the energy transformation processes found in the system. Thus, the experiment facilitates discussions regarding the principle of energy conservation, as well as the practical limitations of theoretically conservative systems.

The paper is organized as follows. Section 2 aims to contextualize the work carried out, initially presenting some elements of the Brazilian basic education curriculum guidelines, related to the use of digital information and communication technologies. It then highlights the importance of implementing educational robotics, using low-cost platforms like Arduino®, in educational tools, and lists some works using technology similar to that emphasized in this project. Section 3 describes the work carried out in relation to the development of the experiment, which deals with the automated monitoring of energy in a looping setup. Section 4 initially discusses the results obtained with the developed system, regarding the monitoring of the motion of a small sphere in one of the looping tracks and the visual analysis of this motion using a video analysis software tool. Then, the results of a demo session performed for a class of high school students are presented. The discussion details the demonstration and an assessment tool used to obtain students' feedback on the experiment, along with a succinct presentation of the results obtained from student responses. The section ends with the discussion of some pedagogical issues related to the potential of the developed work to assist in the teaching of Physics concepts. Finally, section 5 includes some conclusions of the work.

2. CONTEXT OF WORK DEVELOPMENT

2.1. Digital technologies in science teaching: Brazilian curriculum guidelines

The Common National Curriculum Base (under the acronym BNCC in Brazil) is a document of the Brazilian Federal Government (Ministry of Education) which contains the curriculum guidelines that must be followed by Brazilian schools of basic education (Ministry of Education, 2018). The learnings defined in the document should enable students, at different stages of basic education, to develop ten general competencies. The emphasis on digital information and communication technologies - ICT is included in these competences. For instance, competency 5 advocates the importance of:

> Understand, use and create digital information and communication technologies in a critical, expressive, reflective and ethical way in various social practices (including school practices) to communicate, access and disseminate information, produce knowledge, solve problems and exercise protagonism and authorship in personal and collective life. (Ministry of Education, 2018, p. 9)

As will be described in section 3, this competence is worked on in the experimental system presented in this article mainly using digital technologies for knowledge production and problem solving. Note that the emphasis on digital technologies also appears in competency 4, which refers to the use of various languages, including digital, by students, "to express and share information, experiences, ideas and feelings [...]" (Ministry of Education, 2018, p. 9). The project also includes aspects of competency 2, which aims to enable the student to "use the appropriate approach to science, including investigation,

reflection, [...] to investigate causes, develop and test hypotheses, formulate and solve problems and create solutions (including technological) from the knowledge of different areas" (Ministry of Education, 2018, p. 9).

In addition to the ten general competencies, the BNCC includes the description of specific competencies for High School. These competencies are linked to four areas of knowledge, related to (i) languages, (ii) mathematics, (iii) nature sciences and (iv) human and social sciences. For each competency, a skill set is presented. The project described here is in line with the area of nature sciences, which postulates "an articulated look at Biology, Physics and Chemistry" (Ministry of Education, 2018, p. 547). More specifically, the work meets competences 1 and 3 of the area of "Natural Sciences and its Technologies". The development of competence 1 aims, among other aspects, to enable the student to "analyze natural phenomena and technological processes, based on the interactions and relationships between matter and energy [...]" (Ministry of Education, 2018, p. 554). It is in this context that, among others, studies should be carried out on the principle of energy conservation. The skill related to this competence, emphasized in the project, aims, among other aspects, to allow the student to "analyze and represent, with or without the use of specific digital devices and applications, the transformations and conservations in systems involving quantities of matter, energy and movement [...]" (Ministry of Education, 2018, p. 555).

The development of the specific competence 3 aims, among other aspects, to enable the student to "investigate problem situations and evaluate applications of scientific and technological knowledge and their implications in the world, using procedures and languages specific to Natural Sciences [...]" (Ministry of Education, 2018, p. 558). In view of this competence, the developed system aims to enable the student to "investigate and analyze the operation of electrical and/or electronic equipment and automation systems to understand contemporary technologies and assess their social, cultural and environmental impacts" (Ministry of Education, 2018, p. 560).

2.2. Arduino®: Low-cost robotic platform

Solutions involving educational robotics, such as the system described in this project, allow aspects of competences and skills recommended in the curriculum guidelines for Brazilian education (BNCC) to be put into practice with students. However, as Scherer; da Silva, and de Oliveira (2020) point out, many of the kits available for educational robotics have costs that make them prohibitive for most schools, especially for public schools. Among these, one of the best-known kits is LEGO Mindstorms, developed from a partnership established between the Media Lab of the Massachusetts Institute of Technology - MIT and the LEGO Group.

To make this technology more accessible to schools, low-cost educational robotics resources can be used (Scherer et al., 2020). More specifically with respect to teaching Physics, low-cost educational robotics help to develop more interesting laboratory classes and expose students to several possibilities, including the building of new robots. In this context, a very used robotic platform today is Arduino®, an open-source platform offering both hardware and software support. Arduino® development boards offer a varied choice of microcontrollers, features and form factors, thus allowing for a wide range of applications.

Arduino® is one of the most popular platforms used by students and developers due to its low cost, multi-platform operation (compatible with Windows®, Mac OS®, Linux®) and its simple and clear programming environment, features that allow for its use relatively simply. Furthermore, it can be interfaced with various electronic components such as sensors, actuators, displays and electronic circuits, thus enabling the construction or automation of

laboratory experiments, used in teaching Physics in schools. Some works based on the Arduino® platform and aimed at helping in the understanding of Physics concepts are briefly described below.

Souza and Duarte (2015) discuss strategies that can be used in Physics teaching (secondary level) through a robotics show. Some of the experiments described were carried out using recyclable and low-cost materials. In addition, some projects used the Arduino®, considered as a low-cost alternative for building efficient robots with simplified programming. The authors argue that they used the enchantment caused by robotics to encourage students to understand physical phenomena.

Llamas Bello, Vegas, González Rebollo, and González Delgado (2018) present a low-cost open-source platform that can be used to carry out simple physics experiments both in high school and in universities. The authors claim that the developed system presents a greater possibility of customization, compared to similar commercial systems. The platform includes a mobile unit, based on the Arduino® Nano, containing sensors, which can be attached to a mobile body to study its movement.

Mesquita, Sena, and Ferreira (2018) present a method for organizing an Educational Robotics course, in which each class is structured in a sequence of steps that include, among others, the contextualization of the problem, assembly, programming, and discussion of results. Based on the proposed structure, a course, using the Arduino® platform, was organized, and applied to groups of high school students from the Brazilian public school system. The work presented in Sena, Mesquita, Monteiro, Muniz-Junior, and Oliveira (2019) also describes a training program in Educational Robotics, based on Arduino®, which was applied to Physics students from two public high schools. Classes in general were organized according to the method proposed in the previous work, but the activities were planned to follow the guidelines of a project-based learning model. In this training, students worked on the various stages of developing a mobile robot.

3. DEVELOPMENT

3.1. Experiments with the looping apparatus

The simple pendulum experiment is a very basic physics laboratory activity in schools. The main idea behind the experiment is to study the periodic motion of a moving body attached to a rod, demonstrating simple harmonics and the principle of energy conservation. It also describes the transformation of energy from one form to another, illustrating the concept that energy is never destroyed. Another interesting theory that can be observed from this experiment is the independence between the period of oscillation and the mass of the moving body.

Figure 1 below shows the Looping device used in the project. As it can be seen, it is composed of two tracks, which can be used to demonstrate various concepts in Physics laboratory activities (http://labdemo.if.usp.br/looping-2/). The work described here is based on an experimental setup that simulates, to some extent, the characteristics of a pendulum, using an object of predetermined mass - a small sphere (snooker ball), which must move in the front track (1) of the device. As we are not monitoring the movement in the rear track (2), we can say that the system described here corresponds to the first of a series of experiments that can be studied with an adaptation of the configuration discussed in the current work.

One should notice that the rear track (2) is the looping track itself. The objective with this trail is to study the characteristics of a body with constant mass that must complete the movement along a curved or circular trail, without deviating from its trajectory, i.e., the body must travel around the loop without falling. This concept, in addition to being interesting, is

functional in many real-life applications, such as amusement park roller coasters. Physical properties related to the concepts of energy and force are studied in this experiment. A specific amount of potential energy is needed to allow the body to circle around the loop, completing its entire trajectory. This is expected to be achieved by starting the movement from a height of twice the radius of the loop, but in practice a minimum height of 2.7 times the radius is required, i.e., the body must be placed at a height greater than 2.7 times the radius to complete the entire looping path (Varieschi, 2006).

Figure 1.
Looping experiments bench.
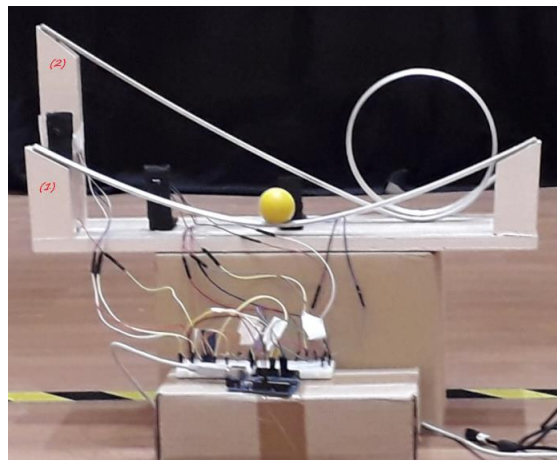
As will be seen in the work description, experiments related to looping can be automated using proximity sensors and a suitable robotic platform. Thus, properties related to the movement of a body along the loop – such as its speed at different points on the trajectory – can be monitored through a suitable electronic configuration.

3.2. Energy conservation in the looping experiment

As mentioned, this project aimed to monitor the movement of a small sphere (snooker ball) on the track 1 of the looping apparatus (Figure 1), in order to help the students with the understanding of the principle of energy conservation.

Demonstrations carried out with the experiment should emphasize several concepts related to energy transformations in the physical system, some of which are mentioned below. Firstly, it should be emphasized that potential energy is more static in nature, while kinetic energy is dynamic. A body at rest has associated with it an amount of kinetic energy equal to zero since the velocity is zero. It is when a body starts to move and therefore has a non-zero velocity, which then has a non-zero kinetic energy value associated with it. As the small sphere moves along the looping track, the potential energy associated with it, stored in the gravitational field, is transformed into kinetic energy and vice versa. The total energy, mechanical energy, which is the sum of potential and kinetic energy values, in an ideal situation, remains constant at any point in its motion.

As can be seen in Figure 1, the front track (1) of the looping apparatus is designed in the form of an open curve that is symmetrical with respect to the middle position and whose height gradually increases as the curve unfolds from the center. This implies that the body's maximum potential energy is at the extremes of the track and its minimum value is in the middle position. On the other hand, the maximum value of the kinetic energy that can be reached by the body occurs in the center – middle position of the track, and the minimum values (equal to zero) occur at the extremes of the track.

Regarding the principle of energy conservation, it is observed that a fraction of the mechanical energy is transformed into other forms of energy, due to friction and air resistance and, therefore, the values of total mechanical energy at different points in the system decrease with time. This illustrates that, although the system used can theoretically be considered conservative, certain imperfections in its realization lead to results that produce a margin of error. Thus, the apparatus was also used in this project to illustrate to the students the practical limitations of theoretically conservative systems.

3.3. Basis for experiment automation

As can be seen in Figure 1, three sensors mounted on supports were positioned at three different heights corresponding to the extreme left position, the medium position of the apparatus, and the midpoint between the two previous ones. Other sensors could be added at different locations to further validate the results (will be included in extensions for this project). In the current work, the three sensors were used to detect the presence of the sphere in each of the three positions. The way the sensors are arranged in the project is similar to that used in the platform described by Llamas Bello et al. (2018), in which four infrared transceivers are placed in vertical beacons and connected to the platform's portable unit.

An Arduino® platform is used in the project experiment setup to collect data from the sensors and calculate experimental values based on the input data. In this project an Arduino® UNO board was used, which is based on the ATmega328P microcontroller. The experimental system, coupled to the looping structure, monitors the movement of the sphere using a sensor circuit composed of three reflective optical sensors (TCRT5000). The information from this data acquisition system is processed by a program developed in the Arduino® IDE (Integrated Development Environment) to provide the desired outputs. The results of the experiment can be viewed on the IDE serial monitor and/or on a device that supports communication via Bluetooth, such as a smartphone. The interface between the Arduino® UNO and the Bluetooth device is established using a Bluetooth wireless communication module (HC05). The Google Play Store makes available, in the category "Bluetooth Terminal", several applications classified as free that can be used to display the results on the screen of an Android smartphone.

4. RESULTS

4.1. Experimental system results

In the current version of the system, the movement of the sphere is monitored by recording the instants of time when it is detected in each of the three sensors, here identified by 1, 2 and 3. Remembering that the sphere moves cyclically from the sensor 1 to sensor 2 and from sensor 2 to sensor 3, the latter located at the midpoint of the experiment. The sphere then moves to the right side to a point on the trajectory (ascending) where it stops and the movement is reversed, returning to sensor 3. From there, the sphere returns to sensor 2 and, in the initial cycles, it is still detected by sensor 1. Based on the instants of time in which it

is detected in each of the sensors, the program calculates and displays the values of the average speeds, vel_{ij} , corresponding to the ball movements from sensor i to sensor j $(i, j=1,2,3)$. Students can view the ball movement data on the Arduino® IDE serial monitor or on a smartphone screen (Bluetooth communication).

The movement is monitored until the sphere is no longer detected by two different sensors (sensors 2 and 3) in which case it still oscillates for some time around the sensor located at the midpoint (sensor 3). The program then presents the value of the initial potential energy as well as, for each cycle of the movement, the value of the kinetic (translational) energy determined from the maximum value of the average velocities calculated for the cycle. Thus, the student, using the device, can verify, with a more qualitative than quantitative emphasis, both the aspect of energy transformation – from potential to kinetics and vice versa, as well as the effect of dissipative forces, since the energy values decrease with each cycle of movement, causing the sphere to finally stop moving after a few cycles.

An analysis of the movement of the sphere on the trail was carried out using the Tracker software, a free video modeling and analysis tool developed by Douglas Brown (https://physlets.org/tracker/), using the Open-Source Physics (OSP) environment from Java language. For the analysis of the movement with the Tracker, a filming (video) of some cycles of the movement of the sphere in the Looping was made, from the beginning of the movement, using the camera of a common smartphone.

After loading the video, some settings were made in the tool. Note that we chose to use the basic features of the tool, so that it could be used quickly to carry out the motion study. Thus, using a "calibration tape", a measurement reference was introduced: in the case of the looping, the length of the base of the experiment was specified. A system of coordinate axes was fitted to the experiment in such a way that its origin coincided with the midpoint of the front track (1) of the experiment. A mass point was created and associated with the small sphere, which was the object whose motion would be analyzed by the tool. In addition, its mass in kg was specified.

Then, video cut adjustments were made, specifying the initial and final frames of the video excerpt that would be analyzed, as well as the frame interval for "marking" the movement of the ball. The marking process consists of "tagging" the positions of the mass point in its movement from the start to the end of the selected video excerpt. Next, we have chosen as dependent variables the variables x (horizontal coordinate), y (vertical coordinate) and v (translational speed of the mass point). The independent variable would be time, t(s). For each marked position of the mass point, the values of all variables would be displayed by Tracker software, as discussed below.

The graphics and data corresponding to the "marks" selected in the video clip for the movement of the ball are presented in the "Diagram" and "Data" windows, on the right of the software interface, as shown in Fig. 2. In the Figure, the graph in the Diagram window shows the variation over time of the x coordinate values, which correspond to the horizontal displacements of the mass point. In the data window, the values of the dependent variables x, y and v are displayed at each instant of time t.

In the Diagram window in Figure 2, the graph of mass point displacement as a function of time was presented. It is possible to change the dependent variable and thus visualize other graphics associated with the movement. It is also possible to view a graph in an independent window, which allows an enlarged view, the modification of some parameters and the carrying out of some analyzes (such as calculations of statistical parameters and curve fitting, for example).

The movement analysis carried out with the tool, from the selected video excerpt, generates data and graphics that can be compared with the results obtained with the automated apparatus. Both the results obtained with Arduino® and those produced by Tracker are experimental and subject to errors. This point should be drawn to the students' attention, thus contributing to their perception of scientific working methods. For example, Tracker results are sensitive to calibration, axes' positioning, and marking of mass point locations. Regarding the looping experiment, a difficulty of the experimental apparatus is related to the determination of time intervals corresponding to the movement of the sphere between the sensors, as it is not exactly a "material point".

Figure 2.
Video Analysis of the motion with Tracker.
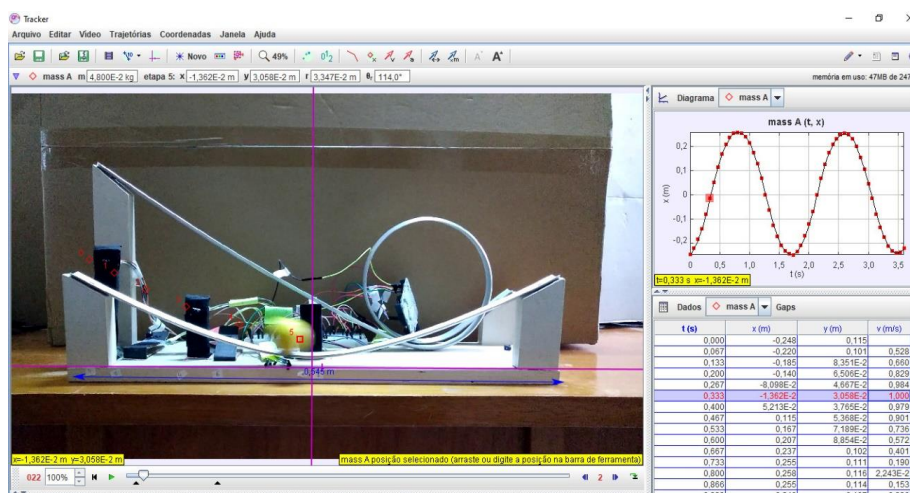
Even though it is not possible to directly compare the Tracker and Arduino® values with each other, it is possible to discuss with students the consistency observed in the results obtained with the two tools. Thus, a qualitative comparison is possible, in which the same behavior of the system can be observed in both approaches, allowing the confirmation that, although the system is theoretically conservative, the mechanical energy gradually decreases, due to the action of dissipative forces.

4.2. Students' Feedback
4.2.1. Demo class with the tool
To carry out a first evaluation of the tool, regarding its use in supporting the teaching of Physics for high school students, a demonstration was carried out for a group of 2nd year students from a public school of technical education in Electronics. In all, 23 students participated in the demonstration, held in an auditorium, in a face-to-face format, with a duration of two class hours. As second-year high school students, they should have already studied energy concepts in the Physics subject. The presentation took place just before the Covid-19 pandemic, with no other presentations for this or other classes of students.

The presentation consisted of four parts: (i) a review of the physics concepts worked on in the experiment (energy, conservative systems, dissipative forces, etc.); (ii) a brief explanation of the monitoring system developed, presenting the main characteristics of the components used (sensors, Bluetooth module, etc.) and a general description of the monitoring software developed for Arduino®; (iii) demonstration of the experiment, moving the sphere in the previous looping track (track 1), showing the results obtained with the tool and discussing them with the students; and (iv) demonstration of the analysis of a video excerpt of the movement with the Tracker tool. The outputs produced by the program were directed to the Arduino® serial monitor but could also be viewed by students on a smartphone, through a Bluetooth communication application. During the demonstrations, students were able to interact with the presenters, questioning them about various aspects such as the development of the experiment and its use, among others.

4.2.2. Assessment

At the end of the demonstration, students answered an evaluation questionnaire organized in three parts: (i) multiple-choice questions about the content of the experiment; (ii) questions about the use of tools to support teaching in the classroom, such as those used in the demonstration: general statements about the use of tools and experiments with educational robotics in Physics teaching, as well as about the looping experiment itself , to assess the degree of agreement of students with them; and (iii) open-ended questions where they could, for example, give their opinion about what they liked and what they didn't like about the demonstration.

As mentioned, the first part of the assessment instrument included several multiple-choice content questions, all referring to energy concepts. Regarding this part of the questionnaire, the students demonstrated a good command of the concepts worked on in the experiment. However, they still had perception difficulties in relation to physical phenomena and the different forms of energy involved in the experiment.

Table 1.
Experiment Evaluation Sentences.

1	Experimental activities with Robotics (sensing) make Physics classes more creative, dynamic and motivating.
2	Robotics' classes facilitate the relationship between theory and practice.
3	The Looping experiment offers opportunities to reinforce, exercise and revise concepts related to energy conservation.
4	Experimental activities with Robotics contribute to increasing interest in Physics.
5	With the Looping experiment, it is easier to visualize the transformation of potential energy into kinetic energy and vice versa, compared to the theoretical explanation.
6	The content worked on in the experiment is related to the theory given in Physics classes (from this year or from previous years).
7	Demonstration classes with robotics' experiments are more interesting than classes with just theory and exercises.
8	Experimental activities with robotics are more motivating than classes with just theory and exercises.
9	The Looping experiment makes it easier to visualize the action of dissipative forces in systems that have an expressive conservative component.
10	One of the difficulties in employing robotics in experimental physics activities is the need to have a good understanding of programming (for example, in C language).

Regarding the second part of the assessment instrument, it contained 10 statements (shown in Table 1) related to the use of tools based on educational robotics to support the teaching of Physics concepts in the classroom, more specifically, to support the discussion of energy concepts. The objective was, through a survey of the students' degree of agreement with the statements, to assess their perception of the suitability of these tools and, consequently, of the digital ICT for learning Physics concepts. The students' degree of agreement with the statements was assessed using a 5-position Lickert scale, ranging from 1 = strongly disagree to 5 = strongly agree.

It was observed that, in general, most students agreed with the statements made. For example, most students expressed agreement with the first sentence (90%), with 55% expressing themselves totally agreeing and 35% only agreeing. The questionnaire also included more specific questions about the experiment, such as sentence 3: most students (95%) agreed with the statement, with 60% totally agreeing and 35% simply agreeing.

The third part of the questionnaire, as mentioned, included open-ended questions that sought to obtain the students' opinions on various aspects, such as what they liked and what they didn't like about the demonstration activities. Examples of these questions are shown in Table 2.

Table 2.
Examples of open-ended questions.

1	Briefly, comment on what you liked the most (or what piqued your interest) about the Looping experiment
2	Briefly, comment on what you didn't like (or think could be improved) about the Looping experiment.
3	Can you imagine any other experiments in which robotics could be used to improve understanding of the physical concepts involved? Or could you mention concepts in Physics that you think could be better understood with experimental practices with Robotics?

It was observed, in relation to what most caught the students' attention, that several points were highlighted, most of them referring to the demonstration itself, since it made it possible to experience in practice concepts of Physics that they had studied only theoretically. Other aspects were also highlighted, such as the relationship between Physics and the design of the system, programming and electronics involved in the experiment. As for what they thought could be improved, several points were suggested. For example, regarding the apparatus itself, there was a suggestion for the use of LEDs (Light Emitting Diodes), so that one could observe the instants of time when the sensors were detected. The use of a larger apparatus was also suggested, since the one used is relatively small. Another suggestion was to perform the sensing of the part related to the looping itself (track 2 in Figure 1). There were also indications from several students about parts (i) and (ii) of the presentation, suggesting greater dynamism and interactivity in the activity as a whole.

4.3. Pedagogical issues

The demonstration of the system described in this phase of project development aimed mainly to verify the adequacy of the tool to help students understand the concepts of Physics on the topic of energy: types of energy, conservative systems, and dissipative forces. In addition, the demonstration also aimed to show examples of how digital information and communication technologies can be emphasized by Physics teachers when working on

Physics concepts in the classroom. In this aspect, the work, by presenting ways of working with these technologies, is in line with what the BNCC advocates for Brazilian secondary education, as discussed above.

Regarding the automated system, this, in its current form, can be used by the teacher to demonstrate the concepts worked in it, as illustrated in this work. Another possibility would be for the students to automate the looping experiment, in the form of a teaching project. In this case, the activities could be performed using the method described in Sena et al. (2019). The advantage of this approach is that, in addition to providing an appropriate environment for a better understanding of the physical concepts related to the experiment, it would give students the opportunity to carry out basic training in educational robotics.

Aiming at a broader work with the system, it is worth mentioning that possible developments from the employed technologies can help to expound other topics of interest in the teaching-learning process, related to the concepts worked on in the experiment. Thus, regarding the Arduino®-based automation, the built prototype makes room for studies on electricity, electronics, and programming, among other subjects. With respect to Tracker, it is possible to modify the configuration parameters for video analysis and verify its influence on the obtained results. Furthermore, the data set obtained can be used to generate several graphs related to the movement, which can be compared with the behavior observed in the movement of the sphere in the experiment.

It is noteworthy that the technologies emphasized in this work can be used in a complementary way, so that one can count on different ways to visualize the results and data sets. Thus, a teacher who wants to make use of new technologies in the classroom can use them independently. For example, if the teacher is not able to assemble the circuits with the Arduino®, he can make simulations of experiments involving movement using the Tracker, since it is a free tool and the analysis can be done from an "amateur" video, obtained with the camera of an ordinary smartphone. Regarding the Arduino® assembly, the teacher could, at first, eliminate Bluetooth communication (used as an alternative to outputting results), since the Bluetooth module is a relatively expensive component.

5. CONCLUSION

The present work focused on the investigation of the use of specific digital ICT to support the teaching of Physics, regarding experimental demonstrations related to the principle of energy conservation in the looping experiment. One of the focuses, in terms of technology, was educational robotics, implemented using sensors interfaced to an Arduino® board, to collect data related to the cyclic movement of a small sphere along one of the tracks of the looping setup. A video analysis tool, the Tracker software, was also used to generate a set of movement data, from a simple filming of the experiment, carried out with a smartphone. A qualitative comparison between the results of both approaches is possible, in which the same behavior of the system is observed, showing that, although the system is theoretically conservative, the mechanical energy gradually decreases, due to the action of dissipative forces.

The use of new technologies in the classroom by itself, in general, is already a motivating factor for most students. In addition, as recommended in the competences of the BNCC, the use of digital ICTs should be part of everyday school life in Brazil. In this context, their use in teaching support systems can contribute to improving the quality of education. As Curto and Moreno (2016) point out, projects based on robots provide students, both in high school and at university, with a more interesting and fun view of Science and Engineering, enabling a practical view of the application of theoretical concepts. The authors

also highlight the inclusion aspect of educational robotics, which can help students direct their university careers to the STEM (Science, Technology, Engineering and Mathematics) knowledge areas. We argue that it can also help them visualize additional applications of theoretical concepts in real-life projects and scenarios. This process of contextualizing knowledge can help them to develop innovative projects and solutions to meet society's needs.

The experiment presented in this work, in addition to being useful in Physics teaching in high school, as discussed, can be used to allow the introduction of robotics and automation elements. Moreover, the use of Tracker makes it possible to obtain datasets that can be useful also for allowing different approaches to motion analysis, both in terms of graphs and data tables, as Tracker allows working with other dependent variables. Finally, it should be noted that the experiment also allows the realization of new research and development, since further experiments can be easily automated with few modifications, using the looping setup.

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Chapter #18

WORKING WITH DIGITAL ESCAPE ROOMS: ADDING VALUE TO THE TEACHING OF LITERATURE

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ABSTRACT

The escape room, also known as an escape game, is a gamification tool that aims to enhance motivation and teamwork (Wood & Reiners, 2012). In the educational field, in particular, the escape room can be defined as an action game in real time in which the players, in teams, solve a series of puzzles or problems and carry out tasks related to the curricular contents studied throughout the course, in one or more rooms, with a specific objective and at a specific time (Nicholson, 2015). The use of escape rooms for teaching-learning the English language at different educational levels has been studied qualitatively and quantitatively (Dorado Escribano, 2019; López Secanell & Ortega Torres, 2020). However, there is no study on the applicability of the escape room in the English literature classroom at the level of tertiary education. This paper aims to demonstrate how the inclusion of this innovative pedagogical tool can be useful for working on theoretical-practical contents of literary studies of the undergraduate degree in English Studies. The study will focus on exercises to implement as part of the educational digital escape room using a sample of students and evaluating their motivation.

Keywords: escape room, new technologies, English literature, higher education, digital escape room.

1. INTRODUCTION

The present research stems from the need felt by a group of lecturers of literature in English, an area of knowledge normally labelled under the general term 'English literature', to engage their students in the subjects of their respective courses at the university level. The teaching of literature has traditionally been at the mercy of two kinds of pressure, those that push the discipline towards the implementation of scientific methods and those that celebrate the multifarious concerns that are normally associated with the idea of reading for pleasure. It is the second aspect, the natural tendency of literature towards interdisciplinarity, that has traditionally been uppermost in the daily practice of this activity: 'One of the reasons for this is that literature is about everything – love, sex, friendship, family relationships, ageing, death, social and historical change, religious faith, intellectual ideas, and so on. In short, it is about life in all its diversity, and this is hard to accommodate within the narrow parameters of a discipline' (Moran, 2002, p. 21). The present study, however, starts from the assumption that it is possible to celebrate literature's extraordinary transversality of interests and, at the same time, carefully design and implement activities for the teaching of the subject that take into account academically tested methods and scientifically oriented perspectives.

The framework of gamification was chosen because it is 'an emerging approach and tool for teaching [that] provides the opportunity to create new, challenging, meaningful and interactive learning experiences for today's students' (Santamaría & Alcalde, 2019, p. 84). Our main concern, as educators, is to keep abreast professionally and, therefore, apply in our

courses recent theories related to motivation, not because of a superficial need to stay in tune with the times but because students in the 21st century demand new perspectives on education that relate to the technological world in which they live. Motivation in the literature class, just as in the foreign language class, is not an easily packed and digested concept. Lecturers of literature are aware of the multiple factors (cognitive, sociocultural, psychological, etc.) that must be considered when designing a course: 'Motivation has long been a hot topic in educational research because of its complexity. The construct of motivation is not a single entity but a multi-factorial one' (Wong, 2014, p. 38). This paper aims to explore one of the most successful developments of gamification, namely, the use of escape rooms in class as a motivational tool, and apply it to the teaching of English literature. A succession of challenges and a diverse assortment of activities may raise the interest of students and increase their engagement with the dynamics of the course.

2. METHODOLOGY: ORIGINS, USES, ADVANTAGES AND DISADVANTAGES OF ESCAPE ROOMS

Thirteen years have passed since the first appearance of the word 'gamification' in 2008. In the second half of 2010 already, the term achieved popularity thanks to the booming expansion of games in the digital media and industry (Deterding, Dixon, Khaled, & Nacke, 2011, p. 9). From that moment on, the impact, success and merging of gamification with real life have been such that Jesse Schell spoke, in an interview for CNN in 2010, of an imminent 'gameapocalypse[,] where every second of your life you're playing a game in some way' (Sutter & Schell, 2010). The methodological framework for our research on escape rooms is grounded on the consultation of primary critical literature on gamification and new technologies applied to teaching. Most of the studies which deal with gamification in the classroom admit that one of the main obstacles lies in finding an adequate method. In the public mind, gamification is associated with hobbies and with children's games; establishing an academic procedure is one way to counteract the stereotype of leisure-time activity associated with this approach to learning. There is nothing wrong, of course, with providing entertaining and enjoyable exercises in class, but these should be directed towards educational aims; the main objective will be to find "inspirational, meaningful, autonomous, appealing and cognitively demanding activities that allow them to escape the boredom of traditional methodologies and awaken their interest in honing their main future tool of work: the English language" (Santamaría & Alcalde 2019, 86). The origins of escape rooms within this paradigm of gamification are somehow diffuse, although research (Gómez Sesé, 2020) places them in 2007, proximate to this crescent evolution and impact of games and by extension videogames in contemporary society. In 2007, Japanese movie and anime director Takao Kato hosted the Real Escape Game (REG) in Kyoto and, shortly afterwards, a large game named HEP Hall in Osaka. These events were soon followed by the creation of a digital magazine by Kato, Real Escape Games, where the concepts and ideas behind this gamified experience were laid bare. Since then, escape-room experiences have been known under many different names, such as 'real-life escape room', 'real escape room', 'real escape game', 'room-escape game', 'live escape game' or 'real-life escape game' (Intervirals, 2015). Escape rooms have gradually become popular leisure activities, wherein, under time constraints a group of people are locked into a room or a series of rooms and have to work collaboratively to find and solve clues hidden in order to escape. Over time and in the wake of many resounding successes in Japan as a form of entertainment, numerous rooms were opened in neighbouring Singapore in 2011. One year later, the escape-room concept became famous in San Francisco as well with the 'Puzzle Break' project. Meanwhile, the first escape

room in Europe was opened in Budapest by Attila Gyurkovics, the founder of the Parapark franchise (Gómez Sesé, 2020, p. 33). By 2019, there were over 7,200 escape rooms in 1,445 cities in 105 countries (Kroski, 2019, p. 3).

Therefore, the field of escape rooms is expanding because of the infinite number of possibilities that it offers, especially when included in educational curricula. Given their important presence throughout the life of a human being, games, their purposes and their possible applications and uses have been studied not only in fields such as economics, exact sciences and social and educational sciences but also by psychology, biology and, a posteriori, in the sociological and cultural fields long before their usefulness in the educational sphere was considered. In his seminal study *Homo Ludens* (2002), Johan Huizinga affirms that human culture arises and unfolds in and as play (Huizinga, 2002, p. 1), which is as important as reasoning and making (Huizinga, 2002, p. 9). Learning, then, is inherent to games; thus, game-like experiences trigger unconscious intrinsic motivation, and deep knowledge is consolidated through play, which is always attractive to people regardless of age. All this must be understood in a context in which students' motivation is one of the major quandaries for education and research, no matter the educational level under consideration, with many studies emphasising the obsolescence of the teacher-centred approach and the ineffectiveness of the overreliance on traditional forms of content delivery in class (Lee & Hammer, 2011). These studies draw a connection between intrinsic motivation and problems of level cheating, disengagement from school and, with this, higher attrition rates, while proposing gamification as a possible panacea (Cronk, 2012; Deterding, 2012; Stott & Neustaedter, 2013). During sessions, educators frequently observe their distracted students checking the time, looking at their watches or their mobile phones hopelessly and impatiently. This might be a clear sign of boredom, distraction, and an open manifestation of our pupils' strong desire to escape the class as soon as possible. Nonetheless, terms can be shifted, and students can check the time for an entirely different reason: they do not want the class to be over or want to remain until they have successfully concluded their class activity. Time limits and spatial confinement are only two of the key elements in escape-room games and, by extension, educational escape rooms that foster motivation and widen the universe of learning.

Escape rooms have evolved despite their relatively short existence and have adapted perfectly to the vicissitudes of the current pandemic, to the extent that it has become feasible to create and play in an escape room entirely online, like the one presented further in this chapter (also called a 'digital escape room'), for edutainment. What is more, the use of the information and communication technology (ICT) dimension in the elaboration of a hybrid version of this form of gamification – which might combine physical and virtual resources – helps to diversify and enrich the players' experience. Curiously and contrary to expectations, the virtual version, wherein 'an avatar in a specific setting, [interacts] with various objects to uncover clues and [uses] information from those clues to solve puzzles' (Brainy Rantz, 2017), was the precursor to the live and physical experiences now offered by escape rooms worldwide.

Escape rooms can be designed around any subject or transversal contents from diverse disciplines, such as mathematics, chemistry and history, providing dynamism to the lessons and to content that may not be very appealing to students. Educational escape rooms, therefore, are conceptualised as bridges between reality and adventure (Kato, n.d.), knitted systems in which all the elements form a complex whole. The gamified experience, then, is not a single element but a whole context with knowledge at its very centre. Nonetheless, the success of a game in the classroom depends not only on factors external to the students, such as the difficulty of the game, its regulatory system of rewards and punishments, its didactic

objectives, its duration, the props used to recreate the thematic atmosphere of the game, but also on internal factors related to the players themselves, such as their motivations, perspectives and tastes. Considering their nature, escape-room games are closed systems that engage players/students in a well-planned structure but might present unequal and uncertain outcomes when implemented in the classroom, regardless of the subject. This is why it is crucial, when planning an escape room for one of our sessions, to consider the following details that determine the success or failure of the experience, its excellence or mediocrity.

High levels of motivation and engagement throughout the experience are maintained by balancing difficulty with challenge within the game. Additionally, the importance of the theme, the narrative or story, must be highlighted. Even though escape rooms can be a combination of puzzles without a common theme and/or a narrative, according to Nicholson (2015), they 'create a moment of passion around specific topics that then can be used as the spark to then ignite interest in something for a player to learn more about later' (p. 19). Therefore, apart from engaging players more deeply by immersing them into the escape room, thematic escape rooms link challenges around the same topic, stories and narratives and immerse the players in the experience, making it more *believable* and enjoyable. Consequently, designing an escape room is not an easy process but one that requires knowledge in fields ranging from the arts and psychology to computer science. It follows basic steps established by the literature and experimentation, which stress the importance of a careful selection of the theme, the conceptualisation of the idea to be carried out in practice, the design of the mechanics of the game, the development cycle of the game and the establishment of the elements to be included, among others. In relation to all these ideas, one of the most important aspects to craft an escape-room experience in the classroom is the drawing of a connection between the game and the non-ludic or didactic objective. That is, the game must present a balance between what is known as edutainment and game and the major aim of this educational tool: the didactic side of the experience. This balance is what distinguishes escape rooms as a form of entertainment from escape rooms as a tool used in the classroom for pure and clear educational purposes.

This dynamic method based on escape-room experiences may be used either as a reinforcement activity or as an evaluation tool, during only one session, several days or even an entire school year. With this method, the student plays an active role in the learning process. Implementing escape rooms, no matter their nature, fights the boredom elicited by conventional exercises with novelty; although pressure exists, this experience is entirely different from the one created by traditional exams or class activities that might count towards the students' final marks. Here, the existence and perception of pressure are constructive as the urgency to solve the challenges helps students to focus on a scenario in which every second counts. However, students do not feel alone in facing the mission or the problem. While escape rooms promote the development of personal qualities such as persistence and resilience through extended play (McGonigal, 2011), they embed the student in a mechanism, a team that works together and pools its knowledge. Students' deductive thinking can thus unfold as they attempt to overcome challenges by calibrating and discussing decisions. Individual creativity, resourcefulness and good communication skills make the difference when solving each task collectively. Therefore, the application of this form of gamification in class foments negotiation and collaboration. Self-awareness, strategising and the use of critical capacities to make decisions or adopt a position of leadership are also fostered. These interpersonal or social abilities strengthen relationships among players, which can be beneficial for the development of lessons and other group activities in the long term as they create a positive atmosphere between peers and improve class management and dynamics. Regarding gamification in the literature class at the university level, escape rooms and, by

extension, gamification promote the assimilation of new vocabulary and grammar (Abrams & Walsh, 2014) in context since different challenges provide opportunities to practise both in different situations and with varied purposes. Oral communication is also improved as oral skills are used throughout the experience for communication and the negotiation of decisions between group members. Written comprehension and production, which are very present in the challenges (Mazur, Rzepka, & Araki, 2011; Grouling, Hedge, Schweigert, & Snider, 2014), are also strengthened. Furthermore, the review of previously grasped concepts and contents, such as historical events, literary figures and works, or sociocultural aspects in classes where literature is taught at the university level provides the educators with an amalgam of themes for their escape rooms. They can use these escape rooms to test the knowledge of their students in tandem with the aforementioned oral and written skills, thus improving the students' command of the English language as well.

The disadvantages of this innovative instrument and gamification tool are connected to the methodology of gamification in general. It is worth mentioning the great amount of time that the educator must invest to create an escape room mirroring the class's necessities, objectives and contents. However, although the process is time consuming and tedious, this drawback is mitigated by the dynamic nature of this form of edutainment. That is, escape rooms are adaptable and reusable class resources incorporating challenges that can be extrapolated to other class activities or escape-room experiences designed for groups with a different educational level.

It should also be noted that the implementation of escape-room experiences may not be entirely satisfactory, especially in the online format because of the possibility of technological problems. The escape room might also become an unmanageable activity when dealing with numerous groups and the high number of students in each university class. In this case, the lecturer may need help from other colleagues to carry out the activity. The present article, nonetheless, considers that the disadvantages of escape rooms are outweighed by the benefits offered by this valuable form of edutainment with numerous positive side effects, as the following pages will reveal.

3. ANALYSIS AND RESULTS

After assessing the applicability of escape rooms to education and the advantages and disadvantages of their use in the classroom as an educational tool – particularly in the English classroom –, an experimental session was carried out. This experience aimed to add extra value to regular English literature sessions to evaluate the improvement of students' active participation, teamwork and engagement regarding the course contents, both theoretical and practical. Moreover, the context of an English literature classroom provides an innovative approach to the pedagogical dynamics of escape rooms since there is no scientific evidence that this kind of resource has been used as an educational instrument. Since this experiment was carried out in 2020 when tertiary-education sessions were taught online due to the COVID-19 crisis, the escape-room experience was designed to be developed online by educators/facilitators and, by extension, students. This entailed great adaptability to educators' training requirements and usefulness as well as students' interests, which allowed us to explore the effectiveness of a combination of gamification and IT tools in the (virtual) English literature classroom.

The study aims at analysing, qualitatively and quantitatively, the degree of motivation before and after the implementation of the escape room compared to conventional teaching methods. The sample group for this intervention was composed of 29 undergraduate students (between 19 and 27 years old, 85.2% female and 14.8% male) taking second- or third-year

English literature courses as part of their regular academic load in a Spanish university. The sample was selected because of its accessibility to the researchers and because a considerable number of newly arrived students were not motivated. The experiment took place once at the end of the semester, with approximately three hours to solve the virtual escape room reviewing the main contents taught over 16 weeks. Spoken and written production and comprehension were part of the daily schedule and proposed activities. The first half hour of the intervention was devoted to presenting the escape room's rules and functionality and answering the students' questions.

The escape room consisted of six challenges, each only accessible after the completion of the previous one. All challenges were set in the historical context of the authors included in the syllabus of the corresponding English literature course and related to texts and genres dealt with throughout the semester. The challenges included a variety of activities such as puzzles, padlocks, audio-visual resources or the use of (simulated) social networks. Participants were pushed not only to search for answers relating to the course materials (which allowed them to properly review course contents) but also to extend their knowledge by seeking information from other sources (websites, audio-visual contents, books and articles).

Before the experiment, all participants filled out a survey comprising 24 closed-ended questions on a 1–5 scale investigating students' motivational approach to and enthusiasm for English literature lessons at the tertiary level and traditional and current teaching methodologies. They were also asked for their observations regarding cooperation and competition in learning, teamwork and working on online assignments. Finally, students were asked about their degree of interest in gamification as a tool to study English literature. Similarly, a post-intervention survey comprising 15 closed-ended questions on a 1–5 scale was designed to assess the impact of the tool on the students' acquisition and learning process, insisting upon the degree of stimulation and significance of the content of the activities, the usability of the tool after the experiment and whether the students would recommend this teaching practice for the assimilation of contents related to English literature.

The results of the pre-intervention survey show that 70.4% of the participants considered that learning English literature is useful, and 63% believed that the acquisition of the necessary knowledge is difficult. General participation in activities in the classroom was average (55.5% of the participants chose 4 or 5 out of 5), and 70.3 % claimed to work hard to acquire the required knowledge to pass the course. However, even though 37% of participants enjoyed attending English literature classes and 48.1% felt the need to learn more because they like the contents, one of the key questions related to engagement reveals that only 18.5% of the participants felt motivated in English literature lessons and only 14.8% were willing to participate actively. Additionally, 85.2% of the students admitted that their motivation depends on the professor teaching the course. Regarding gamification as a pedagogical tool, all participants (100%) believed that learning through games is useful to strengthen their knowledge related to course contents and preferred games to traditional learning styles (63%).

The post-experiment survey focuses on questions related to the virtual escape-room experience and its impact on the students' motivation when studying English literature. Most participants considered that studying English literature with escape rooms was useful (89.7%) and easier (89.6%). Additionally, the activity in the virtual classroom was very successful since 96.6% of the respondents declared that they enjoyed their active participation. The experiment seems to have impacted their attitude towards English literature classes as 89.7% of them claimed that they have a more positive attitude towards

contents and activities if escape rooms are among the teaching methods used in the classroom and considered that the professor would motivate them (93.1%) when escape rooms are included as an assessment method. Finally, the students felt that learning through such games would be beneficial for their acquisition (89.7%), and they were preferred to traditional learning styles by 96.5% of the participants. The respondents' answers seem to confirm that the escape room, as a pedagogical tool, is a particularly beneficial and motivating resource to teach English literature and have a strong impact on students' approach to content.

4. DISCUSSION AND CONCLUSION

The results of our experiment are positive in terms of achieving a higher level of motivation among the students in the English literature class. The use of escape-room experiences is shown to be an appropriate method to include students in the learning process and create in them a need to know more about the topics addressed in the classroom. Educational escape rooms are gradually being established in formal education settings, where it has been observed that the experiences enhance the development of skills and competences for students, in addition to being a motivating element in their education. According to the students included in the sample, the escape room was entertaining, it helped them to review most contents, and they enjoyed having worked in teams. Participants also declared that more approaches of this type should be implemented in the teaching of literature as these demonstrate that these teaching strategies are suitable for motivating students. The experiment also showed an optimal classroom flow in which the challenge (concentration) and the game (enjoyment) are preferred. This allows the experience to be intrinsically important. This signposts that the use of escape rooms can advance in the acquisition of curriculum content. Our results reinforce previously mentioned research which found that escape rooms can be a fun and motivating teaching–learning strategy to reinforce and evaluate the curricular contents of English literature.

These positive results, however, should not distract educators and students from the fact that several constraints may impede the full success of the activity. First, online activities are prone to interruptions due to power cuts or faulty internet connections. The improper use of technological devices such as cameras or microphones may also play a part in the lack of fluidity of the teaching process. We are also aware of the fact that our sample is very limited (29 participants) and generalisations cannot be assumed. More experiments have to be carried out in order to establish a sounder connection between the use of this gamified experience and students' higher level of motivation. Additional problems are presented by the density of academic programmes and sheer lack of time during a regular working week. Creating and implementing an engaging and attention-grabbing escape room for the students also requires a considerable investment of time on the part of educators, usually taken from their personal time. All in all, however, the benefits of the use of escape rooms in the English literature class may compensate for all the difficulties met along the way. Given all benefits mentioned, this proposal implies a very powerful tool, not only for the area of English literature, but also other fields of knowledge that allow to design and implement this teaching strategy, as it promotes educators' creativity to adapt contents.

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Chapter #19

A QUALITATIVE CASE STUDY ON THE SELF-RELIANCE EDUCATION PROCESS OF THE DIVORCED MIGRANT WOMEN IN SOUTH KOREA

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ABSTRACT

The purpose of this study is to explore the point where divorced migrant women who have been given the goal of self-reliance for their new lives are reconstituted as 'Adventurers' and identify the limitations. For this objective, a case study was conducted using the life histories of 5 divorced migrant women residing in the self-reliance support facility (named Didimteo), selected among the life history interviews of 80 migrant women. We performed open coding for data analysis, repeatedly reading the participants' interview data. As a result, qualitative classification revealed three distinct meanings for the self-reliance education process: *Recovery of affirmative, Rediscovery of 'becoming,' Empowerment for the futu*re. If the self-reliance education experience is defined in terms of the results of this study, it may be described as a 'process of becoming an adventurer for economic self-reliance'. However, the psycho-emotional comfort and support that migrant women experience through self-reliance education at Didimteo confirmed the possibility that Didimteo could move forward as a self-reliance education community and social network for divorced migrant women.

Keywords: divorced migrant woman, self-reliance education, self-reliance support facility, qualitative case study, South Korea.

1. INTRODUCTION

The spread of capitalism and globalization has amplified the feminization of migration from underdeveloped countries in Southeast Asia. In this new phenomenon, South Korea tries to maintain the patriarchal gender division of labor and solve social reproduction and care work problems through a new marriage system called 'international marriage' (Hwang, 2009; Kim, E. J., 2016). On the other hand, if we examine this phenomenon from marriage migrant women's perspective, migration through international marriage can be viewed as an objective of providing a livelihood for the family in their home country and as an active practice of the modern desire to live in a country that is wealthier than the home country and enjoy the middle-class life (Hwang, 2009; Palriwala & Uberoi, 2005; King & Christou, 2011).

The marriage migrant women are 'adventurers' who have decided to move (Hwang, 2009), but migrant countries' social norms, including family norms, make them passive and dependent on others (Kim, S. N., 2014; Kim, Y. S., 2010). Regarding the divorce of marriage migrant women, Hwang (2009) reveals that it is one of the common phenomena in the diversification of marriage and family systems in a postmodern society. The divorce rate of marriage migrant women in 2020 decreased by 12% compared to 2019, and the proportion of the total divorce was 8.2% (Statistics Korea, 2021). Nonetheless, the lower percentage of divorced migrant women and the reduced divorce rate do not mean their minority status has improved.

In South Korea, where migrant women have no family or relatives, divorced migrant women who have lost their qualifications as 'Spouse of the people'[i] face the triple blows of being migrant women along with the stigma of divorce and the rejection due to the absence of their husband (Kim, Choi, Huang, Cheong, & Kim, 2019). In addition, after divorce, most migrant women encounter the burdens of raising children and adjusting to psychological, social, and economic conditions (Kim, T. R, 2019; Lee, 2013).

Didimteo[ii] is an institution where migrant women who divorced due to the violence of their spouse can stay for two years, receiving various education for self-reliance. For those who have experienced the life-changing event of divorce, a community such as Didimteo not only provides emotional support and comfort but also enables them to move forward as a subject through learning (Cooley, 2007; Kim, Y. J., 2019; Back, 2016). Still, previous studies on the self-reliance of divorced migrant women (Kim, K. N., 2016; Kim, T. R., 2019; Lee, 2013) did not discuss the process of self-reliance in facilities such as Didimteo. Therefore, this study is differentiated in that it examines the process of self-reliance in facilities that was not covered in previous studies. According to the necessity and purpose of this study, the research question is "What is the meaning of the self-reliance education process in Didimteo for divorced migrant women?"

2. BACKGROUND

2.1. Self-reliance of divorced migrant women

The dictionary definition of self-reliance is "not dependent on others, not subordinated, and self-sufficient." However, self-reliance is not treated as a single point of view but rather a concept that includes the process, experience, and state of self-reliance (Sung, 2017). Yasutomi (2011) defined self-reliance as not the ability to do anything alone but properly utilize its resources.

Sung (2017) defined Korean divorced women's self-reliance experience as accepting divorce and exercising self-control, securing expertise through various job experiences and exploration, establishing and retaining social support, establishing mid-to-long-term goals, and designing the future. Kim and Wang (2021) defined the self-reliance of marriage migrant women after divorce as a process of maximizing self-efficacy through solidarity of migrant communities, strengthening human capital, psychological and emotional support of their families, establishing social trust, and helping them.

Kim, K. N. (2016) stated that the self-reliance experience of divorced migrant women consists of economic self-reliance, psycho-emotional self-reliance, and socio-cultural self-reliance. First, economic self-reliance is a process of coming out of poverty and achieving dreams. Second, psycho-emotional self-reliance is the process of accepting wounds and difficulties as a single parent in the divorce process and healing them. Third, socio-cultural self-reliance is the process of living a self-reliant life by participating in the community along with efforts to survive in Korea as a stranger, the crisis and coexistence of single-parent migrant women, and difficulties in naturalization due to divorce. Choi and Kim (2021) defined the self-reliance of divorced migrant women as a nomadic subject to form various relationships in new environments, although they are treated as strangers after divorce.

In other words, the self-reliance of divorce migrant women can be defined as a process of actively utilizing various resources (economic, psycho-emotional, and socio-cultural) around them on the journey to heal the wounds of divorce in the past and move toward a new life. Thus, this study intends to examine the meaning and limitations of how divorced migrant women are reconstructed as 'adventurers' with a focus on self-reliance education in Didimteo.

2.2. Self-reliance education in Didimteo

In November 2010, the Ministry of Gender Equality and Family and the Seoul Metropolitan Government jointly founded the 'Didimteo.' It is located in Seoul and has an independent residential space for each household. Around 40 devoted migrant women, victims of domestic violence (together with accompanying children), can stay in the center. From its inception to September 2020, this facility accommodates a total of 176 people, including 81 migrant women and 95 accompanying children. The education manual after admission is shown in Table 1.

Table 1.
Education manual after admission.

Stage	Early (1 month)	Middle (12-17 months)	Final (6 months)	Follow-up
Con-tents	-Psychological and health checkup -Korean language test -Vocational aptitude test	-Regular vocational education -Life culture education -Individual vocational training	-On-site practical training -Work counseling -Support for jobs near the residence	Counseling management for stable settlement

Source: Reorganization of the education manual for Didimteo (Seoul Metropolitan Government, 2020)

As illustrated in Table 1, the period of residence in Didimteo is two years in total, and it is operated according to a 3-step education manual. The early stage of admission is approximately one month. Through this education for adaptation to life, Didimteo carries out psychological and health support, Korean language test, vocational aptitude test, etc. Korean language classes, computer use practice, parent education, psycho-emotional programs, and regular vocational education are provided during the middle stage of admission. Regular vocational education is divided and operated according to individual characteristics. In the final stage of the admission, it provides on-the-job training in preparation for leaving Didimteo, job support near the residence, etc. For follow-up management, counseling for stable settlement after discharge is conducted (Seoul Metropolitan Government, 2020). It can be inferred from the education manual that its focus is on economic self-reliance.

On the other hand, divorce can be defined as life transformation events that trigger individual cognitive, psychological, and social changes (Park, 2016). Schlossberg and Goodman (2005) stated that these decisive life events could lead to the change of life through learning. Cooley (2007) pointed out that friendship, trust, and the importance of residence or gathering as factors that help women learn and that a deep relationship in a group leads to a change in the meaning perspective. In particular, the educational space based on intimacy serves as the basis for moving toward a participatory entity that practices emotional support and comfort, career development for the future, and sharing with the local community (Back, 2016; Kim, Y. J., 2010). Therefore, although Didimteo's education focuses on economic self-reliance, they will be able to provide various learning experiences for self-reliance as an educational space.

3. METHOD

3.1. Research design

This study conducted a case study, a representative method of qualitative research. A case study restricts the boundaries of topics to be addressed through research problems on 'how' and 'why' within the context of real-life when the demarcation between phenomena and context is not clearly defined (Yin, 2005; 2009). In other words, it is critical to establish appropriate case study limits by imposing constraints on data collection, including research subjects or the time and place of observation. Through this, a case study enables researchers to gain a unique perspective on the phenomenon they want to explore by exclusively focusing on the bounded system (case) (Kim et al., 2018).

In this study, data from five women who fit the purpose of the study were used from the life history interviews of 80 marriage migrant women performed with funding from the National Research Foundation of Korea from 2017 to October 31, 2020[iii]. As for the data selection, 7 cases of migrant women who have experienced divorce and live in Didimteo were first selected. After that, the life history data of 5 people were finally chosen after consultation among researchers. Their life history data totaled 115 sheets.

For data analysis, open coding was executed to examine the meaning of the self-reliance education process in Didimteo while reading the life histories of 5 divorced migrant women. The final topic was determined by categorizing it through a comparative analysis between the topics derived from open coding. Additionally, in order to secure the reliability of this study, peer examination[iv] and external audit[v] were implemented as suggested by Merriam (1998).

3.2. Research participants

The basic information of the selected research participants is shown in Table 2.

Table 2.
Basic information of research participants.

No.	Age	Period of residence	Visa	Country of origin	Family relations (Age)
1	25	6yr.	F-6	Vietnam	2 children (3,6)
2	27	5yr.	F-6	Vietnam	1 child (4)
3	28	7yr.	F-6	Cambodia	1 child (7)
4	37	7yr.	F-6	Vietnam	1 child (4)
5	28	4yr.	F-6	Vietnam	2 children (3,5)

The basic information of the participants is as follows. First, their age range is between the 20s and 30s. Second, the average residence period in South Korea is 5.8 years. Third, their residence status is F-6 (marriage visa), and they did not acquire permanent residency or nationality in South Korea. Fourth, all participants were staying at the facility with their children. In the case of study participant 1, the first child was living with her ex-husband. Participant 4 wanted to bring her children from a previous marriage living in Vietnam once she achieved self-reliance.

4. RESULTS

According to qualitative analysis, the self-reliance process in Didimteo has the following three features: Recovery of affirmative, rediscovery of 'becoming,' and empowerment for the future.

4.1. Recovery of affirmative

Divorce, which they had never imagined in their lives, became a reality. As discussed above, divorce is a life-changing event that induces personal change, leading to learning. However, the study participants, who have no basis in Korea, experience economic and psychological difficulties due to divorce and cannot proceed with the process that leads to learning. Didimteo is a place of psychological comfort that allows participants in this situation to move forward to the next step. Participants 1, 2, 3, and 5 described Didimteo as 'Chin-jeong.' Chin-jeong, a Korean word, is used by married women to refer to their parent's home, including parents, siblings, and hometown. The divorced migrant women heal the stress they suffered during their marriage at Didimteo, like Chin-jeong, and the psychological wounds, "feeling of wanting to die," (participant 4) caused by the divorce process.

> When I lived with my husband, he reprimanded me every day, saying, "How come you're doing it so wrong? I can't stand it." I was under a lot of stress at that time. When I got divorced and came here, my teachers constantly told me, "Oh, that's all right. You can do it. You can do it much better in the future." It really warmed my heart. I want to work hard. - Participant 1

Kim, E. J. (2018) mentioned that a relationship was a network that connected with others, and through this, abilities and competencies could be drawn out. The various relationships formed at Didimteo become the basis for their mental support. In addition, parental education can help restore relationships with children. This is the first step towards recovering the affirmative to assist them in developing their abilities and capabilities.

> I used to have a lot of fights with my child in the past. We were unable to understand each other. Whenever I had a hard time, I yelled at my son. So, he was stressed and peed in his pants. He looked at me while he was peeing. It enraged me. I didn't know what to do or how to raise my child. But, through parental education, we can understand one another now. - Participant 2

4.2. Rediscovery of 'becoming'

In Deleuze's concept, "becoming" means breaking away from the modern human being who has as its identity a molar multiplicity such as the dichotomous gender division of labor and patriarchy (Kim, E. J., 2014). Behind the marriage process of migrant women, there is a tentative agreement that they should conform to the new hierarchical order from their home country's patriarchal system to the Korean patriarchal system and take responsibility for their livelihood (Kim, E. J., 2016). Nonetheless, divorce breaks this agreement, and they explore a new role as daughter, wife, and daughter-in-law. Regular vocational training at Didimteo and, depending on individual aptitudes, professional programs rekindle recollections of long-forgotten dreams.

I'm currently learning to use computers, bake bread, and cook. What a variety! I also learned how to groom dogs. I chose it as my profession because I like dogs. - Participant 4

I originally dreamed of working in interpretation and translation, so I wasn't interested in anything else (independent programs at the center). I just studied hard according to the program, but I wasn't interested in it and didn't want to do it. Just one thing, I graduated from college dreaming of becoming an interpreter and translator. - Participant 3

On the other hand, they share concerns about their ability to fulfill a mother's role after achieving self-reliance in discovering the desire. Since a daycare center is also operated in the Didimteo facility, participants are relatively less concerned about child-rearing when receiving vocational education or performing internships. Still, after discharge, they are confronted with the reality of working and raising children simultaneously. They hope to accomplish a balance between work and parenting but are compelled to leave their children at the daycare center until late because "if I don't work, I don't have enough money" (participant 4).

This place (Didimteo) is close to the daycare center. The daycare center is right in front, so I am satisfied with my current life here. But I'm worried about what to do after leaving here. - Participant 2

Although self-reliance proceeds in a complex process, economic self-reliance is the most crucial part for divorced migrant women. This is because, to survive with children in Korea, a minimum stable life must be supported. Participant 5 is learning nail art, which she wanted to learn from her home country, but considers she should have a different job to achieve stable self-reliance with her children.

(What are you planning to do after learning nail art?) I just want to do it as a hobby. This job makes less money. I have to work late to make a lot of money in this field. But I can't work late because there is no one to look after my children, and I don't make enough money. (Then it would be difficult to do nail art.) However, I really wanted to learn nail art in Vietnam. I like it so much as it allows me to do what I want to do at Didimteo... I'm still learning nail art because it's what I wanted to do. - Participant 5

4.3. Empowerment for the future

The 'support facility' becomes a place that provides solid social support to divorced migrant women (Im, 2016). Social support can be established through all types of interactions with others (Cobb, 1976), and these interactions are the driving force for 'personal effort.' It suggests that women who remain social minorities can have the ontological competence necessary to revalue and create their own values (Braidotti, 2008). Participant 3 endeavored to prevent divorce but ended up divorcing. Her shattered expectations for life deprived her of her will to achieve self-reliance. However, "the will, which I can do on my own," has grown stronger at Didimteo. Participant 5 now can give a word of consolation to others.

I can live well independently. I have confidence and don't think of my ex-husband. There is no one to rely on, and I can do it myself. It makes me stronger. - Participant 3

> At first, I was stressed as well. But, after studying hard, I passed the test. Now I can also tell other people. "If you work hard, you can do anything." Everything was stressful at first. - Participant 5

In spite of this revaluation, the participants fear stepping out of the fence and becoming 'adventurers.' It is a place that provides the foundation for them to "live comfortably" (participant 1). Leaving Didimteo like a "Home" is another challenge.

> It's not enough. As I'm unemployed and just came in, I have no money, and my house requires high monthly rent. That's how I pay. With assistance, I may buy a good place. If not, I should live in a basement or a small room with a lot of stuff. If I go out here, I'll need many things. That's my biggest concern. - Participant 4

Economic problems exert significant influence on the process of self-reliance. Living well in unfamiliar Korea with children requires a stable job. Therefore, Didimteo also organizes an educational manual to ensure they get appropriate work. Participants are well aware that it is a "great advantage" (participant 4) to stay at an establishment such as a Didimteo. They are afraid to become 'adventurers' again, but their experience at Didimteo has become a force for the new future. Divorced migrant women regain their own names and prepare to take a new position.

> The best part is that people call me by my name. Since coming here, I have been getting better, and my thinking has grown a lot. If I lived with my husband, I would not know the Korean language and be forced to stay home. But here, I'm doing everything myself, so it somewhat encourages me. - Participant 2

5. CONCLUSION

This study aimed to explore the meaning of the self-reliance process for divorced migrant women in Didimteo, victims of spousal abuse. As a consequence of the research, it determined Recovery of affirmative, Rediscovery of 'becoming,' and Empowerment for the future.

If we describe the experience of self-reliance education of divorced migrant women based on the content presented in the research results, it may be defined as the process of becoming an 'adventurer for economic self-reliance.' "Financial issues" are central to experiences such as the recovery of affirmative, rediscovery of 'becoming,' and empowerment for the future. Kim and Wang (2021) stated that psychological and socio-cultural self-reliance is achieved when economic self-reliance is supported, implying that the financial aspect is critical in self-reliance. However, simply achieving 'economic self-reliance' does not change the social reality that participants will face double discrimination against multiculturalism and limited opportunities to participate in various education (Kim, H. J., 2018).

Nevertheless, it is worth noting that self-reliance education in a space called Didimteo provides an alternative possibility to change the social reality. Didimteo is a community where divorced migrant women can learn to change their lives, free from the yoke of 'divorce.' Park (2011) stated that migrant women naturally form a 'divorce network' through institutions such as Didimteo and shelters after divorce. Based on this, divorced migrant women can create a support system and take charge of the functions of the social family. The

community of migrant women not only becomes a personal dimension as emotional support in the form of a 'divorce network' (Kim, Y. O., 2010) but can also play a role in the social dimension with the potential for social participation (Kim, S. H., 2019). Thus, Didimteo requires continually developing as an educational community and social network for the self-reliance of migrant women who have experienced life changes due to divorce.

This study is significant because it explored the point where divorced migrant women living in Didimteo are reconstituted as 'adventurers' and grasped the limits. Based on the self-reliance education process of the participants, it examined the meaning and confirmed the influence of the community environment called Didimteo and the prevailing norms of Korean society. Still, in terms of data collection, since it was a secondary study using existing data, there was a limitation in that it could not capture the vivid interaction between the participants and the Didimteo. Therefore, future research is required to conduct to capture substantial interactions. Furthermore, it is necessary to discuss in detail what kind of social practice can move forward with Didimteo, a self-reliance education community, and its possibilities.

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[i] According to the "long-term stay qualification" in Table 1-2 of the Enforcement Decree of the Immigration Act (Enforcement Decree as of 2021. 10. 26), a person with a marriage migrant visa (F-6) is referred to as a "spouse of the people." In other words, 'spouse of the people' refers to a foreign spouse who maintains a marriage relationship with a Korean citizen. In this paper, this term was used to emphasize that divorced migrant women are out of the boundaries of Korean law.

[ii] 'Didimteo' is a Korean word, meaning a place that becomes a steppingstone.

[iii] Support for basic research by the National Research Foundation of Korea (research project number: 2017S1A5B4055802)

[iv] From March 2021 to June 2021, the research contents were presented three times at the graduate school seminar to which the co-researcher belongs, and the research results were discussed with peer researchers.

[v] On June 12, 2021, the research results were announced by participating in the workshop of the Inha University Multicultural Education Policy Lab, and the research was revised and supplemented by receiving comments from two external experts.

Chapter #20

TRAINING PROGRAMS BASED ON REFLECTIVE STRATEGIES IN THE CONTEXT OF MDVI

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ABSTRACT
MDVI children acquire and develop communication skills based on their specific features and usually they need a large amount of time to learn how to employ different systems of communication to express a need and have an impact on other people or on the environment. In this context, a Consortium of 3 universities, 4 special schools, one NGO and one IT company have addressed the need of a professional training in communication abilities of the specialists working with MDVI children in an Erasmus+ European project called PrECIVIM. A training program has been created, based on common experiences, reflective strategies, and different components. The results of the training program are presented in terms of the data regarding the number of responses registered in the reflective logs (RL), the analysis of the professionals 'reflections on their interventions, the number of professionals who at the end of the training program began to use the RL to record data about MDVI children's communication skills and to acknowledge teamwork with specific feedback from the intervention sessions. The training program has emphasized the need of trainers and partners who offer constructive feedback and who implement reflective strategies in the intervention process regarding communication with MDVI children.

Keywords: training programs, MDVI, reflective-based strategies.

1. INTRODUCTION

The Erasmus+ PrECIVIM (Promoting Effective Communication for Individuals with a Vision Impairment and Multiple Disabilities) project had two major contributions within the Consortium which consisted of 3 universities, 4 special schools, one NGO and an IT company: the first one to develop a training program for the professionals working with MDVI (multiple disabilities with a visual impairment) children and the second one to apply this training followed by supervision and analysis of the impact on the professionals. The training program was created having in mind the challenges reported by different studies (Siegel-Causey & Bashinski, 1997; Mitha, Whiting, & Scammell, 2009; Boers, Janssen, Minnaert, & Ruijssenaars, 2013; Pletsch, 2015; Safak, Yilmaz, Demiryurek, & Dogus, 2016; Tuomi, Kykyri, Aro, & Laitila, 2021) regarding communication between professionals (educators, teachers, therapists, psychologists) and MDVI children. The program would focus on training professionals regarding assessment and teaching communication skills to MDVI children. Within the training program the reflective-based strategies were an approach implemented with the use of the reflective-logs. Using the reflective logs, the professionals would write in a reflective manner about their teaching activities and intervention programs with the MDVI children.

2. BACKGROUND

The use of reflective writing by a professional determines the development of a deep learning style, by understanding the process rather than memorizing facts (Powell, Vlachopoulos, & Shaw, 2017). Reflective writing is linked to personal development and self-awareness, therefore many practitioners who begin using reflective writing may confront themselves with a resistance about writing down their thoughts and feelings, so that they need to employ strategies to overcome different personal obstacles (Wright, 2018). Reflective writing can guide the process of understanding the implications of multiple disabilities on the intervention, interaction and on the relationship that individuals develop with professionals.

Reflective writing can also be used to identify different attitudes, behaviours, reactions, and thoughts that the specialists may have and may not be aware of (Bager-Charleson, 2019). It addresses the idea of looking back to one's own activity and writing down the steps of the actions and the factors that determine the decisions. In this view the specialists will easily and immediately gain a perspective of the employed strategies and personal feedback. So, while a participant was writing back his/her activity, the aim of the training program was to guide him/her to constantly observe and analyse the process (alternatives which may come to mind, different angles of interpretation of a behaviour or of an intention of communication from the MDVI child).

Reflective thinking addresses relating, experimenting, exploring, and connecting theory and practice (McCarthy, 2011; Helyer, 2015). Specialists working with MDVI children are required to develop the ability to do reflective thinking as it is an important skill for learning, changing perspective or transformation (Bell, Kelton, McDonagh, Mladenovic, & Morrison, 2011). Research on training procedures in the educational field has shown some of the most used instruments and methods of assessing reflective thinking: reflective logs (Hubbs & Brand, 2010; Sedhu, Lee, & Choy, 2013), checklists and interviews (Lee, 2005), questionnaires (Choy & Oo, 2012; Choy, Sedhu, & Lee, 2019).

Effective professional development is an on-going process which includes training, practice, and feedback, provides sufficient time for the trainee to deepen knowledge, but also allows follow-up support (Darling-Hammond, Hyler, & Gardner, 2017). When engaging in a professional development program, the specialists working with MDVI children should develop different sets of skills to support the evaluation and the intervention regarding the communication process. Among the professional responsibilities highlighted by a training program, the participants should learn to make a reflection about their own teaching, create documents and resources adapted to the needs of the MDVI child, use communication strategies with the child's family, engage in the professional community, and pursue general professional development (Rudiyati, Sukinah, & Rahmawati, 2019). Even though reflective practices are always encouraged, sometimes the trainer must select a range of different techniques and strategies to teach the reflection process itself, for there are professionals who are not prepared to reflect or have never done it (Kreber & Castleden 2009, Coulson & Harvey, 2013).

Based on these literature acknowledgments, the three partner universities in the PrECIVIM project have created a training program for the professionals working in the four special schools and in the NGO, which were also project partners. The reflective-based strategies presented above were described in the manual, discussed at the onsite group trainings, exercised during the online supervision and emphasized within the reflective logs.

3. METHOD

3.1. Profile of the professionals

A group of 21 professionals working with MDVI children were the beneficiaries of the training programme conducted by three experienced trainers from a Romanian university (European project partner) on a time frame of 6 months. All 21 professionals were working with MDVI children in an NGO from a partner country of the Consortium. They were special education teachers, speech pathologists, psychologists, caregivers, educators, and therapists. They were part of the training group following a selection in their NGO as a European project partner. The requirement of the project for this selection was that the professionals are involved in educational and rehabilitation programs for children with MDVI.

The professionals' profile was as follows: 17 women and 4 men; 13 professionals with an experience between 0-5 years and 8 professionals with 6 to 10 years of experience; 7 were special education teachers, 4 occupational therapists, 3 caregivers, 3 psychologists, 2 educators and 2 speech and language therapists.

3.2. Profile of the trainers

The trainers were three members of the project from a Romanian university which was one of the European Partners in PrECIVIM. All of them had a PhD in Psychology, over 20 years of experience in special education and over 10 years of experience in training professionals in assessing and teaching communication skills to children with special educational needs. Two of the trainers had a vast experience in the education of children with MDVI and the third one in education of children with disabilities.

3.3. Objectives of the training program

The first objective was to present the training manual created particularly for this project. The manual presented strategies and methods which can be used in assessing and teaching communication skills to MDVI children.

The second objective was to implement the onsite group training during which the professionals could apply some of the strategies and methods from the manual and enrich their knowledge and understanding of assessing and teaching communication skills to MDVI children.

The third objective was to conduct online supervision sessions with the professionals from the onsite training. The sessions would focus on case studies of the professionals working with MDVI students and aimed (a) to follow the way the information from the manual and the onsite training was used in the case studies and (b) to give an opportunity to the participants to share their experiences, challenges, outcomes, successes with the other participants in the group while also receiving group-feedback and feedback from the trainer.

The fourth objective was to individually guide and assess each professional from the group by giving feedback to their written individual reflective logs delivered by e-mail.

4. PROCEDURE

The first component of the programme that has been delivered to the participants was the training manual – meant for individual study and reflection.

The second component was the onsite group training. This has been delivered by one of the university trainers in a modular way on a 3-days session.

The next component was the presentation of the reflective logs. They were delivered individually via e-mail to all the participants of the onsite training. The reflective logs consisted in the presentation of a case study.

Each case study had to be described in the reflective log in terms of: the communication profile of the beneficiary, the preparation steps for the intervention plan (assessment tools, materials, long and short-term objectives, strategies and techniques), the description of the intervention (strategies, resources, challenges), reflection on the observation techniques that they have used during the intervention and finally a self-reflection section (challenges, progress, feelings about the relationship with the beneficiary, improved aspects in their strategies, etc.).

The reflective logs were completed by the participants and sent to two university trainers who then provided individual feedback on each case. During a 6-month period, the participants have each completed between 3 and 4 reflective logs.

The fourth training component consisted of the online group supervision sessions. They were introduced after the participants started to get familiar with the reflection logs. The trainer of the online group sessions was the same one who conducted the onsite training session.

5. RESULTS

The results of the reflection-based strategies used in the training programme will be presented by addressing each training component. The reflection-based strategies were as follows: questions and introspective techniques addressed to the professionals by the trainers, reflective self-analysis of the professionals regarding their intervention plans for the MDVI children, written reflections of the specialists about their professional development.

The training manual which was delivered to the professionals for individual learning promoted reflection-based strategies through the specific communication approaches used with MDVI children: routine based strategies, communication diaries, field notes, checklists, video recordings, audio recordings, discussions with the multidisciplinary team, meeting notes with the multidisciplinary team, self-assessment activities, use of the educational environment, following the child's initiatives, co-creative communication. The manual encompasses the findings from literature and structures the main methods.

All the professionals have indicated that they found in the manual reflection-based assignments, tasks and examples that have guided them through their learning process. The chapters of the training manual were designed to support the specialists in their learning process about communication strategies and resources for the children with MDVI and also to offer these professionals the opportunity to plan supervised specific interventions for the MDVI children in their praxis (Argyropoulos et al., 2020).

The manual was created as a tool which professionals can turn to for alternatives and reflective analysis. Table 1 presents the methods that were mostly used by the participants in terms of communication approaches.

Table 1.
The use of communication methods based on reflective strategies from the training manual.

Communication method	No of participants (total N=21)	Percentage
Use of the educational environment	18	85,71%
Routine based strategies	18	85,71%
Discussions with the multidisciplinary team	17	80,95%
Meeting notes with the multidisciplinary team	14	66,66%
Communication diaries	11	52,38%
Following the child's initiatives	10	47,61%
Field notes and check lists	7	33,33%
Self-assessment activities	5	23,8%
Video and audio recordings	3	14,28%

The onsite training promoted reflection strategies by acknowledging the importance and the sense of belonging to a multidisciplinary team and by listing possible challenges and solutions to different problems when working with MDVI children. The reflective perspective was encouraged during the onsite training by questions and introspective techniques: *What did you do? How did you feel? What solutions did you find? How can you do better?* The reflective strategies were also stimulated by different case studies discussions. These were meant to prepare the participants for a correct and complete presentation of their working cases in the next phase – reflective logs.

The online supervision sessions highlighted very well the reflection process of the participants by encouraging them to share their professional strategies regarding the MDVI children. Table 2 presents the focus questions of the online group supervision sessions.

Table 2.
Focus questions on the online group supervision sessions.

No.	Reflective questions for the professionals
1.	How do you see the intervention?
2.	What do you feel about the MDVI child you are currently working with?
3.	How does your relationship with the MDVI child shift each session?
4.	What are the main challenges that you face in this intervention with the MDVI child?
5.	How do you deal with the family of the MDVI child?
6.	What can the other members of your team bring to your experience?
7.	How do you value the multidisciplinary team perspective?
8.	What different approaches have you learnt from other professionals?
9.	What coping mechanisms have you found for the unexpected events in the MDVI child's behaviour?
10.	What new interpretations or new developments can you share regarding the intervention?

The reflective logs were the final component of the training programme and in this section, we are going to present what a reflective perspective focuses on in this type of individual assessment and supervision tool. As previously stated, the reflective logs were an individual written task comprised of an analysis of a current working case that the specialist decided to share with his/her mentor and supervisor via e-mail.

The reflective logs were considered the most insightful instrument of professional growth because it contributed to the development of the professionals' reflective skills, and it gained value as it was supported by strong feedback on the intensity of reflection that they have achieved. These reflective logs were used in the Erasmus+ PrECIVIM project as an individual evaluation and supervision tool. They were implemented for 6 months during the most active professional engagement of the participants.

The reflective logs were strongly connected with all the other training components of this professional development program, as stated above, and offered the possibility of a refined understanding of the communication process with the MDVI child as the process was internalized by each professional through their own experiences.

At the end of the 6-month period, many of the professionals have already made new intervention plans or had a new or better vision on how to improve their intervention, their relationship with the MDVI child, and so on, as illustrated in Table 3.

The reflective logs gave participants the possibility to reflect on their own intervention by acknowledging the objectives they have achieved, stating how they managed challenging behaviours, recognising, and naming their feelings about the intervention and finally revealing what has changed in their professional development (relationship with the child, a better understanding of the child, higher acceptance/ tolerance of the child's opinions, and so on).

The reflective logs had a very important component: the feedback section filled in by the trainer. The feedback allowed the specialists to reflect further by comparing it to their own thoughts as well as to the opinions of the other team members. All the interventions have been improved during the 6 months of the unfolding of the reflective logs and the contribution of these reflective logs to the personal growth of each professional was stated in the final comments of their reflection logs. This kind of individual process has ensured for the professionals the specific significance of the communication development in the context of MDVI children where the diversity of the needs and abilities is so great.

Table 3.
Professionals' reflections about self-development as registered in the reflection logs (RL).

Type of reflection	Participants responding in RL 1* Total N=21	Participants responding in RL 2** Total N=21	Participants responding in RL 3*** Total N=21	Gain indicator**** at the end of the program
I will use the reflecting log as a tool for recording data and building teamwork	3	9	12	3
I feel much more confident and secure about my intervention	10	11	13	0,3

I feel that my intervention is now more appropriate and focused	16	16	16	0
I feel much more tolerance and/ or acceptance toward the MDVI child I am working with	5	8	9	0,8
I feel that the relationship between me and the MDVI child has been improved	3	10	11	2,66

*RL 1 (reflective log no. 1) has been completed after 2 months of the training programme.

**RL 2 has been completed after 4 months of the training programme.

***RL 3 has been completed after 6 months of the training programme.

****The gain indicator measures the profit of self-development regarding a certain type of reflection from the first reflective log to the last one. The formula for the gain indicator is:

$(P3/P1) – 1$; where P3 represents the number of participants acknowledging that type of reflection in the RL3 and P1 represents the number of participants acknowledging that type of reflection in the RL1.

As presented in Table 3, there were some immediate benefits after the first two components of the training programme (the manual and the onsite training) in terms of adjusting the intervention to the needs of the MDVI child. 16 out of 21 specialists have stated that studying the training manual, acknowledging the specific communication strategies, planning the intervention and observing their relationship with the MDVI child as he/she is making steps toward the short-term objectives have given the professionals the feeling that their intervention is now more appropriate and focused.

This type of reflection was written in the logs in multiple ways as this self-reflection question was asked in an open manner: *How do you feel about what you have learnt? How do you intend to use the data which occurred from the action and observation phase in order to improve or move on to your next interventions?*

Some examples of the responses which were registered under the tag: *I feel that my intervention is now more appropriate and focused* are presented in Table 4.

Table 4.
Professionals' responses on self-reflection analysis of their intervention.

The intervention helped me to proceed with my objectives for the student. The communication diaries were used in a more systematic way.
This procedure reminded me that we should have small and clear objectives each time.
I'll use the data to improve the intervention in order for him to communicate better with his environment.

I feel that I need to be prepared to re-think an activity and practice it tirelessly with the student. I think this procedure is really helpful in that manner.
The data we gather will be used to determine whether our intervention is successful and what has to be corrected, so that the results will be the best possible.
This data will help to improve the design of the next interventions since it will be easier to assess the level of communication of the student. So, the choice of the intervention methodology will also be more appropriate and focused.
I feel it helps me become more structured and organized.

This type of reflection was constant in all three important steps of the reflection logs which means that the training program has reached its objective in terms of identifying and observing the use of the communication strategies needed for each specific MDVI case.

A second type of reflection which also had a constant presence in all the 3 steps of the reflective logs was: *I feel much more confident and secure about my intervention.* This was a very positive and encouraging feedback for the training programme. Some of the answers in the reflective logs that were registered in this category are presented below in Table 5:

Table 5.
Professionals' responses regarding confidence with their interventions.

The information, the suggestion and the methodology proposed make me feel safer about my decisions.
I feel more prepared to interact with the student
I feel more prepared and flexible to change
I feel confident and think I can continue with my next objective
I am very satisfied
I feel more confident and thankful for this training trip
I feel prepared and safe to interact with the student, but I am always alert that her reactions may be unsafe for other trainees or that these reactions may trigger other trainees too.
The feedback given by an external trainer make me feel more confident.

The other 3 types of reflections presented in Table 3 illustrate that the programme had an impact on the way the participants began to use their knowledge as they became more aware of their new skills through the continuous feedback from the mentors – either in the online group supervision sessions or in the reflective logs.

There was an increasing number of specialists from the first to the last reflective logs who began to use this type of instrument to record their data and build a strong team of specialists with real-time feedback from different interventions.

6. DISCUSSION

The implications of the training of the professionals refer mainly to the increased competencies that were developed through the analysis of the reflective logs and the feed-back that was given after each intervention of the teachers and professionals. According to studies (Bain, Mills, Ballantyne, & Packer, 2002; Coulson & Harvey, 2013) the feedback given by the trainers to their trainee should also be combined with issue-related questions which challenge critical thinking. In this sense, the training program implemented in the PrECIVIM project represents an original contribution in the field of

MDVI children's education by using the reflective log as an evaluation and supervision instrument of the interventions of the professionals. This aspect is also grounded in the literature where the reflective logs are defined as describing experiences and critically reassessing the activities, thus achieving a higher level of understanding (Powell et al., 2017; Walker, Cooke, Henderson, & Creedy, 2013; Urdang, 2010).

Throughout the training, professionals became aware of their own knowledge and skills and how to interpret situations and observations within assessment and intervention and the process of taking decisions regarding development of communication skills in children with MDVI.

The concept of the training program can be replicated to other educational contexts and in-service trainings of teachers and professionals. The use of reflective logs and reflective writing represent efficient modalities for teachers and professionals to note down their observations and evaluations and use self-reflection analysis to understand not only the process of communication and communication skills in children with MDVI, but also the understanding of the consequences of their interventions.

7. CONCLUSION

The Erasmus+ PrECIVIM project has emphasized most of all the need to have trainers and partners with a constructive opinion and feedback. The professional development program highlights the importance of using reflective-based strategies to develop competences of teachers regarding intervention and interaction MDVI children. The use of reflective logs should be considered part of the intervention process because they provide valuable information about the development of communication skills in MDVI children as there is a great resource for evaluating the consequences of intervention decisions regarding methods, form of communication, evaluation and time and resource management. The evaluation and intervention practices need to be continuously perfected and reflected upon and specialists working with MDVI children should always convert their reflections into actions, but also their reflections into actions.

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Chapter #21

IMPACT OF IDENTITY-ORIENTED LITERATURE EDUCATION ON ADOLESCENTS' LEARNING PRACTICES AND LEARNING OUTCOME

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ABSTRACT

A mixed-methods quasi-experimental study evaluated the effects of a pedagogical intervention in literature education on Austrian upper secondary high school students' insight into the self and the other. The intervention is based on the newly developed NDR-model, the letters in the abbreviation representing the basic practices of narration, dialogue and response underlying the model. Two cycles of NDR interventions on the identity issues of "happiness" and "relations" were implemented.

An IPA study was conducted to explore how the implementation of the NDR-model of literature education affected participants' learning practices (narration, dialogue, response) and learning outcomes (self-understanding and understanding of the other). Qualitative analysis of interview and artefact data suggested that NDR students' learning practices were promoted. Additionally, they experienced insight into the self and the other because they were stimulated to engage with literary texts in the context of their personal identities.

Keywords: literature education, scientific study of literature, narrative engagement, insight.

1. INTRODUCTION

Fialho, Zyngier, and Miall (2011) discovered that methods in language arts classes "ha[ve] not been subjected to much empirical research investigation and classroom interventions are generally taken for granted" although "the way classes are conducted can play a role relevant to students' responses to literature" (ibid., p. 237). The prevalent methods primarily aim at teaching students interpretation and formal analysis, thus distancing students from genuine literary experience (ibid.). Students do not perceive literature as a source of pleasure (Mahling, 2016) and reading as a personally significant process (Sumara, 2002). In addition, emotions and values constitutive of a meaningful reading process (Koopman & Hakemulder, 2015) are neglected in dominant approaches to literary education.

As literary education fails to encourage students to make literature significant by establishing personally relevant connections, the learning potential of fictional narratives to intersect with and build upon the learners' lives is not fully realized.

The implementation of the NDR-model primarily aims to improve students' narrative engagement and self-insight, trigger meaningful literary response and foster accommodative and transformative learning (Illeris, 2017). The model is termed NDR-model because of the basic practices elicited by the model. Narration (Goodson & Gill, 2011; Goodson, Biesta, G., Tedder, & Adai, 2010), dialogue (Wilkinson, Soter, & Murphy, 2010; Alexander, 2020; Resnick, Michaels, & O'Connor, 2010) and response

(Sumara, 2002; Rosenblatt, 1994; Iser, 1978; Kuiken, Miall, & Sikora, 2004) are the key activities triggered by the model.

The NDR-model comprises six phases. In phase one, students are supposed to tell autobiographical narratives (Ricoeur, 1991, 1992; McAdams & McLean, 2013). Students are asked to perform narratives in interaction in step two (Bamberg, 2011; Bamberg & Georgakopoulou, 2008). Based on Kuiken's and Miall's approach (2001), students personally comment on the literary text by applying the *self-probed retrospection technique* in step three. In step four, text teams analyze the text in its context and interpret it (close reading: Bears & Probst, 2013; wide reading: Baßler, 2005, Hallet, 2008). In the following phase, diverse analyses and interpretations as well as personal insights are discussed (Thein, Beach, & Johnston, 2017; Wilkinson et al., 2010). Step six requires students to carry out a personal project on one aspect of the given identity issue (Johnston, 2014; Sumara, 2002; Spinner, 2001). Finally, the narrative from step one is reflected in the light of new literary knowledge and reading experiences and possibly reconstructed.

In the given intervention, two cycles of the NDR-model based on the identity issues of 'happiness' and 'relations' were implemented.

The present study addresses the following research question:

RQ: *How does the pedagogic intervention on the basis of the NDR-model of literary education affect participants' learning practices (narration, dialogue, response) and learning outcomes (self-understanding and understanding of the other)?*

2. METHODS

A quasi-experimental mixed methods design was implemented (Creswell & Plano Clark, 2018) in which the qualitative data are supposed to explain significant results from the quantitative analysis in an explanatory sequential design.

In order to be able to generate a detailed description of the phenomenon in question and to prevent data overload, sample size for this study was small (N = 70; seventh-form grammar school students). For the qualitative study, stratified purposive sampling (Teddlie & Tashkkori, 2009) on the basis of the results from the quantitative study was used. The participants were selected on the basis on their scores on reading orientations, reading experiences and self-insight in the pretest. A limited number of students within the experimental group took part in the qualitative study (n = 6).

To collect the quantitative data, self-report five-point Likert scales were used. To measure reading orientations, the Empathy and Insight scales from the Literary Response Questionnaire (LRQ, Miall & Kuiken, 1995) were adopted. Qualitative attentional focus was quantified on the Narrative Presence subscale from the Narrative Engagement Scale (NES, Busselle & Bilandzic, 2009). Two forms of absorbing reading engagement were measured by means of the Absorption-like States Questionnaire (ASQ; Kuiken & Douglas, 2017). The Self-perceptual Depth subscale from the Experiencing Questionnaire (EQ; Kuiken, Campbell, & Sopcak, 2012) was included in the questionnaire to collect data on self-insight. Pretests were administered to experimental and control groups before the start of the intervention, posttests after completion of the intervention.

In order to tackle the question if there is a statistically significant change in participants' reading orientations, attentional focus, narrative engagement and self-insight after the pedagogical intervention, a Wilcoxon Signed Rank test was conducted. A Mann-Whitney U test investigated the question if there is a statistically significant difference in literary response scores (reading orientations, attentional focus, self-other relations, verisimilitude, self-insight) between participants of the experimental group

(implementation of the NDR-model) and participants of the control group (no implementation of the NDR-model).

The qualitative study was conducted within the framework of Interpretive Phenomenological Analysis (IPA; Smith, Flowers, & Larkin, 2009) because this methodology allows us to gain a detailed personal insight into participants' experiences and their interpretations of these experiences. In line with the theoretical underpinnings of IPA, the qualitative study pursued two purposes: (a) to phenomenologically explore participants' descriptions of their experiences of literature education, (b) to hermeneutically understand how the intervention affects the participants' learning outcomes.

To collect qualitative data, individual face-to-face semi-structured interviews were conducted in a receptive style (Wengraf, 2001). A semi-structured interview protocol containing open-ended questions to encourage detailed responses was used. The questions focused on (a) the general description of the experience, (b) the personal relevance of the experience, (c) engagement and agency during the experience, and (d) the detailed description of the learning experience. The interviews were audiotaped and transcribed verbatim. In addition, participants produced experiential reports and artefacts. Discussion were videotaped and transcribed verbatim. All the data were anonymized and treated confidentially. Informed consent was obtained in written form from each participant prior to the implementation of the intervention.

In accordance with the principles of IPA, the following strategies of data analysis were applied to the qualitative data in an iterative cycle until thematic saturation was reached: a. reading and rereading, b. initial noting, c. developing emergent themes, d. searching for connections across emergent themes, e. moving to the next case, f. looking for patterns across cases (Smith et al., 2009). Finally, the data are presented in a coherent narrative format, citations from the data are supposed to illustrate each theme.

3. RESULTS AND DISCUSSION

First, the Wilcoxon Signed Rank Test revealed statistically significant changes in reading orientations, attentional focus, narrative engagement and self-insight following participation in the educational intervention. In addition, the results of the Mann-Whitney U Test indicated that there was a statistically significant difference in reading orientations, attentional focus, narrative engagement and self-insight between the experimental group and the control group after completion of the intervention. (Grandits, 2021).

Second, four main themes were identified in the qualitative analysis of interviews, artefacts and observations. Participants described their experiences of how the intervention affected: (a) engagement; (b) learning practices; (c) self-insight; and (d) insight into the other.

Theme 1: Engagement
This theme covers how the students experienced their engagement with the learning content during the intervention. Intensity, balance between guidance and freedom, and personal connections make up the key aspects to engagement.

All participants perceived themselves as highly agentive during the intervention. Compared to regular lessons, the intervention was regarded as "more thorough" (Mary), "more active" (Bea), "more real" (Sarah), and more intensive:

What surprised me was that we dealt with the book once again because usually it is like this: We read a book, then the teacher asks questions, and this is it. And, yes,

…, this time we dealt with the book again and again, and actually I found this good because we could deal with the book more intensively. (Bob)

In addition, participants repeatedly described engagement during the intervention as balance between teacher's guidance and students' freedom:

Teachers regulated the process, but we could work much more independently because of the tasks, we could bring in our own stuff or voice our own opinions. That's what I experienced. (Mae)

Bea reported that students were given "ample scope" although they had to work on assignments, and Mary stated that the process "was guided, but you still had your freedom". Bob used a very similar formulation: "On the one hand we were guided so that you hand in everything on time, but on the other hand, I think, you were free to contribute all your ideas to the group, that gave you some freedom."

As far as text response is concerned, students experienced the engagement with the text as transaction between themselves and the text (Rosenblatt, 1994). They could personally relate to the text during the lessons:

[In regular literature education] we read the book and got a question and then we forgot about it. And now we engaged much more with it, and I think it was more relevant to students, so that we could make a better connection, and that was why I enjoyed it more, yes. (Bea)

Thorough engagement with the text resulted in a connection between the world of the text and the world of the reader, which in turn established personal relevance. Mary added that "you like books better if you can connect to them personally, mostly, and you understand them more easily because of that, yes, as I said, it was the connection with yourself, to some degree, this was very good". According to Mary's interpretation, understanding of the text was fostered by the personal connection with the text. Students could also link up their behavior to the characters' actions in the text. This was mainly triggered by phase three of the intervention in which students picked three passages and "always had a personal connection to it [the text], and this was thought-provoking." (Mary). Mae gave reasons why phase three was crucial in establishing personal relations with the text: (a) The texts addressed relevant identity issues that had been explored in phases one and two before. (b) This kind of task was transactional in nature, it required students to actively bring in their associations and memories.

In conclusion, participants perceived activity as intensive, they conceptualized agency as dialectic of freedom and guidance and interpreted engagement with the text as transactional relationship between the world of the text and the world of the reader which mediated learning effects.

Theme 2: Learning practices

This theme covers the development of the skills of narrating, engaging in dialogue and responding to literary texts.

It can be concluded from participants' interviews and artefacts that the intervention fostered skills learning. First, response learning was promoted by close reading activities in phase four. Due to in-depth discussions of the process of analysis and analysis results in the group, students reported an improvement of their competence in formal analysis. In addition, deep reflection on the transactional relationship enabled them to put forward more plausible hypothesis that could be supported by quotes from the literary text. Phase three was considered most helpful for interpretation: "You see the text in a different light because you divide it into sections and then you again have a different perspective on the text, I think that helped a lot." (Bea) In sum, participants found selecting relevant passages

from the text and connecting them to the world of reader facilitated the formulation of interpretation hypothesis. Only Mae reported that she did not improve her analysis and interpretation skills.

Second, narrating a personal story was conceived as beneficial for skills learning. Sarah reported a progress in narration. Judith explained that the intervention promoted narrative learning: "I have never done such stories at school before. It was actually the first time we had to tell a personal story, and it helped me on because it was the first time." The novelty of the approach offered new opportunities for learning. For instance, Mae outlined how phase one supported her to perform better at school:

> […] I had never found it easy to write a story, and last year writing was very difficult for me. […] And maybe this was the incentive to put more effort into it, that I manage German better. […] And I think it was really good to start out with this task so that we could express our emotions, yes, I think this was really good. (Mae)

Third, dialogic skills were fostered during the intervention: "[…] and I also think that they [dialogic skills] were trained because we dealt with discussion rules right in the beginning, that you let others finish, and that you should consider different perspectives, and that, I think this brought me a step forward." (Judith). All participants agreed that the capability of comparing differences was increased. Recapitulation of the essences of the learning process and outcome was experienced as valuable in dialogic learning.

In conclusion, participants reported that they could develop their skills of narration, dialogue and response. Skills learning was associated with intensive engagement.

Theme 3: Insight into the self

Participants distinguished between five effects of the intervention on identity learning. Students' interpretations of the effects on their (a) traits and behavior, (b) attitudes to life, (c) psychological well-being, (d) storied lives, (e) perception of time, and (f) identities as readers and learners will be outlined below.

Bob stated that you could "learn something for yourself, in most cases". In the following, we will present what students reported about the learning outcome. First, the intervention prompted self-assessment. Students pondered about their action patterns and their character traits as a result of the transaction with the literary text. As a consequence, they discerned a change in behavior and character traits: "[…] I try to partly improve my behavior and my qualities or I simply do not push my negative qualities aside, but I rather really reflect on them, and I consider various perspectives." (Sarah) Reflection raised the awareness for the need of change and self-care: "This clearly showed me that I need to change a bit and that I need to take more care of myself." (Sarah)

Self-assessment also impacted on how students valued their lives. By comparing the tragic life stories of characters with their own stories, they understood the true value of their lives: "It [the intervention] evoked good things, yes, that I'm simply happy with my life as it is." (Sarah)

Second, participants pictured the intervention as transformative as far as their attitudes to life are concerned. These were modified and therefore students gained self-insight:

> What did I learn? This is hard to tell, but, I have already mentioned it, concerning happiness, find out what really makes you happy, don't be superficial. Now, personally it was a big advantage for me. (Mary)

Students achieved self-insight by feeling into themselves. This was prompted by the authentic questions posed during the intervention, e.g. 'What makes you truly happy?'. This kind of self-insight had effects on participants' actions: "[…] and maybe I'll do some things

or won't do them in the future so that I'm happier, yes, this really made me thinking very much, and, I think, this also influenced me, yes." (Mary). Bob had a similar experience:

> Yes, in this text about happiness, there were two characters who had a lot of problems, but the ending still was like, ehm, 'Yes, we are fine!' And then I thought for myself, yes, whatever harm happens to me, in the end everything will be alright, and that's what I learned. (Bob)

Bob's attitude to life changed, he grew more optimistic because of the transaction with the literary text: "Yes, I'm a somewhat pessimistic person as far as my future is concerned, but what I've maybe learnt from the tasks is that I should be hopeful for the future whatever happens."

Third, the intervention also affected the psychological well-being of the participants. Narration enabled the participants to cope with sad events, thus changing their lives. Judith found the writing of the autobiographical story transformative:

> No, not depressing because I don't have a problem to tell people about negative events, but I found the task hard when I did it at home, I found it really difficult to write about it or it took me quite long because I needed breaks all the time. But I have benefitted, I feel better when I think about it now. […] Telling the personal story, the self-experience, it really helped me, I can cope with it now, it was like a therapy. (Judith)

Other students confirmed this purging effect: "For me, it was very important to write the story in the beginning, that sad experience that I had, in order to come to terms with it." (Mae) Mary highlighted the consequences of the disclosure of repressed life episodes: "[…] that you are thankful in the first place, that it doesn't come to that anymore, and, that you'll maybe change your behavior because of it."

Fourth, participants experienced an effect on their personal life stories. Past events were recalled and reflected when students told their personal stories: "[…] It [the past] was called to mind and I could think about it once more." (Bea) Disturbing memories were revived in the present, they aroused feelings and had future implications on students' behavior. For example, Sarah realized through the identity task that she had been too submissive in the past, she disapproved of her behavior and decided to change it. She stated that it was the intervention that "made me realize my past, and where I went wrong and what I could have done better". Recall of the relevant episodes of the life story also gave participants the opportunity to account for how they acted in the past.

In addition, the evocation of memories raised participants' awareness of the fact that past experiences shaped their present being. This awareness was regarded beneficial for the future as life was perceived less superficially.

Fifth, students also reported an influence on their time perception, they became aware of the temporality of their being. They realized that time perception was closely linked to their storied lives. When telling their personal stories, the past was reflected in the present, and this present reflection provided students with additional future opportunities. Past memories were evoked during the present transactional engagement: "Yes, I realized what I had experienced in my short life, […] and, yes, I found it nice that I could account for the past yet again, from childhood till now, so that you can recall the past." (Judith) Participants experienced the effect that the temporal distance between past and present was bridged during the process of remembering, discontinuities were overcome. In addition to personal memories, cultural experiences of the past were recalled in the intertextual reading of the literary texts.

The present experience that the students linked up with their past had implications for the future. Participants explained that a changed attitude to life, which had become apparent in new life concepts, shaped their perception of the future. Bea discovered that she had a different perspective on problems although having read the book did not help her solve the

problem. Mary realized that the intervention had offered her future possibilities for action. She was taught that she was agentive and that she could change her behavior. Awareness of the past made Sarah recognize the need for change.

Sixth, the intervention also changed the participants' identities as readers. Bea stated that she had not been interested in reading before the intervention, but as a result of the intensive engagement with the literary text she was enjoying reading then. Therefore, she identified the future objective of adopting a new reading attitude. In addition, modified orientations to reading were reported: "I think I would read the book with a different attitude now." (Mary) Judith adopted a new approach to reading which was grounded in perseverance. She had realized that high engagement was essential for the learning outcome. We can conclude that intensive engagement could facilitate a change in reading orientations. Mae also noticed a better overall performance at school because of the change in reading attitude.

Participants also remarked on the insight into the self on the meta level. Emotional resistance was regarded a precondition for change. Learning was experienced as transformative: traits, actions, attitudes, psychological condition, life stories and habits were changed due to the intervention. Although they answered the question in the negative whether the intervention fundamentally changed them as a person, participants reported changes in self-understanding, in their psychological condition, in their storied lives, in their perception of time, and their identities as readers and learners. They actively increased their capacity to rethink life. In the discussions, participants additionally mentioned changes in their relational identities.

Participants agreed that the reported changes could be traced back to the intervention. No other factors were detected. Moreover, students repeatedly stated in their experiential reports that were written three months after the intervention that the lessons had a lingering effect. The ideas triggered by the intervention had stayed with them by then. Students also highlighted a better retention of the learning outcome. Sarah concluded in her report that students gained a lot of new insights about themselves, they got to know literature better, they got to know their classmates better, and they escaped the daily school routine. Despite their spontaneous negative answers to the question whether fundamental changes had taken place, we can infer from the interviews, artefacts and observations that transformative learning occurred as an effect of the intervention.

Theme 4: Insight into the other

Mae's description of how participants experienced the insight into the relationships with others is representative: "I don't know, I just think I will treat people differently than before." Bob, for instance, decided to respond to significant Others in a more friendly way because he had learned to empathize with characters during the intervention. Mary expounded on the insight into the other:

> It was very interesting, I think, to get to know close people better once again, and I think that the question what people think about happiness is very interesting though very personal. If people tell a story … what really makes them happy, and, as I said, that really influenced me. First, how I see these people, and second, how I treat them, and, what I maybe want to do to make others happy. (Mary)

Insight of the other was yielded by listening to significant Others telling their personal stories. Identity work in phases one and two influenced the participants' perception of others, their response to others as well as the actions towards others. Changes in students' perception of their relations could be partly traced back to a change of life concepts. Affective behavior towards others was also altered. Mae, for instance, acted more emotionally expressive towards others after the intervention.

A further effect on the insight into the other was that people were evaluated differently: "In any case, I'll be able to judge people differently from what I thought before" (Judith). Higher tolerance for others was shown, participants had become more unwilling to change others and interfere with others' beliefs: "Yes, well, I'll try to let people be the way they are, and I'll try not to think ill of them somehow. […] Everybody can decide for themselves, and, it doesn't concern me. And, I think, I've learned this only recently." (Judith). In conclusion, general insight into human nature was reported. Others were perceived and judged differently, and as a consequence, actions towards the others changed.

Adopting different views was considered a means to insight into the other: "It was interesting that, I've said this before, that there were different opinions, and that you allow these different opinions, and that you change your own opinion a bit or that you can rethink things, yes." (Mary) Acceptance of alternative views was facilitated by putting yourself in the other's position: "It made me clear that I had to see things from different perspectives because I think, well, I tried this before, but through it [the intervention] you got a much better picture of it, you see things differently." (Sarah). To sum up, participants reported a better understanding of the other through the change of perspective.

The intervention also had ethical implications. First, students reconsidered ethical norms:

> "Well, I wouldn't draw a clear line between good and evil anymore because there are people who somehow seem, well, not bad, but nasty, but there is a reason why they are that way, and therefore I wouldn't divide people simply in two groups, in good and evil, but you have to question these categories." (Judith)

Ethical reflection of that kind was caused by a thorough analysis of characters' traits and reasons for their actions. Students held that both the text's structure and the intensive engagement with the text provoked ethical thinking.

In addition, participants discovered the harmful nature of prejudices. They also felt a moral obligation to voice their own opinions and to defend their opinions, but also to scrutinize others' opinions and to accept them.

In conclusion, participants reported a change in perceptions and evaluations of significant Others and in actions towards these significant Others. Identity work and the transactions in personal response to the literary text were seen as causing these changes. In addition, different views in external dialogues facilitated insight into the Other. Finally, the intervention did not only affect personal relationships. Ethical knowledge about norms, obligations and imperatives was generated as well.

4. CONCLUSION

It can be concluded from the qualitative results that the intervention based on the NDR-model affected the participants' learning practices (narration, dialogue, response) and learning outcome (self-insight, insight into the other).

Engagement during the intervention was described as intensive. Students experienced the lessons as a balance between teacher's guidance and students' freedom. Making personal connections was interpreted as a form of engagement that promoted the learning outcome.

Furthermore, the intervention fostered the skills of narrating life story episodes, enacting dialogue and responding to the literary text. First, participants learned how to coherently tell and retell personal stories. In addition, they realized how cultural scripts influenced the configuration of their stories. Second, students developed their dialogic skills in the given community of practice. Especially exploratory talk and elaborated

explanations (Wilkinson et al., 2010) were promoted. Dialogue in the literature classroom fulfilled three essential functions: It was deliberative as participants learned to discuss different views, it was cumulative as they collaboratively built up knowledge and experience, and it was mediating as it allowed transactions between student and student and student and text (Alexander, 2020). Third, forms of response to literary text were furthered. Students developed their capacities to experience and analyze texts. On the one hand, they learned how to make associations between the plot and personal memories and how to fuse with characters. On the other hand, they acquired the skill of contextualizing texts which enabled them to put forward more plausible interpretation hypotheses.

Participants did not only improve learning practices, skill development also affected insight into the Self, and insight into the Other. Students constructed identities by practicing identities. They wrote, read and listened to identities and thus redid their own identities. Practices thus caused transformative identity learning. Experiential reading also had a revelatory effect on the readers, hidden aspects of their personalities were disclosed. In addition, higher-level thinking, especially reflection, recapitulation and deep understanding were triggered by the intervention. Participants also reported higher accountability due to the practices they adopted.

There is empirical evidence for the insight into the self that was effectuated by the intervention. To begin with, the intervention enabled the participants to aesthetically experience the literary text during reading. Analysis of the qualitative data suggests that aesthetic experience is a precondition for insight into the self. In the literature, the following effects of reading literary texts on identity are postulated. First, knowledge about identity is discussed and performatively produced (Krammer, 2013). Participants reflected and co-reflected on their traits, their behavior, their attitudes to life, their habits, and their storied lives in response to reading literary texts, and by reflecting identity, they generated new knowledge about identity. Second, reading literature has the potential of transforming the reader's identity (Ricoeur, 1991). Behavior, attitudes, psychological condition, personal stories, time perception, and identity as readers and learners were changed due to the intervention. Third, literature affects personal identity in its temporal dimension (Ricoeur, 1992). The students experienced themselves in their temporality. They realized how past, present and future are interrelated. New possibilities of agency were opened up by learning how to apply the learning outcome to personal life. In addition, participants realized that the personal story could provide continuity. Narrative change and consolidation were experienced as indicators of development. Fourth, literature affects social identity negotiations in situated contexts (Beach, Johnston, & Thein, 2015). Dialogue allowed insight into how identity was conditioned by relationships to significant Others. Thus, both understanding of the self and the other was enhanced. Fifth, literature emphasizes the ontological status of identity as cultural fiction (Krammer, 2013). Participants' recalled and reflected their storied lives, thus becoming aware of the fictional nature of the story and the selective mechanism that generates the story.

The qualitative study also proved that the intervention yielded insight into the other. Changes in the perception and evaluation of others and in the actions towards others were evident. In addition, ethical norms that regulate social living together were reconsidered.

In conclusion, the intervention based on the NDR-model is purposeful as it met the principal learning objectives set out at the beginning of the design process. First, engagement with the text was enhanced, thus promoting the practices of narrating, engaging in dialogue, and responding to literary texts. Second, the intervention fostered students' learning about themselves and others.

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Section 4
Organizational Issues

Chapter #22

PJI PRINCIPLES: TAKING STEPS TO HAVE CONVERSATIONS ON EQUITY IN OUR CLASSROOMS AND DAILY LIVES

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ABSTRACT

Today's educators, from kindergarten through higher education, are uniquely positioned to provide their students with real life opportunities that demonstrate and promote equity, change, and social justice ideals amongst their peers, throughout the schoolhouse and into their communities. These opportunities for students, supported by the norms and culture of the classroom, often come in the form of daily interactions with curricula, which affords teachers the window to teach how to disrupt inequity among students and in their lives. For teachers and school leaders to open this window, each must also have the courage to investigate and learn from the mirrors of the experiences of others reflected to them. The work of the Peace and Justice Institute at Valencia College provides educators with the courage to investigate those personal mirrors for the benefit of their students. Their courage is found in the sharing of stories about themselves and by turning off their automatic responses to the stories of others. The following chapter considers how The Principles, the philosophical foundation of PJI, translate into an equitable classroom practice. This qualitative case study of 24 teachers explores the impact of the PJI Teachers Academy in the k-12 classrooms of these teachers.

Keywords: teachers, education, social justice, professional development, inclusive education.

1. INTRODUCTION

"Not everything that is faced can be changed, but nothing can be changed until it is faced." These words of James Baldwin serve as a roadmap in the role of education today. Educators not only instruct students in various content areas but also serve as a conduit for the introduction to the societal norms, beliefs, and expectations each will encounter during their lifetime. Students today will be asked to meet the challenge of WHAT diversity truly looks like. In the curriculum and in classrooms every day, educators need to be equipped with the tools requisite to provide a socially just and inclusive education for all students. One of these tools is the establishment of a set of classroom norms that embrace inclusiveness and foster a sense of community within the classroom setting and the school. For educators who have participated in the PJI Teachers Academy, these norms come in the form of The Principles for How We Treat Each Other: Our Practice of Respect and Community Building (The Principles, see Table 1). The Principles are the core philosophy practiced in the Teachers Academy and throughout the work of the Peace and Justice Institute. With the mission of "Making a difference by intentionally engaging in practices and principles that explore, advocate, and honor the dignity of self, others, and the earth" (PJI Website), The Principles were prepared by the founders of PJI (which included the current Director, Rachel Allen) with considerable help from Peter Block's work in building community, Parker Palmer's Center for Courage and Renewal, the Dialogue Group and the retreat work of Center for

Renewal and Wholeness in Higher Education. PJI adapted and customized The Principles to serve the needs of the community since 2010. The Principles are foundational in all its professional development opportunities offered for nonprofits, city employees, the faith community, police departments, school districts in and around Central Florida, as well as, the faculty, staff, and students at Valencia College.

2. BACKGROUND

Each summer since 2018 PJI has offered the PJI Teachers Academy that provides educators a weeklong cohort experience that leads to making a difference – personally and professionally. Created by PJI facilitators, educators themselves, with educators in mind, the PJI Teachers Academy creates a safe space for participants to engage in difficult conversations throughout the five days about privilege and personal identity. Each day, the cohort intentionally engages in interactions that pushes each to become better equipped with tools to work effectively in a pluralistic society. With The Principles in mind participants explore their own identity, hidden bias, and life experience through the lenses of privilege, race, gender, trauma, resilience, empathy, and mindfulness. This unique combination of reflection and social justice provides an opportunity for participants to explore their influence on their curriculum and student/teacher relationships. The knowledge gained through this professional development is reinforced through selected readings, written reflections, engaging activities, and discussions, as participants identify ways to expand inclusion and create safe and welcoming learning spaces.

Previous studies have focused on the need for an inclusive and welcoming space, while other, more theoretical research, has centered around the reproduction of inequity in educational spaces. This chapter addresses the combination of the disruption of inequity in education and the creation of inclusive spaces using the PJI Principles in k-12 schools.

Table 1.
The Principles "How We Treat Each Other: Our Practice of Respect and Community Building".

1. **Create a hospitable and accountable community**. We all arrive in isolation and need the generosity of friendly welcomes. Bring all of yourself to the work in this community. Welcome others to this place and this work, and presume that you are welcomed as well. Hospitality is the essence of restoring community
2. **Listen deeply**. Listen intently to what is said, listen to the feelings beneath the words. Strive to achieve a balance between listening and reflecting, speaking, and acting.
3. **Create an advice free zone**. Replace advice with curiosity as we work together for peace and justice. Each of us is here to discover our own truths. We are not here to set someone else straight, to "fix" what we perceive as broken in another member of the group.
4. **Practice asking honest and open questions**. A great question is ambiguous, personal and provokes anxiety.
5. **Give space for unpopular answers**. Answer questions honestly even if the answer seems unpopular. Be present to listen not debate, correct or interpret.

6. **Respect silence**. Silence is a rare gift in our busy world. After someone has spoken, take time to reflect without immediately filling the space with words. This applies to the speaker, as well – be comfortable leaving your words to resound in the silence, without refining or elaborating on what you have said.

7. **Suspend judgment**. Set aside your judgments. By creating a space between judgments and reactions, we can listen to the other, and to ourselves, more fully.

8. **Identify assumptions**. Our assumptions are usually invisible to us, yet they undergird our worldview. By identifying our assumptions, we can then set them aside and open our viewpoints to greater possibilities.

9. **Speak your truth**. You are invited to say what is in your heart, trusting that your voice will be heard, and your contribution respected. Own your truth by remembering to speak only for yourself. Using the first person "I" rather than "you" or "everyone" clearly communicates the personal nature of your expression.

10. **When things get difficult, turn to wonder.** If you find yourself disagreeing with another, becoming judgmental, or shutting down in defense, try turning to wonder: "I wonder what brought her to this place?" "I wonder what my reaction teaches me?" "I wonder what he's feeling right now.

11. **Practice slowing down**. Simply the speed of modern life can cause violent damage to the soul. By intentionally practicing slowing down we strengthen our ability to extend nonviolence to others—and to ourselves.

12. **All voices have value**. Hold these moments when a person speaks as precious because these are the moments when a person is willing to stand for something, trust the group and offer something they see as valuable.

13. **Maintain confidentiality.** Create a safe space by respecting the confidential nature and content of discussions held in the group. Allow what is said in the group to remain there.

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3. LITERATURE REVIEW

Education equity work begins with understanding the barriers and structures that prevent students from obtaining a quality and inclusive education. Social reproduction theory aids in identifying these barriers by considering the ability of social institutions, including schools, to replicate the inequities in capital that are found in society (Au, 2008; Bischoff & Tach, 2018; Bourdieu, 1986; Vesely, 2012). Capital, while commonly used as an economic term, can also be used to describe the educational, cultural, and social benefits an individual accumulates. Bourdieu (1986) centered his writings on social reproduction theory around these four types of capital, deeming them to be the building blocks of an individual's success.

The first two forms of capital, economic and human, are easily identifiable inside and outside of the educational realm. Economic capital, or wealth that is directly related to tangible financial capacity, can be seen within income inequality in communities, and the difference in funding in American schools. Human capital, on the other hand, represents the intangible educational attainment of an individual. Through family educational expectations, and increased access to academic resources, human capital and economic capital are

intricately linked: the higher the education, the greater the anticipated paycheck. This symbiotic relationship also applies in the reverse; children from households that have limited educational resources are likely to replicate the educational attainment of their parents (Vesely, 2012). When schools are divided by economic and human capital expectations, the educational environment compounds the gap between those with resources, and those without.

The third and fourth form of capital, cultural and social, while more abstract, can be easily encouraged or suppressed within a classroom. Cultural capital refers to both the tangible artifacts of culture (e.g., art collections), and the knowledge and cultural experiences (Bourdieu, 1986). Linked to economic and human capital, increased cultural capital represents an alignment with desired norms and understanding in a society. In schools, cultural capital can be supported by fieldtrips, extensive extracurricular programs, dual language programs, and a plethora of electives, all of which are traditionally found in more affluent education settings. Thus, those who have the means to engage with various cultural aspects outside of school are likely to attend schools that offer opportunities to further grow cultural capital (Bischoff & Tach, 2018). Unfortunately, the suppression of cultural capital is found in schools that serve students from low socio-economic backgrounds. This is seen in the narrowing and standardizing of the curriculum, high enrollment in remedial courses, and the focus on testing the material rather than connecting to the curriculum (Au, 2008; Vogler & Virtue, 2007). Another aspect of cultural capital refers to the alignment between linguistic capabilities of the students and the academic language in the school. Students who attend school in a language that is different from their mother tongue, are often seen as having less cultural capital, which can be erroneously linked to their academic potential and ability (Croizet, Goudeau, Marot, & Millet, 2017). While it is considered a cultural benefit to speak more than one language, the advantage only applies to those who speak the dominant language first.

The final form of capital, social capital, refers to the connections one has with the world around them. Social capital is the meaning behind the adage "it is not what you know, but who you know", and can open the metaphorical doors of opportunity. On a superficial level, social capital can refer to the popularity of students within a school, who likely also possess a higher degree of economic and cultural capital. Within the classroom, however, social capital can take on a more intimate role. When a classroom is considered a community, with everyone seen as valuable to the success of the class, all students experience an increase social capital. This creation of social capital within the classroom also lends itself to the universal manifestation of cultural capital in the classroom environment. Students in these settings find a sense of belonging to the culture of the classroom, equal and united under a standard set of norms, rather than attempting to meet the expectations of the culture outside of school.

4. METHODS

The data for this chapter comes from two studies that were conducted with PJI Teachers Academy alumni. The first study (S1) was a funded evaluation of the first year of the PJI Teachers Academy program, and was conducted by a team from the University of Central Florida Public Affairs PhD program (Anderson, Sanguiliano, & Mack, 2019). The data from the second study (S2) was part of a mixed methods doctoral dissertation that considered the personal and professional impact of the PJI Teachers Academy on k-12 educators and on their sense of professional agency (Sanguiliano Lonski, 2020). Both studies addressed the use of The Principles as part of a culture change in the classroom and school.

4.1. Participants

Participants for both studies had to meet a set of criteria prior to recruitment for either study. The participants had to have completed a full week of the PJI Teachers Academy and currently work in a k-12 setting. As the PJI Teachers Academy hosts teachers from around the state, this chapter only used the data from teachers who taught within the same school district. This was done to control for geographical differences as well as district expectations. The final selection of participants yielded 24 educators representing nine schools. The schools ranged from a charter k-12 school that focused on a high-need's rural population, to a large public high school serving nearly 3000 students.

4.2. Setting and data collection

The data for this chapter came from recorded interviews. Due to the social distancing restrictions from COVID-19, the S1 focus group setting was replaced with interviews on a web conferencing program for the second study. Other than the difference in setting, the participants were asked the same eight semi-formal interview questions for both studies (see Table 2). As per guidelines from the Institutional Review Board of the University of Central Florida and the school district's research office, pseudonyms were used for the participants, and numeric identifiers were used for the schools.

Table 2.
Semi-Formal Interview Questions.

Focus Group Interview Questions

1. What is your purpose as a teacher, and how do you fulfill that purpose?
2. How do you reflect on your teaching practice?
3. How did participating in the PJI Teachers Academy impact you personally and professionally?
4. Think back and compare you and your classroom before you attended the PJI Teachers Academy, and you and your classroom now. Discuss the most impactful strategies that you have implemented in your teaching/administration? How do you know it was impactful?
5. Regarding Principle 1 of "How We Treat Each Other", how have you created a hospitable/welcoming and accountable educational community? What has worked/not worked?
6. How have you used Theoretical Framework: Curriculum as Window and Mirror (Emily Style) and Strategy: Serial Testimony?
7. As PJI Teachers Academy will be offered again, what recommendations do you have regarding areas of improvement or addition?
8. Finally, is there anything else that you would like to share that we have not covered?

4.3. Data analysis

Twenty-four participants participated in over fourteen hours of recorded focus groups and interviews. The recordings were transcribed using an online transcription software and were verified for accuracy by the research team. The transcripts were then loaded into *Dedoose*, an online qualitative analysis program, for initial open coding. Axial coding was then used to collapse the codes into related themes. Finally, the themes were compared to determine further relationships and ensure that the participant voices were appropriately represented within the results.

4.4. Results

The coding revealed three central themes within the participant responses: (1) Using The Principles as a Guide, (2) Creating a Welcoming and Inclusive Environment, and (3) Focusing on Individual Principles. The following section uses the voices of the participants to explore each of the themes.

4.4.1. Theme 1: Using the principles as a guide

One of the most prevalent themes during the interviews was the participant's discussion on their reliance on The Principles as a guide for their professional and personal lives. Many spoke about how they used The Principles in their classrooms and professional spaces. Ms. Molly, a high school teacher, mentioned that she "found a lot more harmony with all of my students," while Ms. Charming discussed the change she felt with her coworkers.

> Just taking one of The Principles and applying it in my daily work changed another employee's perspective of me as a person. I challenged my coworkers to do the same, to take one of The Principles and use it throughout their day.

Many teachers also shared that they had The Principles posted in their classroom. Usage of The Principles spanned across grade levels, with examples found ranging from pre-k to twelfth grade. In some of the elementary classroom settings, The Principles were used in lieu of classroom rules. Second grade teacher Ms. Ashley explained:

> They [The Principles] are posted on our wall. We talked about them the first couple of weeks. We created motions to go with them. We took one per day and talked about what does this look like in our classroom, in our school...They've signed them. It's been something that I can continually go back to throughout the year again. Before the class created rules with me, but it was so different than these Principles because these are principles that are overarching class rules. The way I know they're working is to watch these students. When I say, 'wait, stop talking, it doesn't look like everyone's listening deeply' they know what that means.

Several of the schools, predominantly those that include elementary grade levels, had schoolwide application of The Principles. For example, a charter k-12 school that had a campus-wide implementation of The Principles, k-12 principal Mrs. Manatee shared that she uses The Principles to model a positive environment for her students.

> I realized that our students are watching every move I make. Am I going to model those Principles? Am I going to be a role model for them? But they're observing. When I was home with my ankle, my injury, a second-grade class made little love notes for me and they wrote, "I love how you do this" or "how you do that?" But one of the students said, "I love how you're careful with everyone that you meet." I was blown away. That was so impactful to me and really brought home that they're watching. Am I following these Principles too?

Unlike content specific strategies, The Principles were also seen across content areas, including electives. In high school, Mr. Artman described how The Principles informed his art classroom management, "You can always use them. You can use them when you are disciplining or when you're disappointed, or when something nice happens you can use The Principles in your praise," Summarizing the impact of The Principles, Dr. Turtle, who has

her high school Spanish class read The Principles aloud in English and in Spanish every day, condensed the general sentiment that, "I think the most important thing are just The Principles. Because if you do nothing but instill the Principles for How We Treat Each Other, you're going to be fine."

Practicing The Principles in the classroom also guided changes in the personal context of the participants. Several of the participants mentioned that The Principles helped them with colleagues outside of the classroom. Dr. Turtle shared that "after the PJI, I feel much more comfortable in the way that I treat my student and my co-workers." Others noted that they use The Principles at home. Mrs. Toni, for example explained,

> The Principles helped me with how I handle my children and deal with conflict at home with my husband. It helps me to stop and reflect and really turn to those Principles and think about what…my kids are feeling, what they've been through when they start acting up or they're whiny or cranky or they're just wanting to argue with me about something.

Another common theme was comparing the use of The Principles and participation in the Teachers Academy to a religious experience. Dr. Turtle expressed, "I love it [PJI]. I love it. So, if they let me, I'm going every year again because it's like in church." Similarly, Mrs. Snickers noted that "I grew up Baptist. It [PJI] was like going to a Revival and you just would come out of there and there'd be so many things to think about and process. I couldn't wait to come home and share it." Finally, Ms. Adria, when discussing The Principles shared, "I want to embody them [The Principles]. I try to introduce them to the people that I most routinely talk to and interact with. Almost like a religion, like come convert to these beautiful things".

4.4.2. Theme 2: Creating a welcoming and inclusive environment

In addition to guiding and informing the classroom interactions, teachers frequently referenced the first Principle as the motivation behind changing their classroom environment and how they facilitated student relationships. The first Principle emphasizes the need for a "hospitable and accountable community" and reads:

> We all arrive in isolation and need the generosity of friendly welcomes. Bring all of yourself to the work in this community. Welcome others to this place and this work and presume that you are welcomed as well. Hospitality is the essence of restoring community (The Principles for How We Treat Each Other).

Teachers who attended the PJI Teachers Academy focused their discussions on transforming their classroom into a community that resembled a family. This change ranged from rearranging the physical layout of the classroom to the way they facilitated classroom relationships.

The easiest change to identify is the physical layout of the classroom. For some teachers, like Ms. Bernice, this included changing how the students were arranged for daily lessons.

> I offered flexible seating, and that was just a way so that kids could find their own little area. I had a table where students could stand, I had a rug and some floor pillows where they can sit, it made them like 'this is my space'.

High school teacher Ms. Tami emphasized the importance of having a rug with oversized cushions, noting that "maybe some of these kids don't have this at home." Others, like Mrs. Butterfly, used furniture to facilitate community explaining that "I have tables that they all sit at; I don't have [individual] desks." Similarly, high school Spanish teacher, Dr. Turtle explained the change in her students following using a group table seating arrangement.

> One of the students was absent during the week, like two or three days, and when she came back, I watched her table. When she got there, the tables are four students, and the other three students turned to her and started telling her, 'ok, here is what you have to do' and 'we did this and that', and I was so happy…I didn't have to ask them to tell her what we were doing.

In addition to rearranging the classroom, several of the teachers offered Peace Corners for their students. Mrs. Bea, a middle school chorus teacher, transformed one of her practice rooms into a peace room. This calming room was open for students to use during the class,

> Nighty percent of the time they came back out, and they were completely different students, and it was nonreactive. It was non-combative, and it was a way for me to show the student that I care that it's okay that we all have those moments.

Outside of the change in environment, the welcoming and hospitable community also came from within the classroom. Mrs. Snickers, an elementary school teacher, highlighted the importance for students to feel a connection to each other. "For the most part my students got along like a family; they would squabble like brothers and sisters, but they stood up for each other." Ms. Adria shared a similar sentiment, "I explain to my class that we are together more than we are with our families, so we have to trust each other and be open and honest. This helps us unite as a class family." Another second-grade teacher, Ms. Ashley, hosted daily classroom meetings to greet the students. "This is an important piece of what I'm building, the accountable and respectful community. And just the other day one of the students said, 'you know, I feel like our class really likes each other'." This idea was repeated in Mrs. Charming's discussion on her classroom that "we really got to hear everybody's voice. The classroom did become like a community, and everybody was a lot more welcoming." The link between the classroom and a family unit was also discussed by Mr. Artman who routinely mentioned the connection to his students. "I got to be the father and the mother and said, 'you guys are like my kids.' I've tried to use that old cliché. 'This is our home, and we have to try to come together. We're like a family.'"

4.4.3. Theme 3: Focusing on individual principles

The third theme found within the conversations related to the use of specific Principles in the classroom. More than just guiding the general classroom, or establishing a welcoming environment, comments in this theme focused on the direct impact of using various Principles to inform interactions among the teachers and students. For example, Ms. Tami, a 10th grade English teacher, used three of The Principles in her explanation:

> I think one of the biggest things that PJI taught me, that works both professionally and personally, is to stop expecting myself from others. You know, when you stop expecting yourself from others, that allows you to kind of tap into that the place of wonder [Principle 10], where you just start asking those open-ended questions [Principle 4], you started just like suspending judgment [Principle 7]. It just all falls into place.

Instead of taking The Principles as an overall guide, Ms. Tami highlighted the ones that she frequently employed. Ms. Adria, a second-grade teacher, explained the power of the 10th Principle in her classroom.

> The Principles ... especially #10, when things get difficult, turn to wonder. I encourage the students to listen and think before they speak. They may not agree with their friend, but their friend may be going through a difficult time, maybe dad had to go out of town, maybe they didn't have breakfast, could be a million different scenarios. Stop and turn to wonder. How can you help your friend? Principle 10 will change everything!

By turning to wonder instead of jumping to conclusions or dismissing the lived experience and opinions of others, these teachers focused on the individuality of their students and those around them. This shift in thinking, from expecting others to behave in a similar way, was emphasized by Mrs. Kay in her description of a tough situation in her class.

> I think the big thing was that I let my students express their feelings instead of coming in with judgment and cutting them off... one day we did have a fight… I really wanted to know why it was happening... calmly I started to ask some open-ended questions, and they were just all amazed that a teacher would care about what's going on behind it [the fight].

This final category, of turning to specific Principles, demonstrated the power of the set of norms in transforming the personal and professional spaces of the PJI Teachers Academy participants.

5. DISCUSSION

While it is apparent from the discussions that The Principles were influential, the conversations also revealed a disruption to the reproduction of inequity in the classroom. One of the more striking examples of this is how The Principles helped to create a classroom where students had a similar sense of cultural capital. By having the students work within a common frame of reference (The Principles), the students were introduced to the set of norms and expectations for the classroom. When the rules were reinforced either by daily reading or monthly emphasis, each student was provided multiple opportunities to understand and work with The Principles. Furthermore, the content of The Principles themselves facilitated a more equitable and welcoming classroom. Through suspending judgement and turning to wonder, students and teachers were invited to question the cultural capital and social capital of others. The combination of having similar social capital within the classroom and the questioning of social/cultural capital from outside of the classroom created a space where the students felt comfortable sharing and learning.

Having a welcoming environment at school provides a sense of stability and community for the students, something that the participants mentioned occurred following their participation with the PJI Teachers Academy. Several of the teachers explicitly stated that their classroom ran smoother, had a calmer atmosphere, and that their students were more likely to engage with the content and with each other. Even more telling of the impact that The Principles had made on the classroom were the comments by students that the teachers chose to share. This implies that when teachers are exposed to social justice and inclusive professional development, implementation has the potential to enact change that extend beyond the teacher, directly impacting the lives of the students.

6. CONCLUSION

The most exciting implication of the qualitative analysis is the magnitude of change that can stem from relatively small initiatives. While schools cannot change a student's economic capital, cultural capital, nor their family's educational background, the changes presented in this study increase the social capital for all students.

One recommendation for future implementation both within the PJI Teachers Academy and in schools worldwide is an emphasis on a common set of norms (in this case The Principles) to provide an equal sense of social capital amount students. Another recommendation would be to ensure that the physical classroom environment provides an engaging and welcoming environment for students. As the classroom becomes increasingly digitized, the classroom itself has the potential to promote a sense of community and agency among students, further increasing the social capital of students.

The PJI Teachers Academy serves as an example for how to disrupt the reproduction of inequity in the classroom in a way that is easily implemented, transferable, and applicable to any school setting. Through the introduction of The Principles within an extensive professional development session, PJI Teachers Academy reaches beyond the participants and into the hearts and minds of those they teach.

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Chapter #23

EDUCATION AND LEADERSHIP AS DRIVERS FOR ECONOMIC GROWTH
The case of Portugal

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ABSTRACT

The competitiveness of nations requires several factors that must occur for it to attain sustained levels of economic development. Some of the most important vectors that constitute differentiators of nations competing globally are the qualification of its population, as well as the degree of sophistication, capacity for decision-making and strategic vision of its leaders and elites. A greater competitive ability of a nation translates into a higher capacity for wealth creation and a better performance on key items of social and human development. Often, small niches of excellence and strong leadership in key sectors are crucial, notably for the example that these examples of excellence signify to others, thus producing a dragging effect whereby other sectors and individuals are pulled in by inspiring role models and their examples. This chapter examines the performance of Portugal from different indexes, providing different perspectives, all related to levels of education and retention of qualified individuals, aiming to assess and evaluate the deep constrains that the country faces at a critical moment. Recommendations are centered around the key idea of a strong emphasis on the acquisition of knowledge as a catalyst for economic development.

Keywords: leadership, human capital, elites, education, knowledge, economic development.

1. THE ROLE OF ELITES IN AN ECONOMY

An economy develops based on its productive capacity where the formal skills of the labour force play a central role. The existence of highly skilled labour is the key to the world's development, progress, and innovation (Labas, Darabos, & Nagy, 2016; Farinha, Ferreira, & Nunes, 2018). Key to leveraging these competencies, however, is the existence of strong leadership, both at the national and corporate levels. As Jones and Olken (2005) have shown, a nation's elite is fundamental to its economic growth. According to the WEF (2010), regarding the leadership pillar and the role of elites, three competitiveness factors have been identified: retention and ability to attract talent and avoid brain drain; management training and the quality of management schools; and availability of highly qualified experts. In 2018, the WEF changed the evaluation framework, with some categories being replaced by more digital-oriented aspects. There are now 2 out of 12 fundamental pillars for this analysis: Pillar 6 - Skills, which evaluates the role of education in the development of skills and competences in the workforce and Pillar 8 - Labour market, which evaluates the role of "flexibility", especially in human resource management and "talent management".

The study of the role of education in the world of work is not recent (eg Raymond, McNabb, & Matthaei, 1993) and has been studied by different authors and in different countries. The education and training of senior management has become an asset for the

economic development of countries (Abosede, 2018) and organizations (Lis, 2021), allowing for sustained economic growth in different sectors of activity (Flores, Xu, & Lu, 2020; Li, 2020; Monteiro, Almeida, Gomes, & Sinval, 2020; Bak, 2018).

The ability to retain and attract talent, to keep the best individuals in the country at the age when they are most productive and can make decisive contributions to the prosperity of a nation are critical factors of national competitiveness (Brown & Lauder, 1996).

A country's ability to prevent brain drain abroad, to train elites who effectively play a critical leadership role in steering the nation's destiny, are determinants of a nation's future economic growth as well as the future well-being of its citizens. According to Miyagiwa (1991), brain drain will boost the income of the destination country and hurt workers with mid-level skills.

In this context, strong leadership and well-prepared and dynamic elites are critical to the future of nations and are the locomotive and force that characterize the world's most competitive economies. This reinforces the imperative need to retain true talent within a nation's borders, given the disproportionate importance of these individuals in building societies and their distinctive contribution to the economic competitiveness of nations (Beine, Docquier, & Rapoport, 2001). Furthermore, the brain drain abroad has the net effect of reinforcing the critical mass and experts of competing economies for the same resources and markets, resulting in a loss of comparative competitive capacity of the national economy in one of the most important factors for the competitiveness of nations: people (Meyer & Brown, 1999).

The world's most competitive nations have in common the ability to attract talent and keep it from leaving their borders, along with a strong investment in the competence of individuals, identifying and enhancing their leadership capabilities (Paulsen, 2001; Kuprina, Baraniuk, & Vaskovska, 2019). The excellence of elites, and their dynamising role in politics, academia, the economy and culture are important drivers of a nation's development (Woolcock, 1998).

Empirical evidence suggests that the existence of true elites, legitimized by criteria of knowledge excellence, and leadership skills, can be important drivers of societies and economic systems (Brown, Hesketh, & Wiliams, 2003). True knowledge elites should assume in this context a critical role for the economic development of nations and for the improvement of the living conditions of society. Dynamic and competent elites, who offer differential contributions of applied knowledge to their respective areas of intervention, from politics to economics, or in any area critical to social construction, play a fundamental role in achieving sustained competitive advantages for the national economy (Grant, 1996).

The Elite Quality Report 2021 argues that elites are a key to provide the capacity to coordinate the resources of an economy, whether human, financial or knowledge-based (Casas & Cozzi, 2020). On the other hand, high quality elites manage management models based on value creation, which are reflected in wealth creation and improvement in the quality of life of societies. Portugal occupies 27th place in this ranking, in the group of countries classified as holding quality elites (3rd group, after very high quality and high-quality elites) (Casas & Cozzi, 2021), with a value creation index of 57.3 in contrast to the 14th place held in 2020 (value creation index of 58) (Casas & Cozzi, 2020).

2. THE IMPORTANCE OF ATTRACTING AND RETAINING TALENT FOR ECONOMIC DEVELOPMENT

As Schumpeter (1942) noted, innovation is the engine of economic growth and development and is generated by competition between firms that constantly seek an innovation path to confront competitors.

Thus, the ability of a nation to retain and attract talent is a driver for an innovation spiral and one of the most important factors for the competitiveness of contemporary economies. The training of individuals and the excellence of educational systems that trains them, as well as the universal access of citizens to education are critical factors in the competitiveness of nations (Nelson & Phelps, 1966; Keller, & Meaney, 2017). The world's most competitive nations have uniquely talented pools, very strong academic elites, which emanate from rigorous and demanding educational systems (Caballero & Jaffe, 1993; Wallace, Lings, Cameron, & Sheldon, 2014).

The academic elite provides the individuals who attend it to contribute in unique ways to change not only their surrounding realities but even the world. Many of them are important players in their countries of origin, and in their respective areas of intervention have made enormous contributions to building their societies of origin, in many cases being catalysts for authentic paradigm shifts in their worlds (Benhabib & Spiegel, 1994).

In both cases, what underlies the formation of these elites is the access of these individuals to excellent teaching, to the state of the art of knowledge, under the best teaching conditions. However, there is a dimension of networking which is crucial in the formation and spirit of these elites, and which is sometimes more important than the curricular merits or excellence of the programs and lecturers who deliver them (Hale & Moorman, 2003).

This type of atmosphere constitutes beyond the constant intellectual challenges it raises and the cultural and academic heterogeneity that allows a vast incorporation of knowledge and experience, an important credibility capital, of trust that is transmitted to the individual by teachers and students in a systematic and secure way and that, sooner or later, finds expression in the individual's intervention in his world (Gurin, Dey, Hurtado, & Gurin, 2002; Alves, Dieguez, & Conceição, 2019). Often, this halo ends up excusing some failures that happen in these institutions, which like others have their weaknesses, but the reputation capital that they incorporate allows a little like what happens in the context of the phenomenon of product and company brand reputation, to somehow float above these failures.

In the WEF ranking (2018), Portugal ranks 64th in attracting talent and 62nd in retaining talent, which is a mediocre performance and a drop from the 52nd position it occupied in 2008. Many recent graduates, as well as future Portuguese graduates, end up leaving the country in search of job opportunities outside Portugal. This aspect becomes even more important when we observe that in the most competitive countries, with greater capacity for economic growth and development, this criterion is fundamental, occupying the top positions and with attempts to improve for those with less appealing positions. As an example, analysing the first three places of competitiveness of nations, Switzerland ranks first in terms of competitiveness, coinciding with an identical position in the capacity to attract and retain individuals. Another example is Singapore, which ranks fourth in terms of attractiveness and fifth in the retention of highly qualified individuals, a trend that accompanies the global competitiveness ranking where it ranks third. Finally, the USA which ranks second in terms of competitiveness, is ranked third in retention and 5th in attracting talent (WEF, 2008-2018).

With the ageing of the Portuguese population, the question that arises is how to reconcile a reduction in the active population, via emigration, of this magnitude, with the social costs resulting from a non-active population dependent on it for survival (Bongaarts, 2004). It is not only about the reduction of the active population, but what kind of active population we are talking about, since we are talking about the most qualified, with greater knowledge and education, younger and with a longer working life ahead.

The ageing of the world population in developed economies, as is the case with Portugal, besides reflecting the generalized advances in medicine, also reflects the achievements of the health system in recent decades and its evident impact on the increased life expectancy of individuals, as well as the general improvement in their quality of life. All this has been very positive and constitutes a strong civilizational advance of the countries (Pardes et al., 1999).

The low birth rates in Portugal, in line with what happens worldwide in more developed countries, stem from different generational approaches, but mainly reflect a collective perception of extreme insecurity regarding the future, a present characterized by strong economic instability and unpredictability in the lives of individuals, together with the sociocultural changes that have occurred. This characterization of current daily life shows that important references in the life of individuals are seriously questioned and, in the face of ambiguity and uncertainty, significant reductions in the birth rate and the gradual but certain ageing of the world population persist (Cohen, 2003). As Cohen (2003) states, in 2050, population growth in world terms is expected to be between 2 and 4 billion individuals, a slower growth and ageing of the population compared to the last century and a greater decline in the more developed regions.

Thus, with the observation of the nation's inability to retain its best talent, to attract talent from abroad and with the ageing of the population, the empirical evidence is not ambiguous regarding Portugal's prospects if these issues are not confronted, in line with what is happening in the European Union (Giannakouris, 2008). The only possible path is the creation of wealth, which can compensate adverse demographic trends, as well as the formulation and implementation of social policies, which objectively counteract the direction of demography, which moves indelibly towards a progressive and accentuated aging of the population (Van de Kaa, 1987).

The flight of the best, most competent and youngest people is evidence of the ineffectiveness or non-existence of employment policy solutions aimed at economic growth (Mahroum, 2005). Occasionally and in isolation, there are occasional and localized social policy measures to settle individuals in communities through financial incentives, but nothing systematized, of strategic scope and national scope.

Retaining talent is critical for a nation's economy. The brain drain to other countries causes a terrible vacuum for a nation, as it means the dilapidation of talent in critical areas of societies' lives. In addition to the waste of strong investments made in the education and training of its best individuals, their departure occurs precisely at the time when they could best contribute to the construction of the country, constituting something deeply disappointing and discouraging. Individuals, on the other hand, feeling that they do not have opportunities in the country to express their talent, knowledge, and creativity, rightfully seek those same opportunities elsewhere (Meyer, 2001; Thibault Landry, Schweyer, & Whillans, 2017).

If Portugal continues to witness the definitive exit of its best assets, this will have incalculable consequences for the future of the Portuguese economy, because it also implies the exit of individuals who can cause the paradigmatic cleavage that is fundamental in the areas of innovation, and applied knowledge, which are essential conditions for the

construction of a new model of national competitiveness, based on excellence in performance leading to sustained economic growth. The paradigmatic leaps in these areas are an imperative for national competitiveness and for the viability of the future of the Portuguese economy, given the challenges of global competitiveness that it will have to face. If it does not do so successfully, there will be hardly any economic growth.

The definitive departure of individuals abroad, also seems to be a scenario that best characterises the current exodus and which represents a fundamental deviation in relation to historical migratory phenomena, some relatively recent, occurred in Europe (Galgóczi & Leschke, 2012). This happens because many of these individuals will have no intention of returning, faced with a country that has harassed them and previous generations that have irrevocably compromised their future (Delicado, 2008).

Another reason why many of these individuals will not return is precisely the same motivation that made them leave, i.e., the country will not recover soon, since the nature of the problems is systemic, behavioral and, above all, slow to be solved, since the vocation and will to reform are non-existent, the obstacles are many, and so is external dependence, making decision-making autonomy in any strategic matter virtually non-existent. Furthermore, the fundamental reforms have not yet started, and they are not only structural reforms in the labor and goods and services markets. They are about reforms towards a more sophisticated business environment, towards characterizing the economy as innovative and centered on fundamental and applied knowledge (Nicholls, 2013). In particular, the sophistication of the business environment is characterized by a very important behavioral dimension, which includes variables such as the orientation of companies towards customers, the constant concern with the concept of value addition, the effective use of marketing tools, etc. (Kotler & Armstrong, 2010).

This happens not only in technocracy, but also in the crucial understanding of the sciences of Management and Economics, and the role they have in enhancing knowledge tending to an effective control of the links in international value chains where value is concentrated in the main chains. Individuals trained to have these competences understand exactly what the requirements and capabilities inherent to occupying prominent positions along these value chains are, namely what is needed to progress downstream in them, with high-profile brands and enormous value-added content.

Without sustained GDP growth, citizens' levels of social and human development, expressed in the universality of access to health, education, and the welfare state as we know it today, cannot and will not be guaranteed (Meier & Werding, 2010). The future provision of public goods without a decrease in quality and comprehensiveness, given current demographics and adverse trends, can only be guaranteed by an (unlikely) economic growth of the nation, which is difficult to envisage with current indicators. Added to this are the economic discrepancies existing in the country, with an ageing and impoverished interior and a more developed coastline, where there is a greater concentration of income. This situation creates an economy with different stages of development that must coexist (Spaventa, 2013).

In addition to the emptying of the fundamental and applied knowledge content, which constitutes the brain drain abroad, the greater cosmopolitanism and sophistication, which characterizes the best of this generation, could contribute to the sedimentation of a culture of demand among the stakeholders of the national economy (Hall & Vredenburg, 2012). Among other economic agents, more cosmopolitan consumers can trigger a profound transformation in the business environment, a purging of consumption criteria towards a focus on aesthetic demand and hedonism. This embodies a brand identity culture, which is

the ideal counterpoint to the sterility of function and price of basic tradable goods, which characterizes the pale national business and consumer environment.

The departure of younger individuals, who despite the serious problems of education in Portugal, constitute the generation with the highest level of education ever and specific training unparalleled in the history of Portuguese society, also translates a surgical reduction of talent, which prevents the construction of critical mass, in the areas of innovation and fundamental and applied knowledge, critical for national competitiveness (Di Maria & Lazarova, 2012).

These are the key elements of the modern competitiveness of nations and the loss of individuals who can best and know how to interpret the requirements for growth in contemporary economies is something dramatic for a nation. This is particularly true when these individuals are lost to competing economies with the Portuguese economy, which compete for the same markets and consumers, and which operate in many cases in the same sectors of economic activity.

3. COMPETITIVENESS THROUGH BUSINESS SCHOOLS

Higher education assumes a critical role in the growth of local, regional or national competitiveness (Lane, 2012; Chentukov, Omelchenko, Zakharova, & Nikolenko, 2021). Management education is one of the important predictors of the competitiveness of nations, i.e., there is a strong clustering of nations with excellent performances in the quality of their Business Schools, which consistently appear at the top of global competitiveness rankings (Sabadie & Johansen, 2010). Nations with excellent Business Schools are usually the most competitive in the world. This association between management training variables and the competitiveness of nations does not imply a causal relationship, but it is an important one. What it does show is that the quality of management education in an economy is correlated with the nation's competitiveness and its economic performance.

In this context, the quality of business schools is associated with better performance of the economy in the pillars of innovation and sophistication of the business environment, greater linkage between academia and business (Hewitt-Dundas, 2013). These developments translate into greater consumer competence and demand, as well as the overemphasis of the crucial role played by marketing in modern competitiveness. Management education contributes to a better performance of the economy in these critical factors of competitiveness and enables a better understanding of the vital importance of the need to control value chains in the globalized context of contemporary economies and enables economic growth (Hanushek & Woessmann, 2012; Máté & Darabos 2017).

In the Financial Times ranking of the 100 best business schools in the world in 2021, Portugal has four schools. The best ranked school is in 23rd position and the fourth school is in 98th position. Since 2007, the year in which for the first time a Portuguese school achieved a position in this ranking, much has changed in education in Portugal. More than just numbers, the rankings in business schools are important because they lead to the optimisation of resources, leading schools to improve conditions and to compete, while collaborating with each other. This healthy rivalry between institutions boosts the quality of teaching and, ultimately, the quality of managers and future leaders.

In this sense, rankings are much more than mere numbers. We should look at rankings as significant drivers of a country`s reputation. A good performance of a country is indicative of the quality of its leaders. Business education rankings have been long criticized, in particular the methodology used (Jack, 2021). However, there is a societal

impact, although it is difficult to measure. But it is unquestionable that positive rankings improve quality, and improved quality provides better future leaders.

In 2018, Portugal occupied the 31st position (WEF, 2018) regarding the quality ranking of its business schools. Although distant from the most competitive economies, it should be noted that in 2008, Portugal occupied the 38th place, having been trying to improve its performance in this variable. The recent performance of some Business Schools in Portugal regarding some programs should be imitated and generalized to the different MBA, master's and doctoral programs. Excellence in performance in Full-Time MBA programs, but also in PhD programs, constitute the universally accepted barometer of Business School quality and, given the importance of the quality of management education as a factor significantly associated with the competitiveness of nations, the role of management education and the quality of institutions in modern economies should be emphasized.

4. ENGLISH PROFICIENCY AND COMPETITIVENESS

Another important ranking for the competitiveness of a country through education is the EF English Proficiency Index (EF EPI, 2020), which intends to measure English skills. The index comprises 2,2 million nonnatives speakers in English. English proficiency is often regarded as a competitive advantage, not only for students, but also for managers and countries. In today´s world, the English language represents a powerful network effect: it brings people together and facilitates the dissemination of new ideas. In 2020 Portugal reached the 7th place in this ranking, after having achieved for the first time, a place within the *high proficiency* group in 2019, with the 12th position.

There is a strong correlation between English proficiency and the Global Talent Competitiveness Index, a report that assesses a country´s ability to attract, develop and retain skilled workers. The index includes essential skills like market attractiveness, global growth skills, professional and technical competence, global knowledge, and retention rate. Portugal integrates the group of countries with the best talent index in the world. In the general ranking, which includes 132 countries, Portugal reached the 28th position. Some of the most important findings of the EF EPI 2020 Report is that English proficiency correlates with innovation and produces changemakers. English skills help countries stay competitive and make way to economic growth.

5. THE NEES FOR APPLIED KNOWLEDGE FOR ECONOMIC DEVELOPMENT

The current paper has been emphasizing the importance of labour factor development and sophistication in building foundations for sustained economic development and growth (Acs, Estrin, Mickiewicz, & Szerb, 2018; Bosma, Sanders, & Stam, 2018). This development can be done by upskilling existing human resources or attracting highly skilled resources. Another key aspect is maintaining a strong and consistent pool of scientists and engineers in the economy.

But what does an economy gain from having many scientists and engineers? In a context of intense competition among nations, in capital-intensive economies, and with strong requirements for fundamental and applied knowledge in areas of engineering and technological knowledge, the quantity and quality of scientists and engineers available in an economy is an important indicator of its competitive capacity (Hunter, Oswald, & Charlton, 2009). The study by Ioannidis (2004) shows that regardless of the degree of economic

development of the country under analysis, the emigration of scientists reduces the development potential of knowledge areas, because the migratory trend will perpetuate.

An economy characterized by capital-intensive productive sectors gains from having many qualified engineers, scientists, and experts, as they can transform fundamental knowledge into applied knowledge, innovating productive processes and, in the best examples, even revoking the technological paradigm and the incumbent business model in important sectors of economic activity (Eraut, 2009).

Portugal's position in the WEF ranking, regarding the availability of highly qualified scientists, engineers and experts in scientific areas is 52nd in 2018, below the globally more competitive economies that occupy the top places in this ranking (Finland or USA), having even worsened in the ranking since 2008 (it occupied the 48th position). However, since there is a correlation between the competitiveness of nations and the availability of qualified professionals in the economy, the key is to optimise the use of these specialised resources by the industrial and business sectors so that the national economy increases the levels of efficiency resulting from these added values.

If the Portuguese economy is only viable according to a model of competitiveness based on capital-intensive sectors, then the availability of highly qualified scientists, engineers, and experts, who can best meet the knowledge requirements that this type of model imposes, is by definition a critical imperative for the competitiveness of the national economy.

In view of this, aspiring to compete with knowledge economies without making the necessary investments in the areas of innovation and without taking advantage of the best brains in engineering and science is a contradiction in terms, which cannot lead to good results. The proliferation of scientists and engineers in an economy can never translate the idea of a qualified unemployment problem. In the framework of the challenges faced by the Portuguese economy, the country cannot waste the use of its specialized human resources. In fact, the diagnosis presents a single possible way out of the current situation: incorporation of the most educated and sophisticated resources into the economy, with the aim of creating activity sectors with goods and services with increased value, resulting in the creation of wealth, the only way to sustained economic growth.

6. CONCLUSIONS

The inability to absorb extremely well qualified individuals in critical areas for the economic growth of nations translates into a serious problem of dangerous strategic bias in the path of the economy, with high costs today and in the future. A brain drains to abroad and the waste of investment made in the training of individuals, who will later be taken advantage of by competing nations, constitutes the genesis of the inability to compete on an equal footing in the global economy. It has underlying it a negative mechanism of self-reinforcement of the economy's (in)competitive capacity and will certainly translate downstream into unsustainability of the social state and a drastic reduction of the nation's performance in an important set of social and human development indicators.

The brain drains from a country such as Portugal is extremely harmful for a nation of limited resources, and represents a terrible perpetuation of its dependence on the exterior, which can only be reversed through a substantial improvement in the nation's competitive capacity and in the command of its own destinies. If this situation is not changed, the brain drain from the country will translate in a short space of time into losses of competitiveness and not the desired gains, which occurred in the first two decades of the millennium, according to WEF reports (from 22nd in 2000, to a 34th in 2019).

More than that, if this brain drain materializes in a systematic and continued way, with the most capable individuals leaving the country, then one can expect even more abrupt drops than those that occurred in the last decade, of Portugal in the competitiveness ranking of nations. It will not be too much to repeat that this will inevitably translate into sharp drops in the social and human development indicators of the Portuguese.

Unfortunately, the brain drain item does not give grounds for optimism, since there is no specific concern with retaining the best people. Sometimes the opposite even happens, with the recent institutional stimulus by the decision-maker to the emigration of the youngest. Nor does there seem to be a specific concern with retaining them in the country, translated into concrete employment programs, aimed in particular at individuals who fit this profile.

The existence of more and better engineers and scientists in an economy is, in the abstract, a positive contribution to its greater competitiveness, because it has a direct impact on an economy's capacity for innovation. However, the relationship between the number of qualified engineers, scientists and experts in an economy and its innovative capacity depends on other factors, which may enhance, or alternatively mitigate, the positive effects of the availability of many engineers and scientists in the economy.

In conclusion, to increase the competitiveness of nations, which sustains economic growth, it is fundamental that economies base their economic development model on sophisticated technology, knowledge, and qualified human resources. These will be the pillars for a developed economy struggling for sophisticated markets and demanding consumers, but with high purchasing power, where the potential for value creation, brands and reputation will be substantially higher, formatting the economy for a spiral of sustainable growth.

Finally, the analysis carried out will be conditioned soon by the effects of the pandemic. The pandemic had relevant but still unpredictable impacts on education with the use of distance learning as a tool to overcome confinement. This period of adaptation to an unpredictable reality generated different adjustment processes and clearly accentuated asymmetries between the learning of different social realities.

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Chapter #24

THE PERCEPTION OF EMPLOYEES IN THE CONSTRUCTION OF UNIVERSITY BRAND: SPANISH CONTEXT CASE STUDY

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ABSTRACT
This research was carried out to examine the role of brand capital in higher education. For this purpose, the main contributions of the literature to the study of brand capital and its application to the education sector were analyzed. Then, the variables determining brand capital in the higher education sector were identified and a comparison between the main employees was made. Once the educational brand capital construct was established, an empirical study was carried out using a valid sample of 1,106 responses (690 from lecturers and 416 from service staff, belonging to eight public and private universities in Valencia (Spain). SPSS v.19 for Windows and EQS 6.2 were used as statistical work tools. The present investigation fills a gap in the marketing discipline because it is considered that there are no current investigations that analyze the perception of the brand capital through the opinions of the main employees involved in Spanish universities. The results obtained show the effects of each variable of brand capital in relation to the determining variables and, especially, to brand awareness, thus, helping the university managers to decipher the key aspects for their employees and thereby generate strategies to maintain them or improve them.

Keywords: marketing, brand capital, higher education, university employees, structural equation modeling, Spain.

1. INTRODUCTION

Globalization and free trade have meant that public universities have lost growth in recent times, in terms of enrollment of new students and attraction of talent. This implies an increase in the same parameters within the private university environment (Salgado & González, 2015). In the Spanish environment, according to the 2020 report developed by the Ministry of Science, Innovation and Universities, there are currently around 50 public universities and 37 private ones. Thus, Retamosa (2018) highlights the need to build an education brand, seeking to differentiate itself from aggressive competition and cover a greater share of the student market. Within this marketing strategy, one must aim at maximizing brand capital, defined as an individual relationship and the experience of each consumer with the brand, although universal guidelines and behaviors can be generalized (Casanoves, 2019). University agents become a fundamental part of the process, and they must be considered as professionals but also as people (Zabalza, 2016). In other words, the aim is to generate a feeling of love for the brand by the groups involved and thereby improve

the sales figure (Esteban, Ballester, & Muñoz, 2014). The present research has selected the two that are considered to be most linked to the inside functioning of the university, lecturers and service staff.

In the scenario described, the objectives of this research are based on (1) analyzing at an empirical level which variables of brand capital are most relevant in the Spanish higher education environment, (2) deciphering what the most significant variables are by university agents involved internally (lecturers and service staff) and (3) comparing their perceptions in order to decipher whether there are significant differences.

2. THEORETICAL FRAMEWORK

After reviewing the seven most relevant proposals on brand capital found in the literature (Farquhar, 1989; Aaker, 1992; Keller, 1993; Faircloth, Capella, & Alford, 2001; Yoo & Donthu, 2001; Delgado & Munuera, 2002; Buil, Martínez, & De Chernatony , 2010), four elements shared by the authors have been considered: (1) brand awareness, (2) brand image, (3) perceived brand quality and (4) brand loyalty. Following this line, and applying it to the context of this research, the Spanish higher education sector, the hypotheses are detailed below.

2.1. Brand awareness
In the field of higher education, Foroudi, Dinnie, Kitchen, Melewar, and Foroudi (2017) argue that university brand awareness will increase as brand elements such as identity, service attributes or public relations are maximized. Rachmadhani, Handayani, Wibowo, Purwaningsih, and Suliantoro (2018) detail that the knowledge that students have about the university, amongst other factors, can tip the balance to choose to study in the public or private sphere in Indonesia. Noor, Manan, and Kuthoos (2019) highlight that, amongst other dimensions, brand awareness has a positive relevance with respect to the corporate brand value of Malaysian public universities, so it is importante to be taken into account by educational managers. Finally, Sagynbekova, Ince, Ogunmokun, Olaoke, and Ukeje (2021) argue that brand awareness has often been achieved within the higher education context through promotion and word of mouth (WOM), indicating in their study that electronic word of mouth acts as a mediator of the relationship between social media communication and higher education brand equity.

In view of the above, it is possible to propose the first research hypothesis: H1. The perception of brand awareness influences the perception of the brand capital of internal agents involved in higher education.

2.2. Brand image
In the field of higher education, Mirzaei, Siuki, Gray, and Johnson (2016) evaluate the associations with succesful and unsuccesful university brands, highlighting that a better university image can be generated through communications from the most distinguished associations to the students themselves. Rauschnabel, Krey, Babin, and Ivens (2016) state that in the face of the aggressive increase in competition, universities must aim at generating a solid brand position, based, above all, on its personality and image. Yuan, Liu, Luo, and Yen (2016) consider that marketing activities and the transfer of resources improve the reciprocal influence of the image of a university and its brand extensions. Ruiz, Forcada, and Zorrilla (2019) argue that the affective image, perceptions of teaching resources and the training of graduates influence the formation of the university image among different groups

involved (society, potential students, current students, graduates, alumni and companies). These findings are of great value to generate marketing strategies that project a favorable image to various audiences. Finally, Alcaide, O'Sullivan, and Chapleo (2021) argue that brand image is crucial for every university, and it is important to prioritize communication with students through the institutional website in countries such as England and Portugal, as well as placing more emphasis on topics like ethics and social responsibility for Spanish students.

In view of the above, it is possible to propose the second research hypothesis: H2. The perception of brand image influences the perception of the brand capital of internal agents involved in higher education.

2.3. Perceived quality

In the field of higher education, Pinar, Trapp, Girard, and Boyt (2014) show that perceived quality is the most important variable to take into account in building powerful university brands, followed by brand reputation and the emotional environment. The library is the most determining service, followed by student residences, professional development and facilities. Ali, Zhou, Hussain, Nair, and Ragavan (2016) exhibits five dimensions related to the perceived quality of the educational service, which influence the institutional image and, at the same time, maximize student loyalty with respect to universities in Malaysia. Lomer, Papatsiba, and Naidoo (2018) argue that by connecting particular images of the nation with those of future international students and the higher education sector, together with the combination of brand promises, the perceived quality of the national university brand in the United Kingdom can be improved. Finally, Perera, Nayak, and Van Nguyen (2020) indicate that, among other factors, perceived brand credibility has a significant effect on the value of the university brand by Vietnamese students and they provide strategies to improve the higher education sector, taking into account the perceived quality of the brand.

In view of the above, it is possible to propose the third research hypothesis: H3. The perception of perceived quality influences the perception of the brand capital of internal agents involved in higher education.

2.4. Brand loyalty

In the field of higher education, Schlesinger, Cervera, and Calderón (2014) argue that trust affects the perceived value and loyalty levels of students and this, in turn, improves the capital value of a university. Kaushal & Ali (2019) state that brand reputation has direct and indirect effects on students at various universities in India, highlighting that age, seniority, provision of financial assistance in the form of scholarships are the most influential elements. And, Rodríguez, Román, and Zúñiga (2019) emphasize the importance of maximizing the identification of interest groups with the university, through distinctive and differentiating features that thereby improve loyalty towards the university itself. Finally, Rasoolimanesh, Tan, Nejati, and Shafaei (2021) argue that corporate social responsibility (CSR) has a direct and positive effect on brand reputation, brand trust, and brand loyalty in the context of higher education.

In view of what has been stated in previous lines, it is possible to propose the fourth research hypothesis, H4: The perception of brand loyalty influences the perception of the brand capital of internal agents involved in higher education.

In conclusion, Figure 1 shows our proposed theoretical model designed to support the present investigation.

Figure 1.
Theoretical model proposed for the present research.
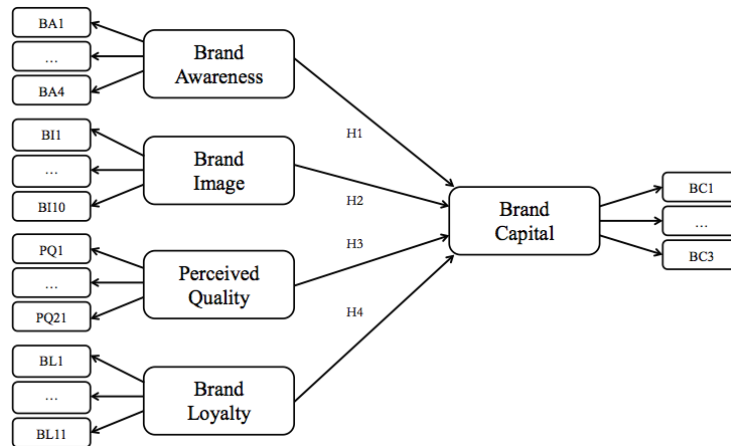
3. METHODOLOGY

To test the contrast of the hypotheses and meet the proposed objectives, a quantitative study was carried out in Valencia (Spain). This region was chosen because it is considered to be perceived by the student population as a large educational venue thanks to the establishment in recent years of eight higher educational centers (both universities and affiliated centers), which have projected the image of the city at national level.

To quantify the target population, a non-probabilistic convenience sampling was used, using official data from two public higher education institutions (University of Valencia and Polytechnic University of Valencia) and six private ones (Catholic University of Valencia, CEU Cardenal Herrera University, European University of Valencia, ESIC Business & Marketing School, EDEM Business School and Florida Universitaria). Thus, it was found that a total of 13,786 university agents were involved, of which 9,735 are lecturing staff and 4,051 are administration and services staff; all of them employees from one of the eight universities studied at the time of the research.

The information was collected through a questionnaire in digital format (using SurveyMonkey) and on paper distributed to a total of 431 service staff (262 from the public sphere and 169 from the private sector) and 698 lecturing staff and researchers (353 from the public sphere and 345 private). After collecting and tidying up the information, a total of 1,106 valid surveys were obtained.

The sample data includes a mixed group of men (47%) and women (45.93%) from public (54.16%) and private (45.84%) universities, of 42 years of average age and with responses from 15 different nationalities, with Spain being the country with the highest number (90%). 62.39% of the sample emerges from lecturing staff and 37.61% from service staff. It should also be noted that, of the service staff, 18.63% had university studies, followed by 10.13% with a *baccalaureate* or vocational training. With respect to the service staff, it should also be noted that 30.29% have obtained the title of Doctor, followed by 24.50% with completed university studies. With regard to seniority, about 58% of lecturing staff and 54% of responses from service staff have been employed for more than 10 years and with a full-time employment contract. Thus, it is considered that the responses received by the majority of respondents are of quality, since they come from university agents with good

knowledge of the operation and know-how of their university. Finally, it is worth highlighting the high participation obtained and the low percentage of respondents who have omitted to answer any of the socio-demographic and classification data questions (7.05%).

Grade 5 Likert scales (1 = Totally disagree and 5 = Totally agree) were used to measure the concepts of (1) brand awareness, (2) brand image, (3) perceived brand quality, (4) brand loyalty and (5) brand capital. All of them were based on the measurement scales proposed by Aaker (1992) and Keller (1993) and selected for having an attitudinal approach similar to that of this work, as well as for having been validated and used in multiple investigations throughout the literature. Following this line, and according to Casanoves, Pinazo, and Flores (2020), the corresponding items have been adapted to our field of study, the higher education sector.

Finally, the techniques for data analysis are based on descriptive statistics and multivariate analysis, using the SPSS v.19 for Windows for descriptive data techniques and EQS 6.2 for executing multivariate techniques. The statistical processing of the data followed in this study involves the application of different analysis methods depending on the information obtained, distinguishing between: (1) description and classification of the data, (2) hypothesis testing and (3) analysis of variance.

4. RESULTS

First, the psychometric characteristics of the measurement instrument were analyzed. To do this, the information was divided into (1) an analysis of the quality of the items and (2) the validation of the scales, which is shown in Table 1. Prior to that, it should be noted that the sampling error was calculated by total of 13,786 university agents involved, obtaining an error of 1% for a confidence level of 99% (estimating the maximum error made in estimating the proportions p = q = 1%).

Table 1.
Reliability and convergent validity.

Factor	Indicator	Load	t Robust	CA	CR	AVE
Brand Awareness	BA1	0.5**	15.7			
	BA2	0.8***	27.2	0.9	0.8	0.6
	BA3	0.8***	27.3			
	BA4	0.8***	30.0			
Brand Image	BI1	0.8***	21.0			
	BI2	0.8***	21.7			
	BI3	0.9***	27.3			
	BI4	0.8***	27.7			
	BI5	0.7***	17.5	0.9	0.9	0.6
	BI6	0.8***	26.5			
	BI7	0.8***	24.5			
	BI8	0.8***	23.1			
	BI9	0.7***	25.6			
	BI10	0.8***	23.6			
Perceived Quality	PQ1	0.8***	25.5	0.9	1.0	0.7
	PQ2	0.7***	26.1			

	PQ3	0.9***	31.0			
	PQ4	0.9***	31.4			
	PQ5	0.8***	27.7			
	PQ6	0.8***	27.3			
	PQ7	0.8***	27.7			
	PQ8	0.8***	29.3			
	PQ9	0.7***	27.2			
	PQ10	0.8***	28.0			
	PQ11	0.8***	26.7			
	PQ12	0.8***	30.6			
	PQ13	0.9***	28.6			
	PQ14	0.8***	30.7			
	PQ15	0.8***	33.0			
	PQ16	0.8***	30.0			
	PQ17	0.8***	33.2			
	PQ18	0.8***	30.4			
	PQ19	0.7***	24.3			
	PQ20	0.9***	29.7			
	PQ21	0.9***	26.6			
	BL1	0.9***	30.8			
	BL2	0,9***	31.0			
	BL3	0.9***	33.7			
	BL4	0.9***	33.6			
	BL5	0.9***	36.3			
Brand Loyalty	BL6	0.8***	28.5	0.9	1.0	0.8
	BL7	0.9***	33.9			
	BL8	0.8***	25.7			
	BL9	0.9***	32.1			
	BL10	0.9***	30.3			
	BL11	0.8***	27.1			
Brand Capital	BC1	0.7***	17.1			
	BC2	0.9***	30.3	0.8	0.8	0.6
	BC3	0.8***	21.5			

N = 1,106; ***p<0.01; **p<0.05; * p<0.1; Satorra-Bentler χ^2 (p) = 7,053.97 (0.0000), df= 1,264

CFI = 0.8; NFI= 0.8; NNFI= 0.8; IFI= 0.8; RMSEA = 0.07

Reliability was verified using three analysis methods: (1) Cronbach's (CA) obtaining, in all cases, values greater than 0.7 (Nunnally & Bernstein, 1994); (2) the analysis of compound reliability (CR), also obtaining values higher than 0.7 (Carmines & Zeller, 1979) and (3) analysis of the average extracted variance (AVE), highlighting that the validity of the

factors is considered acceptable, obtaining in all cases results greater than 0.5 (Fornell & Larcker, 1981). Parallel to this, it should be noted that the elimination of 3 items of the initial 52 items (one pertaining to brand awareness, one to brand image and one to brand capital) was provided as a result, mainly due to their low factor load (Bagozzi & Yi, 1988). Despite this, it should be emphasized that no factor had to be eliminated, maintaining the initial structure of the proposed construct. For its part, the RMSEA = 0.07 indicator also presents an acceptable fit, its value being between 0.05 and 0.08 (Browne & Cudeck, 1993) and suggesting that the structural model fits well with the data structure. Although it should be noted that the adjustment indexes of the model (NFI = 0.8; NNFI = 0.8; CFI = 0.8; IFI = 0.8) presented lower values than those recommended by Hair, Black, Babin, Anderson, and Tatham (2005), which should be 0.9. This indicates that the results should be interpreted with caution, since these indexes are not excellent.

Second, and using a structural equation model based on the robust maximum likelihood method, the hypothesis test was carried out, as shown in Table 2.

Table 2.
Hypothesis test.

Hipothesis	Structural Relationship	β Estand.	t Robust	Criterion
H1	Brand Awareness Perception --> Brand Capital Perception	0.7***	3.6	Accepted
H2	Brand Image Perception --> Brand Capital Perception	0.1***	5.1	Accepted
H3	Perceived Quality Perception --> Brand Capital Perception	0.5***	9.9	Accepted
H4	Brand Loyalty Perception --> Brand Capital Perception	0.3***	8.1	Accepted

N = 1,106; ***p<0.01; **p<0.05; * p<0.1; Satorra-Bentler χ (p) = 7,053.97 (0.0000), df= 1,264

CFI = 0.8; NFI= 0.8; NNFI= 0.8; IFI= 0.8; RMSEA = 0.07

As can be seen, the results suggest that the model designed in this research applied to lecturing staff and service staff is satisfactory to explain the 4 hypotheses raised. Thus, a positive relationship was demonstrated between the perceptions of brand notoriety, brand image, perceived brand quality and brand loyalty with respect to brand capital, accepting the first hypothesis (H1: β = 0.68; p <0 , 01), the second hypothesis (H2: β = 0.14; p <0.01), the third hypothesis (H3: β = 0.52; p <0.01) and the fourth hypothesis (H4: β = 0.33; p <0.01). In other words, a favorable perception towards brand capital will be consolidated as positive perceptions are built towards each of the four variables of the education brand by the 1,106 employees surveyed.

Specifically, it is noted that the most significant variable in the construction of brand capital is brand awareness. In other words, if internal agents have good brand awareness and are willing to recommend their University courses, the brand capital of the same will be consolidated in a more significant way. This result that brand awareness stands out as a pillar of the construction of brand capital is in line with previous research (Foroudi et al., 2017; Rachmadhani et al., 2018; Sagynbekova et al., 2021), which reiterates that such variable is a key element in the perception of education brand capital.

Third and last, an analysis of variance was carried out for each of the variables of the proposed model, in order to extract the arithmetic mean by response and type of university (public and private) and to compare perceptions of brand capital, as shown in Table 3.

Table 3.
Analysis of variance with respect to the type of university.

Factor	Internal Agents Public University	Internal Agents Private University	F	P Value
Brand Awareness	3.86	4.03	2.53	0.00***
Brand Image	3.49	3.74	0.00	0.00***
Perceived Quality	3.11	3.51	0.00	0.00***
Brand Loyalty	3.36	3.78	0.81	0.00***

***$p<0.01$; **$p<0.05$; *$p<0.1$

As can be seen, and based on the grade 5 Likert scale chosen, the results suggest that the perceptions of the private sphere are higher in all variables with respect to those in the public sphere. And, with regard to brand awareness (the most significant variable in the construction of brand capital), the important difference between one and the other is also appreciated (4.03 in the private sphere compared to 3.86 in the public sphere).

5. CONCLUSIONS

The proposed global model demonstrated a positive and direct relationship between the four variables described and the brand capital with respect to internal empoyees, thus supporting other research on brand awareness (Foroudi et al., 2017; Rachmadhani et al., 2018; Sagynbekova et al., 2021), brand image (Mirzaei et al., 2016; Rauschnabel et al., 2016; Yuan, et al., 2016; Ruiz et al., 2019; Alcaide et al., 2021), perceived quality (Pinar et al., 2014; Ali et al., 2016; Lomer et al., 2018; Perera et al., 2020) and brand loyalty (Schlesinger et al., 2014; Kaushal & Ali, 2019; Rodríguez et al., 2019; Rasoolimanesh et. al., 2021).

With this, four managerial implications arise. Firstly, brand awareness stands out as the most important variable for employees with respect to brand capital. Thus, the results show that universities have generated high brand awareness thanks to the good opinions and interesting recommendations given by the employees, in case they decided to carry out other

studies at their University. And, together with this, differences in perception are observed between both types of higher educational institutions, highlighting that there is a better opinion about the university and that of postgraduate studies at the private level, whereas doctoral studies are preferred at the public level. On the other hand, the degree of knowledge of the university and the preferences for undergraduate studies are similar in both contexts.

Secondly, and focusing on the brand image, internal employees have a good opinion of the value that their university brand transmits in terms of trust, admiration and professional growth. In addition, many of them consider that other people they admire would like to work in their centers. However, it is true that there are differences in perception between both types of universities, highlighting that personnel in private institutions have a better perception of their university in terms of trust and service offered, as well as professional growth and social respect. On the other hand, the public university is considered to have more history and prices are lower than in the private sector.

Thirdly, focusing on the perceived quality of the brand, the involved participants are satisfied with the quality that their institution gives, the relevance it has as a brand, the relationship between colleagues and with students, and the feeling of self-respect and social approval. It should also be noted that participants in the private sphere have more positive perceptions of almost all the items of such variable, emphasizing that they perceive greater innovation at work, interest in their colleagues and students, work warmth and security at the job. Public sector employees consider that their job at their university gives them a greater sense of job stability than in the private sector.

Fourthly, and in terms of brand loyalty, educational institutions have managed to project a brand on their staff that they would like to work there. Private personnel have more positive perceptions in all the items of such variable, emphasizing their pride in belonging to the university, their identification with the values of the educational institution and their interest in learning more about the same. Public sector employees stand out for considering that their university is the type of center where they want to work and for having a great sense of belonging. They often follow the news from their university and want to talk about their center to other people.

Once these results and conclusions derived from the empirical study have been analyzed, a series of limitations of this research should be qualified. On the one hand, the model has been contrasted based on the opinions of the agents involved in a specific period of time and of eight universities in Valencia (Spain) in particular. This may cause some generalisations and it is therefore recommended to extend this study to other national and international universities; thus validating the variables in other institutions and countries and comparing the results taking into account cultural differences. On the other hand, it should be noted that this research has been carried out through a fully quantitative technique but it would also be enriching if it is complemented with a qualitative study in future lines of research, in order to add value to the results obtained.

For future research it would be interesting to include the perception of brand capital of the university managers themselves, in order to be able to make comparisons between employers and employees, as well as to include other collaborating groups in the field of higher education at the external level, such as students or the general public. This addition is considered important to increase the quality of the measurement of brand capital in educational institution, whether public or private. It would also be of great interest to carry out longitudinal studies that contemplate the possible variations over time in their perceptions, to determine any changes.

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Chapter #25

WOMEN IN ENGINEERING: ACTIONS FOR IMPROVING THEIR INTEGRATION IN THE FACULTY OF ENGINEERING IN BILBAO

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ABSTRACT

The situation of women in the engineering world has different aspects that should be carefully analysed. Last century, the woman who first broke this taboo in Spain was the mayor of Bilbao, the first female industrial engineer graduated in Spain in 1929, Pilar Careaga. By means of her public presence, her message could reach general society, but only as something exceptional. At the Faculty of Engineering in Bilbao, the first female Industrial Engineer was Pilar Ipiña, who graduated in 1965. Thirty six years later.

After nearly a century, women in engineering remain a clear minority. Proposing solutions requires knowing the causes, in order to be able to carry out actions that lead to harnessing women's talent and enable them to realise their full potential.

This paper presents a multi-staged process for the integration of women in engineering degrees. The first stage analyses different issues about the faculty structure and regulations. The second stage relates educational objectives and the gender perspective. The third stage marks the importance of educational materials. The fourth stage summarizes educational methodologies and activities. The fifth stage proposes a change of assessment model. Finally, the sixth stage comments on the importance of control and visualization of results.

Keywords: women in engineering, engineering education, gender equality.

1. INTRODUCTION

During childhood and adolescence, school, high school and university are a very important source of references for children. These referents are a fundamental factor in the perception of what is appropriate or accessible for girls. However, these examples of women that girls may want to emulate should be close at hand, not only famous or important. A woman astronaut or Nobel laureate may be admirable, but she can seem to be something unattainable and therefore impossible to imitate. However, many teachers of physics and chemistry, technical drawing or mathematics are women; and they can be a more influencing factor, being examples of an achievable goal, from the viewpoint that technology, engineering and science are girls' things (Ayuso et al., 2019).

The family environment also plays a fundamental role when choosing the field in which to pursue higher education. Not discouraging girls with comments about the difficulty of science or engineering studies is very important. Not dissuading them from a fascinating world where discoveries, pure research, and inventions are waiting for their talent is also essential (Ayuso et al., 2020).

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Actions are being developed from the university world and from professional associations to promote that female talent is not lost in these areas. Actions are being taken to explain all these possibilities to girls and young women. However, it is no less important that the family and community are informed and aware. Girls have no problem with science and technology subjects, and it should be natural for them to enjoy those disciplines. Interesting texts, histories and information about women in science and technology can bring not just girls, but families, closer to the world of science and engineering (Tietjen & Reynolds, 1999).

Social mobility could be defined as the movement from one social position to another. University studies in engineering are linked to social mobility, including possibilities of employment, something important for equal opportunities for boys and girls. Continuing studies differentiate even more for women than for men (Neglia, Tragodara, Paragulla, & Caceres, 2020).

In terms of probability of attaining higher education, Spain is in position 8 out of 20 European countries. This has improved when compared with previous generations (CRUE, 2018). Among people from 45 to 59 years of age, the percentage of adults who attained higher education and whose parents did not is 16%, and among those from 30 to 44 it improves to 21% (CRUE, 2018).

An important piece of information to assess the possibility of social mobility is the number of universities in Spain and their territorial distribution. There are 50 public universities and 34 private universities in Spain (CRUE, 2019). The geographical proximity favours the families that can financially support young people's access to university studies. From the data (CRUE, 2018), (CRUE, 2019) it can be seen that the percentage of women who access higher education is greater than that of men.

Figure 1 shows a report on Public Universities in Spain (CRUE, 2019) about women's first enrolment. The orange colour corresponds to ten of the twelve Bachelor's Degrees of the Faculty of Engineering in Bilbao, it can be observed that three of them are above the average TOTAL STEM and seven below the average.

Reversing this trend and attracting women who like and are interested in engineering fields is a social objective that will be a benefit to all (De Carvalho Fernandes et al., 2019).

The main contributions of this paper are to demonstrate the existing situation of persistent inequality of women in academia and industry, and the proposal of different actions to effect change for improving the integration of women in engineering degrees.

Figure 1.
Women´s first enrolment in Public Universities in Spain.
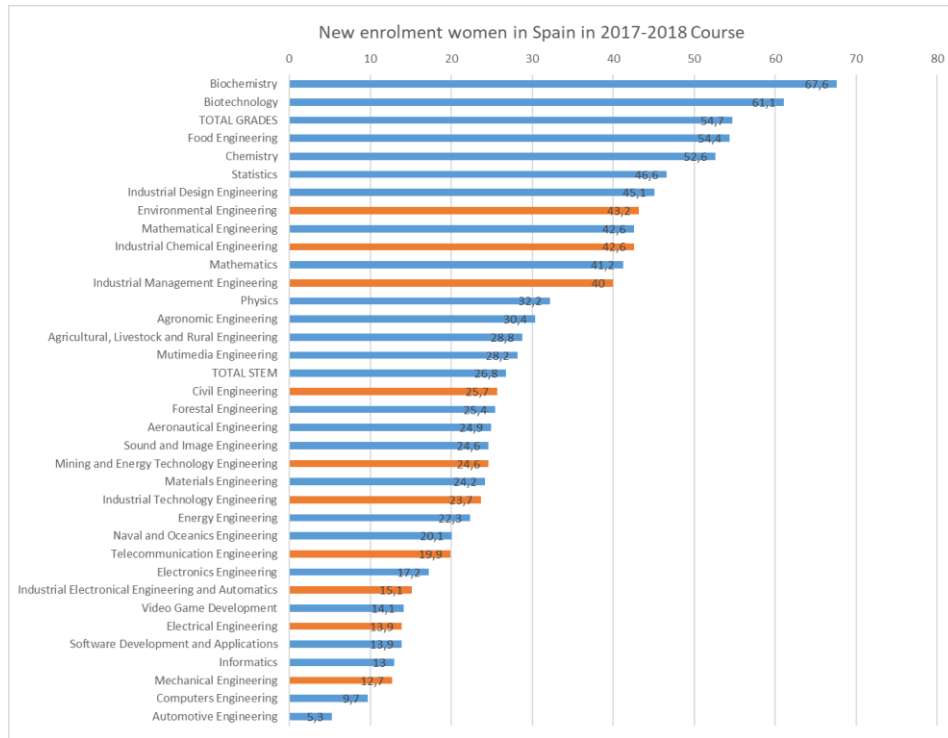
2. WOMEN IN ACADEMIA. THE FACULTY OF ENGINEERING IN BILBAO

Once women enrol in engineering studies at the university, even today, they are entering into a very masculine environment. The classroom environment is generally friendlier and without gender considerations. In the 1960s, 70s, and 80s, the female presence was token but the student experience was generally satisfactory (Udén, 2002). Normality in dealing with teachers and male students was the standard then and continues to be so today. No differentiating attitudes were perceived by gender, neither by the teaching staff nor by the peers.

In the Faculty of Engineering in Bilbao in the 90s, five women and ninety-five men were in their sixth year of Industrial Engineering, Mechanical Degree. Considering 2014/15 to 2019/20 courses, 30 years later, the average ratio of enrolled women is 13%.

The Faculty of Engineering in Bilbao has 4702 enrolled students, distributed into twelve engineering bachelor's degrees and eighteen master's degrees in 2019/20 study year.

Figure 2 shows two blocks of graphics, the first block of four showing the gender distribution for the new incoming students of four bachelor's degrees and, the second block of one showing the percentage of total new incoming women in the Faculty of Engineering in Bilbao. These graphics clearly display and confirm the reality that women in engineering

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degrees are a small proportion of the total students and the tendency has not improved during this period.

On the other hand, it is important to highlight that, for example, the dropout rate in the first year of undergraduate studies is lower among women, 18.1% compared to 23.2% for men (CRUE 2018) and that the percentage of credits passed compared to those enrolled, continues to be higher among women, 73.2% compared to 66.5% for men (CRUE 2018). These examples, among others indicated by the 2018 Conference of University Rectors of Spain, corroborate the good academic performance of women in engineering degrees.

Figure 2.
New incoming students in four bachelor's degrees and total new incoming women in the Faculty of Engineering in Bilbao, 2014/15 to 2019/2020 courses.

It seems clear, in view of the aforementioned data, that female engineering students are perfectly equipped for these studies. These data should demonstrate and reinforce that there is no objective reason that should discourage nor deter ambitious young women from deciding on their course of studies and professional future (Mozahem, Ghanem, Hamied, & Shoujaa, 2019).

3. THE WORK ENVIRONMENT AND THE GLASS CEILING

The career of the professional engineer is a very flexible profession, as the fields of knowledge in these careers are highly diverse. In addition, the engineering graduate will be able to begin practicing their profession after obtaining their title without any additional requirement. These two circumstances allow the entrance into the work environment with certain ease. Industry, academia, research, administration and business are different areas where engineers can develop their professional life.

University studies provide a qualification that generally allows graduates to achieve quality employment. One of the objectives of the students is to have successful access to employment, and the data demonstrates that a university education fulfils this purpose (Ministry of Science, Innovation and Universities, 2018). However, today there are still both a wage gap and a higher unemployment rate for women (Cadaret, Hartung, Subich & Weigold, 2017). Many women still face the double challenge: that of moving up socially and that of breaking different barriers of inequality, such as the 'pregnancy penalty' (Vella, 2020).

Taking public universities and administration in Spain as an example of women in different work positions, Table 1 shows the differences between men and women (Ministry of Science, Innovation and Universities, 2018). The results are revealing and show a gender inequality that could be extrapolated to other environments, especially taking into account that gender polices are regulated through different laws in the Spanish public administration. In industry, the data reveals similar differences (Fouad, Singh, Cappaert, Chang, & Wan, 2016). In their research, the aforementioned authors analyse the twenty percent of engineering graduates in the United States who are women and why only eleven percent of them become engineers. In this way, what are the factors that differentiate women entering, staying or leaving the engineering profession?

Table 1.
Ratio women/men in University and Government institutions in Spain, 2018.

	Universities in Spain	Universities in Spain	Faculties in Spain	Faculties in Spain	Research Institutes in Spain	Public Institutions in Spain	Public Institutions in Spain	Faculty Engineering in Bilbao
	Rectors/ deans	*Vice-rectors*	*Faculty directors*	*Vice-directors*	*Directors*	*Grade D, the lowest*	*Grade A, the highest*	*Lecturers*
Women	2%	39%	27%	47%	19%	58%	25%	34%
Men	98%	61%	73%	53%	81%	42%	75%	66%

When analysing the impact that studying science and engineering has on female university graduates, one could say that there is good news. The higher the qualification, the better the employment rate. In addition, the fields of engineering and science have one of the highest occupancy rates. Combining both factors, these are even more compelling reasons to encourage women to choose these studies (Mills, Gill, Sharp, & Franzway, 2011).

The engineering work environment is one of the most complex ones for women. The main example of this complexity is the continuing difficulty for women to access management positions (Jung & Kim, 2020). Many highly trained and experienced women, including those without children, have hit the ubiquitous 'glass ceiling'. This is a term that, for too many years, has come to define the differing and limiting career prospects for women when compared with men (Tang, 1997).

4. POSSIBLE ACTIONS FOR THE INTEGRATION OF WOMEN IN ENGINEERING DEGREES

Engineering is one of the career fields where women's underrepresentation has been persistent (Jung & Kim, 2020). Frequently the associated research studies about this situation have shown a poor evaluation: convenience samples, limited circles of acquaintances, and personal experiences (Frehill, Di Fabio, Layne, Johnson, & Hood, 2006).

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The Faculty of Engineering in Bilbao and the University of the Basque Country promote different actions for improving the integration of women in engineering degrees. These actions are implemented in six stages. The first stage analyses different issues about the faculty structure and regulations for a better integration of women in the engineering degrees. The second stage relates educational objectives and the gender perspective, underlining the impact of the low number of women in students' groups. The third stage highlights the importance of educational materials as sources of reference for women. The fourth stage summarizes educational methodologies and activities for empowering women when team working with other students. The fifth stage proposes changes in the assessment model. Finally, the sixth stage underlines the importance of the control of results for improving the visualization of women´s achievements as new sources of reference.

4.1. Degree variables related with faculty structure

Many factors have an influence in the gender equality and integration of women in the engineering degrees (Makarem & Wang, 2019). The following data are based on the Basque Country University, in the Faculty of Engineering in Bilbao and some of the data with respect to a specific Bachelor's Degree (BD).

A first factor is the example given by the educational staff. In the Industry Electronics and Automation BD there are 84 men and 51 women. The resultant percentage of 37.7% women, gives a skewed vision of technology as being masculine (Transparency Portal in the University of the Basque Country, 2021). A second factor is the percentage of female students. In the same BD for example, only 18% of students are women. A third factor is related with management positions in the faculty. There has, as yet, never been a woman Director (Equality in numbers in the University of the Basque Country, 2021). All these documents demonstrate the general gender inequality for women in the Basque Country University.

During the last ten years, different regulations have been developed in order to correct the above situations. An example of these regulations in the Basque Country University is the search for strategies to attain the equality of women with men (Equality Plan for Women and Men in the University of the Basque Country: 2019-2022, 2019). These regulations are based on Spanish Laws that establish general rules, for both public administration and private companies (Law 3/2007 of March 22nd, 2019). The equality, which these laws and regulations promote, refers not only to the starting conditions, access to rights, to power, and to economic and social resources and benefits, but also to the conditions for their effective exercise and control.

However, despite all these regulations, it must be said that there are no specific considerations of the gender perspective in the study plans of the Engineering Faculty of the University of the Basque Country. Nor is information collected on the degree of satisfaction of the students with respect to how the gender perspective is addressed in the degree course. An explanation for this anomaly is the presumption that there is not a problem. Perhaps because women, "apparently", are perfectly integrated in the different degree courses.

The training actions are possibly the main factors that could be useful to highlight the real situation of women and help to improve it. Table 2 shows online courses 2020-21 data at the Basque Country University level, with 824 accredited people (Directorate for Equality of the University of the Basque Country, Report 2020).

Table 2.
Gender online courses 2020-21 data at the Basque Country University.

ONLINE COURSE	DURATION	PLACES	INSCRIPTIONS				ACCREDITED PERSONS			
			WOMEN	MEN	NON-BINARIES	TOTAL	WOMEN	MEN	NON-BINARIES	TOTAL
Equality of women and men	25 hours	200	381	41	3	**425**	130	14	2	**146**
Inclusive language	25 hours	200	333	58	4	**395**	104	19	1	**124**
Masculinities. Men and equality: challenges and resistance.	25 hours	200	205	60	7	**272**	98	25	1	**124**
Sexual diversity	30 hours	200	227	40	9	**276**	82	17	5	**104**
Co-education promotion	75 hours	100	92	30	4	**126**	49	13	1	**63**
Child sexual abuse	30 hours	200	293	43	6	**342**	120	9	3	**132**
Violence against women	25 hours	200	208	24	4	**236**	117	11	3	**131**
TOTAL		**1300**	**1739**	**296**	**37**	**2072**	**700**	**108**	**16**	**824**

4.2. Educational objectives

The educational objectives in engineering faculties are stated with verbs like: remember, analyze, apply, identify, formulate, solve, evaluate, among many others. However, rarely are they used with regard to gender perspective. It does not seem to matter that the enrolment numbers for women students have come to a standstill for the last ten years, Figure 2. However, the educational objectives should be based on integral actions towards the recognition of women in engineering, not only in university but also in their future professional commitments (Ayuso et al., 2019).

Active and cooperative methodologies are well developed through Problem and Project-Based Learning methodologies (PBL), one of the most widespread cooperative methodologies in engineering degrees. In these methodologies, the educational objectives are developed in a common mode based on student work groups. The students are distributed with different gender members. There may be groups that do not have any women, groups that have one, two or three. What is very rare is to find groups of females only students, and this situation is justified because there are few women. The reasons for attracting or preventing their presence in work groups are based on the support that women receive, and to understand how they feel will be important to developing their future careers (De Carvalho Fernandes et al., 2019).

If the educational objectives could be divided into theoretical and experimental, perhaps some answer to the dilemma posed could be found. There is a common idea related with women that they are more cautious when manipulating experimental artifacts which have a certain degree of risk. The perceived idea is that women students are more reflective than their male teammates.

An educational objective for the years ahead is to change this false perception. This will be attained by improving the leadership levels of women in complex experimental activities related to the handling of educational and research equipment (Isaacson et al., 2020), and by normalizing industrial objectives in the focus of women (Mozahem et al., 2019).

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4.3. Educational materials

The role of gender in shaping achievement motivation has a long history. The gender differences between girls' and boys' related with beliefs and behaviors continue to follow gender role stereotypes (Meece, Glienke, & Burg, 2006). The importance of academic self-efficacy and positive identity can help generate a constructive interaction for supporting the career development of women in engineering fields (Cadaret et al., 2017). In this way, inclusion of women in STEM positions in the educational material can play an important role as referent models for young women.

With a teaching staff that is mostly male, the gender perspective in the selection and elaboration of educational materials goes unnoticed. In engineering faculties, the majority of educational materials and bibliographies are elaborated by men, hence, the point of view and framework for the resolution of problems is masculinized. This is a complex problem because it requires the commitment and compromise of men and women to change this situation and to incorporate a feminization in an elaboration of new and revised educational materials (Mills et al., 2011).

The improvement in the selection and elaboration of materials will be focused on the works and contributions made by women in the field and with a bibliography in which the first author is a woman. The educational use of selected projects carried out by female students, either from previous courses from final degree and master's projects, can help in this task. The incorporation and visualization of these works as educational examples can help and encourage female students to persevere with their studies in engineering (Fouad et al., 2016), as well as, to close the gender gap (Tietjen & Reynolds, 1999).

4.4. Educational methodology and activities

The active and cooperative methodologies, like Problem-Based Learning, Project-Based Learning, Challenge-Based Learning and Research-Based Learning, among others, have been widely implemented in the engineering faculties for years (Mills & Treagust, 2003). These methodologies have been well balanced to resolve "actual questions" through "real world" scenarios, developing different competencies in education related with technological and social skills. In these methodologies, the gender perspective has not always been a priority. The lack of recognition of the existence of the problem has meant that no measures have been taken to correct it (Udén, 2002). Recent research suggests that the integration of engineering and humanities perspectives in these methodologies promote better learning benefits for female engineering students (Stolk & Martello, 2015). It is the interaction in student groups, where gender roles are more evident and, this is where an opportunity for improvement arises (Hirshfield & Su, 2017).

The improvement in classroom activities and dynamics, methodologies, and general organization skills for female students can and will be attained through their empowerment in their roles and with their responsibilities within the working groups (Neglia et al., 2020). This positive discrimination in the student teamwork leadership recognizes and redresses a hidden situation and revitalizes all classroom activities. Nevertheless, in actuality, this positive discrimination may have little effect with the general dynamic as women only make up twenty percent of classroom students. However, it is expected that it will have an influence in coming years (Fowler & Koretsky, 2018).

4.5. Assessment

The assessment is an educational activity that should be changing from the traditional written examination forms focused on technical knowledge and skills. These changes could include a range of other skills more identified with female students, such as, social implications, human necessities and environmental concerns (Du & Kolmos, 2009). The application of PBL methodologies will help to transfer the weight of assessment to another system more related with grouped activities where women are generally better integrated (Zastavker, Ong, & Page, 2006). The above recommendation seeks to promote other complex competencies assuming that the technological knowledge and skills are sufficiently developed in the engineering faculties.

The use of questionnaires in platforms like Moodle can help in this task, because it allows for the time management with different asynchronous and synchronous activities. These platforms do not have tools for gender analysis that allow for an understanding of gender difference. Tools for analysis based on the collection of data and the subsequent interpretations should be made for obtaining statistics focused on gender.

4.6. Results control

Results indicate that female engineers continue to face significant hurdles in both social and professional environments (Mozahem et al., 2019). The multidisciplinary research project results promoted by women for solving complex world problems should have been an attraction pole for women when considering studies in engineering (Mills et al., 2011).

Female role models for women in engineering in Spain were until recently few and far between. Pilar Careaga, from the province of Bizkaia, was the first woman to enrol and then graduate as an engineer in Spain in 1929. She eventually went on to become the first female Mayor of Bilbao. The first woman to graduate as an engineer in the Basque autonomous region was Pilar Ipiña in 1965. Marrying soon after graduating (to an engineer) her career as an engineer was not encouraged and put on hold to attend domestic duties. While these women were and still are important examples of breaking with tradition and their encountering of traditional boundaries, their stories, their engineering career paths are not well known nor well documented. This however does not need to be the case today where examples of female engineers and their accomplishments are readily available and well documented. This is especially so, when taking into account the omnipresence of the social network. The control and visualization of a selection of women engineers and their stories and accomplishments, from local and global contexts can encourage and reinforce and provide the examples young women need when they are deciding what to study.

5. CONCLUSIONS AND FUTURE WORK

Exploring solutions for the gender differences in the engineering and technology fields is a complex problem. Equitable representation of women is essential for the normalization of the female presence. It is necessary that female engineers are working to their abilities and developing their talents to make their presence normal, and in this way, they must reach decision-making positions.

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In primary and secondary education, having female references in the engineering fields helps normalize girls' vision of their possible career choice in the engineering and technology fields. Visibility of women who work in engineering and science must be promoted so that it is perceived as something normal and that these are options that can be chosen with the same spontaneity with which girls choose to be a doctor, a psychologist, or a teacher.

The fear of an insufficient professional projection after very demanding studies can also keep girls away from the world of engineering. However, the reality of women engineer's employment opportunities, with a high professional category in industry is also motivating.

It must be recognized that in order to change a situation such as this one, with its great internal inertia, actions must be taken to break the current imbalance. In this paper, different actions have been outlined such as a six stage program for improving the integration of women in engineering degrees, a re-evaluation of the gender bias in engineering, a re-evaluation of educational materials, methodologies, workshop practices and assessment, and the importance of role models for aspiring female engineers.

These actions can help to empower women in their careers and in this way improve their integration in the industrial world.

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