

# Education Applications & Developments II



Editor: Mafalda Carmo

Advances in Education and Educational Trends

*Education Applications & Developments II*  
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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 II* as part of the Advances in Education and Educational Trends series. These series of books comprise authors and editors work to address generalized research, albeit focused in specific sections, in the Education area.

In this second 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.

Contents show us how to navigate in the most broadening issues in contemporary education and research. In particular, this book explores four major divisions within general Education, corresponding to four sections: “Teachers and Students”, “Projects and Trends”, “Teaching and Learning”, and “Organizational Issues”. Each section comprises chapters that have emerged from extended and peer reviewed selected papers originally published in the proceedings of the International Conference on Education and New Developments (END) conference series (<http://end-educationconference.org/>). This meeting occurs annually with successful outcomes. Original papers have been selected and invited to be extended significantly, reviewed, and authors of the accepted chapters requested to make corrections and improve 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’ objectives provide information on the book contents.

**Section 1**, entitled “Teachers and Students”, provides studies within educational programs and pedagogy for both tutors and students. Each chapter is diversified, mainly addressing thematic in teacher education, programs, curriculum and practice, continuing education, student affairs (learning, experiences and diversity) and assessment.

Chapter 1: *An Alternative Model to Professional Development in Multilingual EFL Classrooms: Cooperative Management & Residual Practice*; by Sibel Ersel Kaymakamoğlu and Çağda Kıvanç Çağanağa. Many higher education institutions worldwide require that all academic staff have a professional development plan. Teacher professional development has been regarded as one of the most important



factors for improving the quality of both teaching and learning. Therefore it is imperative to use a solid framework evaluating professional development. This chapter aims to provide cooperative management as a comprehensive framework for evaluating the impact of professional development on classroom management. Cooperative management is a voluntary, collaborative process in which a school leader, a teacher and a colleague explore and reflect on learning and teaching practice. Specifically, the suggested model emphasizes the dialectic process with a teacher, a school leader and a colleague that represents the core features of effective classroom management. In this process the teacher, the school leader, and the professional colleague act as feedback receivers and providers. In the suggested model cooperative management has described the residual practice as the core feature of the effective classroom management. The residual practice is the experience or practice left over at the end of the teaching process. The suggested model also fosters the members of the learning community because a residual outcome stays with the school leader, the teacher, and the professional colleague for the rest of their lives. In this study the designed model was implemented and the semi structured interviews were given to five EFL teachers who taught in multilingual classrooms as follow-up. The findings indicated that the suggested model helped the participant EFL teachers develop new perspectives in their classroom management strategies and contributed to their professional development. Furthermore, some implications were provided for school leaders as well as for teachers in Cyprus.

Chapter 2: *"Fatherhood in the Classroom": When Life as a Father meets the Teaching Profession*; by Ina Ben-Uri. The current chapter deals with male-teachers perceptions of the meaning of being a father, in the teaching practice. The research is based on the reports of 43 Israeli teachers-fathers, using semi-structured interviews. The participants ages ranged between their early 30's and up to 60 years old. The age of their children ranges between children of a few months of age through adult children. Findings indicate that the main interviewees' perception, sees fatherhood as a significant experience regarding the teaching practice. The study presents 4 major ways these male-teachers see the use of their parenthood experience in their practice as teachers: 1. Recognizing different characteristics of their students; 2. Accomplishing better empathy toward the students; 3. Implementing parental personal-interaction experience with the students; 4. Understanding the students'-parents point-of-view. Implications for teachers'-training and counseling are discussed.

Chapter 3: *Gender Differences in the Implementation of School-Based Assessment in a Malaysian State*; by Arsaythamby Veloo, Ruzlan Md-Ali and Hariharan N. Krishnasamy. This study aims to identify the differences in assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by male and female Grade 8 teachers who are involved in implementing School-Based Assessment (SBA) and the interrelationship among

these five factors. In addition, this study explores the teachers' views with regards to these five factors. This study uses a quantitative questionnaire designed by the researchers, and a total of 243 Grade 8 teachers answered the questionnaire. Qualitative data was then collected via semi-structured interviews which were conducted with 20 teachers. The findings show that male teachers are more ready to implement SBA compared to female teachers. Compared to the female teachers, the male teachers view school support as more important. In terms of knowledge, skills and challenges towards the implementation of SBA, there are no gender differences. The findings also show that there exist significant relationships among the five factors except between school support and challenges faced in SBA. Although male and female teachers share many similar views, the predominant view among female teachers when compared to the male teachers is that many challenges and issues need to be addressed in the implementation of SBA. The findings from the interviews also suggest that male teachers are more willing to accept changes when compared to the female teachers. This study has implications for the implementation of SBA in Malaysia because 63% of the teachers implementing SBA are females.

Chapter 4: *Inquiry-Based Science Education Modules and their Effects on Teacher Education*; by Josef Trna and Eva Trnova. Inquiry-based science education (IBSE) is currently rated as a promising educational method in science education. Science teachers should be provided with specific IBSE teaching/learning methods, techniques and tools, especially as teacher education for the implementation of IBSE in instruction is not yet sufficiently provided. The objective of this research is the development of an IBSE teaching method, based on modules in IBSE. The second objective is the implementation of this educational method into science teacher education. This research was conducted within the PROFILES project in the European 7<sup>th</sup> Framework Programme. The basic methods of the research were design-based research and the curricular Delphi study. The outcome of the PROFILES curricular Delphi study is a set of concepts in science education which were used as the theme for the overall design-based research. The main outcomes of the design-based research are the IBSE modules, which were used as the basis for training teachers in IBSE implementation. Emphasis was given to the teacher ownership and creativity. These modules were verified by teachers in practice through their action research. The PROFILES module "Safety of the human body: swimming and diving" is shown as a specific example of the research outcomes. An important research finding is that teachers educated in this way continue to implement this innovative educational method, which they acquired during their specific training in the project.

Chapter 5: *Process of Continuing Education in the Program School Managers of Public Basic Education*; by Rita Márcia Andrade Vaz de Mello, Leililene Antunes Soares, José Márcio Silva Barbosa and Maria das Graças Soares Floresta. This study aimed to understand the meaning and importance of training under the

National Program School Managers of Public Basic Education for the participant teachers from the perception and reflection of each other on their practice. We tried to understand how this training is manifested during the course and at the end, in practice teachers, but especially as these teachers participate, through their reflection on their practice as agents acting within their classroom, the school and the community. This field research was carried out with five tutors and ten course participant teachers of that program and engaged in the teaching profession, particularly, the educational coordination in public schools in cities of Minas Gerais - MG enrolled at the Federal University of Viçosa, using one semi-structured interview and document analysis. We concluded that the participant teachers have done and still do a brainstorming exercise on their training and on their practice in the classroom, and in the pedagogical actions at school, in view of what was proposed by the course, the development in the practice of action-triad reflection-action.

Chapter 6: *The Realities of Teaching Adult Learners at the Higher Education Level*; by Jane Iloanya. Teaching adult learners, though challenging, can also be exciting and fulfilling when the right teaching methods are applied. This chapter discusses the issue of lifelong adult education in Botswana's institutions of higher learning. It goes on to examine the challenges and the nature of the teaching and learning process in adult education, while also examining the experiences of adult learners and the teachers of adult learners. The chapter further discusses the methods which can be used to enhance the teaching of adults. A qualitative research approach was used in this research. With the use of semi-structured interview questions, ten teachers of adult learners were interviewed, while twenty adult learners were interviewed through the focus group discussions. Adult learners come to class with a wealth of knowledge, life experience, and some challenges too. The teachers of adult learners should therefore, embrace and apply the right teaching methodologies in order to overcome the challenges of teaching adult learners so as to facilitate effective teaching and learning in an adult education class.

Chapter 7: *Evaluating Programming Competence from Explanations*; by Edward Brown. With a prolific amount of computer code available on the web, students are able to use the Internet as a compendium of solutions to computer programming problems. Web search is not only a problem-solving strategy with which students are familiar with and have highly developed skills from years of practice and implicit cultural knowledge, it is also an approach anticipated in real-world contexts for computer programming (Treude, Barzilay, & Storey, 2011). This chapter is an account of the author's transition from pedagogy disallowing the use of solutions copied from web pages to a pedagogy which encourages students to incorporate found solutions into their work. Instead of penalizing students for "cheating" when they adopt other programmer's solutions

to computer programming problems, emphasis is instead placed on student's explanations of the solutions they provide regardless of their origin. The effectiveness of this approach is predicated on the idea that the ability to produce comprehensive explanation of a programming solution is a good indicator of programming competency. Otherwise, there is no reason to think adopting someone else's code is a valid learning activity. There is literature to support the idea that explaining and studying (sometimes characterized as reading) existing solutions and program code significantly improves students learning and development of problem-solving strategies (Corney et al, 2014). This chapter suggests similar benefits may accrue from code that is not selected as part of the curriculum, but found by the individual students. More speculative aspects of the approach are the absence of specific instruction in specific problem-solving skills, and absence of a requirement that students eventually shift to independent composition of code as a later stage of demonstrating programming competence. Emphasis is shifted away from the text of computer code solutions, towards student description and assessment of computer code solutions. Students provide their descriptions in a combination of natural language and Unified Modeling Language. Thus design and implementation is separated as advocated by Falkner, Vivian, and Falkner (2014), and the Internet no longer serves as a compendium of pre-packaged solutions. Informal observations regarding a one semester application of this approach conclude the chapter. This chapter is an extended version of Brown (2015).

Chapter 8: *The Quality Chain in Education – A Grid Approach*; by Dimitrios A. Giannias and Eleni Sfakianaki. The increasing demand to provide students-and learners in general-with an effective and motivating educational environment has increased the demand for quality management to deliver high-quality results and thereby meet the growing requirements of “customers”. The adoption of total quality management in education is a relatively recent manifestation and has been treated with enthusiasm by a number of researchers and with scepticism by others. One of the difficulties in a service-oriented environment such as education is the complexity of its stakeholders, process and, consequently, the definitions and interpretations of different relationships within the educational organization. The present review defines the quality chain in education by examining the basic stakeholders of the educational sector: the teachers and the learners. It then proposes a methodology based on the managerial grid model developed by Blake and Mouton (1964a), which is based on a concern for people as well as for production. Additionally, it explores the ways in which this model can be applied in the quality chain of education while using basic principles of total quality management. Ultimately, the aim is to examine the potential for improving the educational quality chain and also to provide a personal improvement tool and thereby enhance the overall concept of continuous improvement.

**Section 2**, entitled “Projects and Trends”, delivers chapters concerning, as the title indicates, education viewed as the center for innovation, technology and projects, concerning new learning and teaching models. Knowledge in different usabilities, communication, software and new methods of teaching and learning are used to compile these works.

Chapter 9: *Hybridizing L2 Learning: Affordances of the Inverted Class Approach with Online Tasks*; by Nádia Silveira and Kyria Rebeca Finardi. Based on the assumption that both knowledge of English and digital literacy are important to access information online (Finardi, Prebianca, & Momm, 2013), the present study investigated the impact of a hybrid approach to English as a foreign language teaching in an intact class in Brazil. Hybrid approaches have been described as the combination of face-to-face classes with online instruction, (Graham, 2005), and in this study it was operationalized as an inverted class approach, that is, the combination of face-to-face classes with computer-mediated activities performed in an online environment, outside the class. Twenty male participants were recruited in an intact class in the Brazilian Navy Academy Boarding School to participate in the study. Data includes class observation, questionnaires and interviews, analyzed qualitatively to evaluate the impact of online tasks in L2 learning, as well as in the development of students’ autonomy and digital literacy. Three tasks adapted from Finardi and Porcino (2013) using different sites on the internet were administered, followed by a questionnaire after each task. Overall results of the qualitative analysis of students’ perceptions of the tasks performed in the online environment revealed that the L2 hybrid approach used may contribute to the development of students’ autonomy, motivation, digital literacy and L2 development through extended contact with and in the target language.

Chapter 10: *Engaging the Heterogenous Urban Classroom in an Integrated STEM Course Using Science Research Methods to Develop Apps*; by Ingrid Montealegre, & Randi M. Zimmerman. As educators we struggle to motivate students and to provide individual attention. By combining app development with classic research methodology, we were able to engage students in collaborative learning and higher-level research, thereby providing students the benefits of individualized learning and motivation in the classroom setting. Each of the four STEM fields (science, technology, engineering, and math) was highlighted during this full year course. Science: Students generated authentic questions and created experiments in which they worked as research teams learning to formulate valid hypotheses. Technology: Students were particularly engaged with the online and offline technology aspects of this process, requiring them to play games, and read and write code using NetLogo and Moodle. Engineering: The course began with students’ hands-on practice in computer hardware design and the creation of electrical schematics leading to their understanding of the value of accurate

documentation. Math: Students worked to solve classic unsolvable math problems to learn about critical thinking and perseverance in an academic setting. This class was particularly successful in the integration of students with various abilities and interests to work together towards a common goal.

Chapter 11: *Mobile Learning in Hong Kong Teacher Education. Pilot Implementation and Evaluation*; by Irene Chung Man Lam, Chi Ho Yeung and Yau Yuen Yeung. To align with the international trend on using information and communications technology in education, the Hong Kong government has recently announced a policy to broadly implement e-learning in schools through a more pervasive use of mobile devices (such as smartphones and tablets) and electronic textbooks to support classroom teaching and students' self-regulated learning. However, many local schools and their teachers are not yet ready and confident enough (in terms of their teaching methods, strategies, and approaches) to adopt mobile devices in their classroom activities. The present chapter reports a few case studies showing how a team of teacher educators initiated a pioneer e-learning project to support the education sector, by offering relevant training to pre-service student-teachers and in-service teachers. The team designed, developed, and applied a number of innovative mobile learning activities in five different classes of undergraduate teacher education courses. A total of 364 undergraduate students completed a survey collecting information on their prior experiences, attitudes, and views on mobile learning, in order to evaluate their learning effectiveness in technology-enhanced lessons. To illustrate the educational implications of the present study, selected qualitative and quantitative findings will be presented together with some examples on the implementation of innovative mobile learning activities in some classes of teacher education courses.

Chapter 12: *Gamification and Technological Literacy. Educating Electricity Users*; by Aphrodite Ktena. The staggering technological advances of the last decades and rapid changes in the engineered world surrounding us have led to the emergence of technological illiteracy as a major social challenge threatening to create outcasts. Informal education, a path typically chosen by those who feel marginalized by the formal school system, may be more appealing to children and adults alike since it takes away the pressure of school performance and the stigma of failure. The challenge in creating content for informal learning lies in engaging and retaining the learners in an active mode, in making them truly interested in their learning process and achievements. Gamification technology has been proposed for developing engaging informal education programs targeting technological literacy. A novel methodology for developing gamified applications is proposed which is based on a well established behavioral model. It uses the cognitive model to develop the individual's knowledge base and skills and gamification mechanics

for emotional engagement and triggering. This methodology has been used to develop a pilot application targeting electricity users which aspires to educate them in electricity saving, consumption, production and markets in line with the emerging smart grid paradigm.

Chapter 13: *Speech and Language Software in the Intervention of Oral Motor Functions in Autism Spectrum Disorders*; by Kateřina Vitásková, & Alena Říhová. Aim and objectives: The research focused on the analysis of speech (oral) motor abilities of children with autism spectrum disorder (ASD) using the special speech and language therapy (SLT) software. The relations to dyspraxia, as well as the early educational correlations with the development of speech, and early speech vocalization including complex motor difficulties, are mentioned. The grounds stemmed from our wider focus on the assessment of pragmatic language level, since the ability of facial expression gestures represents one of the most important pragmatic, nonverbal communication activities. Methodology: We mapped the oral motor abilities of children with ASD in the initial and final stages of the examination, applying the software programme FONO 2, a multimedia programme intended for individuals with impaired communication ability. We used the observational numerical scale evaluation followed by comparison of the inter-stage differences within longitudinal observation. Conclusions: The results show that it is possible to achieve positive outcomes by applying a systematic SLT approach based on using the SLT software in the intervention focused on the development of the oral-motor activities in children with ASD. We put forward a discussion on the possible exploitation of the results for assessment in the sphere SLT intervention.

Chapter 14: *Time and Innovation at School. The Efficacy of Space Learning Method in Classroom*; by Giuseppina Rita Mangione, Maeca Garzia and Maria Chiara Pettenati. The concept of *teaching competence* challenges today pedagogical research in the effort of finding new ways to organize the curriculum and to design learning activities in classrooms. EDOC@WORK3.0 project deals with the need to rethink the dimensions that characterize an educational practice, with specific regard to the dimension of “time”, so as to adapt it in order to favor a differentiation in disciplinary teaching. This project supported teachers in acquiring competencies in new methodologies related to *time scheduling* and accompanied them in its design and application in their classroom. In this chapter we will present the didactic methodology known as *Spaced Learning*, inside the theoretical framework of adaptive teaching and allocated time. We will describe the results of the experimentation conducted by the teachers who attended the PON EDOC@WORK3.0 project and the training experience made in such an innovative educational method.

Chapter 15: *Electivity and Education: An Emotional Way to Learn Significantly*; by Elena Visconti. Many contemporary scholars talk about emotion, learning and education. This chapter tries to understand if it is possible to learn through emotional observation and if learning can become significant and effective. In our daily lives, there are many experiences that challenge us emotionally. Being aware of our own emotions and our own ability to solve difficulties, helps both adults and children in a growth phase and in school-age. Authors ranging from Montessori to Piaget, Maturana, Varela to Putnam, from Hillman to Dennett and Damasio, to Karmiloff-Smith, reflect on this topic. This chapter aims to study the phenomenology of the development and of educational experiences. We tried to find the emotional dynamics of adolescents. The analysis of neuro-cognitive and learning processes, which will be called elective, allows a recognition of those dynamics, related to the various self areas, which need strengthening and enhancement and which may become an educational and transformational choice for future generations.

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

Chapter 16: *Promoting Mathematical Modelling as a Competence: Strategies Applied in Problem Solving Activity*; by Cristina Cavalli Bertolucci and Paolo Sorzio. Current international documents claim that schools should enhance mathematical modelling competencies in students, as part of an instructional approach that can be considered suitable for the 21st century learners and problem solvers. The objective of this paper is to identify high-school students’ initial conceptions and strategies in mathematical modelling that can be taken into consideration when teachers work out educational activities. A clinical interview approach is applied to understand the modelling strategies that are used by nine students during their three problem solving activities proposed in this research. Students showed different approaches in: their use of algebraic symbolism, the justification of their reasoning, representing their ideas mathematically. The findings can help teachers design school activities that are sensitive to the students’ initial conceptions, in order to promote their mathematical modelling competencies.

Chapter 17: *Social Competences and Organizational Devices in their Relationship to University Students Retention: A Study at UNCUYO*; by Miriam Aparicio, Graciela Rodríguez and Mirta Rena. This project – which has been included among the priorities of the University Policies Office – is the extension of a research programme developed by Aparicio (1995-2005). It includes three central projects: 1) An analysis of the factors that impact the university graduates’ achievement (two universities, 1980-2014); 2) dropouts within the same period were considered; and 3) students who have been studying longer than expected participated.



This project deals with the academic units that show results about retention and performance above the medium rate, including not only basic socio-cultural and psychosocial factors but also aspects related to the psycho sociology of the organizations which have an impact on their organizational quality. The methodology is quantitative and qualitative (semantic associations). A semi structured questionnaire and interviews were applied. It is expected, at a theoretical level, to contribute to the understanding of factors that have a positive impact on the students' achievement as well as on the academic units in which they are inserted. At an applied level, it is expected that this study allows us to know the distinctive profiles and common aspects of these micro institutions so that they are transferred to decision makers and can afterwards lead to programmes for ongoing improvement.

Chapter 18: *The Research on Mothers' Opinions about School Readiness of their 66-72 Month-Old Children*; by Devlet Alakoç Pirpir, Çağla Girgin Büyükbayraktar, Canan Yıldız Çiçekler, Rukiye Konuk Er, & Banu Uslu. The present research was aimed at studying mothers' opinions about school readiness of their 66-72 month old children receiving and not receiving pre-school education. The scope of the research consists of mothers from Konya -Turkey whose children receive pre-school education and do not receive any pre-school education. The sample of the research consists of 120 mothers in total- that is, 60 mothers having 66-72 months of children that receive preschool education and 60 mothers whose children do not receive preschool education. "Mother's View of Child's School Readiness Scale" was employed as data collection tool. It was found that there was a significant difference between mothers' opinions about school readiness of children and the condition of receiving-not receiving preschool education in terms of readiness from mother's viewpoint, intellectual-linguistic development, social-emotional development, physical development and the general total points. The same difference was not observed in the self-care skills.

Chapter 19: *Teaching and Learning in Technology Rich Schools: Traditional Practices in a New Outfit*; by Catarina Player-Koro, & Dennis Beach. Twenty-five years ago an educational project was carried out in a school class in Melbourne Australia using one-to-one laptop computing for educational purposes. The project took place well before initiatives by global hard and software corporate giants to develop one-to-one computer actions as a global venture in the pursuit of profit. A discourse of technology optimism has worked as a driver in these developments, particularly at school levels. In it computer technology is claimed to solve problems and create educational change and effectiveness when it actually can't and above all doesn't. In the chapter we examine aspects of the discourse at work through critical ethnographic research.

Chapter 20: *Effects of Real-Word Versus Pseudo-Word Phonics Instruction on the Reading and Spelling Achievement in First Graders*; by Jihan H. Khalifeh Mohamad and Ahmad Oweini. This study compares two methods of phonics instruction: real-words versus pseudo-words, on Lebanese first graders to determine the approach that will yield better reading and spelling achievements. To that end, two mixed level groups of three students each were selected. Students' achievement in reading and spelling both real-words and pseudo-words was tested before (pretests) and after (posttests) the intervention using four subtests of the Woodcock-Johnson-III Tests of Achievement. The intervention consisted of a total of 20 sessions (30 minutes each) of phonics instruction based on the Recipe for Reading program. Both groups received the same intervention and followed the same lesson plan. The only difference was in the type of word lists provided for each group. One group was exposed to real words only and the other group to pseudo-words only. Results showed that the phonics instruction based on real-words was more effective in improving decoding of real words, spelling of real-words, and spelling of pseudo-words. The effectiveness of the real-word method was very significant especially with at-risk students. On the other hand, the pseudo-word instruction showed slight improvement with average students in reading real words and pseudo-words, and spelling pseudo-words.

**Section 4**, entitled "Organizational Issues", gives a glance on tools for implementing organizational learning and change. Themes vary from economic and social programs, as well as equity and values for the educational environment.

Chapter 21: *Need for a Democratic Approach to Social Justice in Education and Training*; by Anne Grethe Sønsthagen. This chapter underlies the theory of justice as fairness along with certain capital ideas, such as social and cultural capital. The chapter also highlights the culture of silence and the issue of Western hegemonic discourse. The objective is to look at the connections between the findings collected from five high schools with diverse socioeconomic, cultural and racial backgrounds in South Africa, and the experiences from the work with refugees with a Norway residence permit. The author opts to find similarities between a well-resourced country and a country with an emerging economy. In addition, considering the current refugee problems, it is crucial for the critical examination of the current training and education of refugees in Norway. The research employed a mixed-method research strategy, integrating both qualitative and quantitative methods. The study showed that when focusing on social justice, similarities can be found in the two contexts, and this is the focus of the present chapter. The research about the South African education system indicated that the current approach to social justice was limited by a narrow interpretation of the country's present social inequalities, failing to consider

the hegemonic nature of Western knowledge in the education system. This chapter argues that the current situation of training and preparation of refugees in Norway shares related limitations and calls for a democratic approach to social justice.

Chapter 22: *Leadership and Applied Ethics in Education: A Mencian Approach*; by Hua Hui Tseng. Applied ethics is focused on issues in private or public life that are subject to ethical judgments. Based on how conflicts between personal and professional values in recent legal cases (e.g., Keeton vs. Anderson-Wiley, 2010; Ward vs. Wilbanks, 2010) have interfered with ethical decision making, a question raised in applied ethics is whether integrating personal values and professional ethics in ethical decision making affects the morality of ethical decisions. The purpose of this chapter is to use the three-part division of traditional normative ethical theories identified by researchers at Brown University for making ethical decisions to describe and explore consequentialist and deontologist forms of ethical reasoning for deciding matters of morality in education. A literature search identified published frameworks that define the components of ethical decision making. Using these frameworks, a new framework, called the personal and professional values-integrated framework, is constructed. Consideration is given to areas and practices in the guidelines or rules for the process of forming ethical reasons and variations in reasons that are less easily accommodated by conventional ethical frameworks. The description of Will by the Chinese philosopher Mencius (371-289 BC) is used to gain insight into some of the implications of ethical decisions. It is demonstrated that leadership rules in education are realized by acknowledging the reasons for an action, and ethical decision making is defined as conforming to the criteria pertaining to these considerations as well as the professional conduct expected.

Chapter 23: *Financial Education and its Policy in Japan*; by Suguru Yanata, Kaori Ishibashi and Takao Nomakuchi. Some developed countries conduct financial education in primary school. Financial assets which individuals can access increase and they are more and more necessary for individuals to have financial asset, so financial literacy for individuals is also needed to protect them. Accordingly, the importance of financial education from younger age is more and more necessary. However, the international standards and method of financial education haven't been established yet. That's why they differ from countries. Buy the way, financial education has been conducted in Japan, and it shows great result these days. This study shows problems that financial education in Japan has had, and what is financial educational innovation that shows great result by international comparison. The result of this study can be a good example for countries that will conduct financial education in the future. This study surveys financial education policy in Japanese government, then, previous studies, investigation reports and interviews about financial education cases that are done in Japanese educational institutions. Specifically, this study

surveys financial education in U.S., U.K., Australia, and compares Japanese one with them. Also, this study surveys examples of financial education by public institutions and international institutions such as financial education project by OECD. This study shows as below.

- Financial education in Japan has problems about teacher's financial acknowledgement, educational materials and lack of relationship between actual life and financial economy.
- The collaboration between government and educational institution to solve problems above may cause financial educational innovation.
- The development of financial education in Japan can be a good example for countries which need financial education in the future.

Chapter 24: *Education and Transition to Work: Promoting Practical Intelligence*; by Giuditta Alessandrini. This chapter considers a number of questions in the current discussion on the transition to work, most notably the definition of the pedagogical approach by which the issues at hand are investigated, the review of the relationship between education and development in reference to employability, and the interpretation of the right to education in light of the precarious nature of the productive processes. This contribution also points to the relevance of the notion of "human development" as explored by Martha Nussbaum, professor of Politics and Philosophy at the University of Chicago, and Amartya Sen, who was awarded the Nobel Prize in Economics. It ends with a reflection on a welfare model supported by people empowerment that enhances individual capability. The argument put forward is that major shortcomings can be found in welfare systems in terms of employability. Against this background, the author welcomes a system which enables the full development of human development. In this sense, social scientists should engage in pursuing new avenues for creativity in order to build a new approach to social responsibility.

Chapter 25: *A Study of the Effect of a Computer Environment Business Game*; by Takao Nomakuchi, Suguru Yanata and Kaori Ishibashi. In Japan, entrepreneurs are expected to have the ability to produce new business model ideas based on innovation and their capability as entrepreneurs. However, teaching methods in higher education institutions that offer Business management education programs have yet to be established. Business management education that motivates university students to be entrepreneurial and innovative is required for the development of society. A business management educational program is implemented in the School of Economics of a National University in Japan. In this program, a business game was implemented based on a business-game computer environment. The purpose of this study was to verify the effects of a computer environment business game by analyzing 24 student comments via

Foreword

e-mail after the experiment of business game running using a text mining analytics tool. Therefore, this chapter reviews the previous research on entrepreneurs and business-game-based education and the ability of entrepreneurs. Our analysis confirmed that a various virtual experiences of entrepreneurship could be provided by playing the business game. A regular business management education program conducted in the classroom cannot provide the virtual experience feature. The introduction of this business game into business management education serves to nurture entrepreneurship skill: Associating skill, Questioning skill, Observing skill, Networking skill, Experimenting skill. This chapter examined the educational effect of a business game on the perspective of entrepreneurship in order to clarify whether a business game would be effective for nurturing strategic entrepreneurs.

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**Section 1**  
**Teachers and Students**





## Chapter #1

### AN ALTERNATIVE MODEL TO PROFESSIONAL DEVELOPMENT IN MULTILINGUAL EFL CLASSROOMS: COOPERATIVE MANAGEMENT & RESIDUAL PRACTICE

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#### ABSTRACT

Many higher education institutions worldwide require that all academic staff have a professional development plan. Teacher professional development has been regarded as one of the most important factors for improving the quality of both teaching and learning. Therefore it is imperative to use a solid framework evaluating professional development. This chapter aims to provide cooperative management as a comprehensive framework for evaluating the impact of professional development on classroom management. Cooperative management is a voluntary, collaborative process in which a school leader, a teacher and a colleague explore and reflect on learning and teaching practice. Specifically, the suggested model emphasizes the dialectic process with a teacher, a school leader and a colleague that represents the core features of effective classroom management. In this process the teacher, the school leader, and the professional colleague act as feedback receivers and providers. In the suggested model cooperative management has described the residual practice as the core feature of the effective classroom management. The residual practice is the experience or practice left over at the end of the teaching process. The suggested model also fosters the members of the learning community because a residual outcome stays with the school leader, the teacher, and the professional colleague for the rest of their lives. In this study the designed model was implemented and the semi structured interviews were given to five EFL teachers who taught in multilingual classrooms as follow-up. The findings indicated that the suggested model helped the participant EFL teachers develop new perspectives in their classroom management strategies and contributed to their professional development. Furthermore, some implications were provided for school leaders as well as for teachers in Cyprus.

*Keywords:* cooperative management, professional development, residual practice.

#### 1. INTRODUCTION

We argue that effective teaching contributes to effective learning in educational sciences. While teachers can learn and develop themselves, for the vast majority, teaching will make a significant impact on their classrooms, classroom management, and professional development. As Çağanağa (2014) suggests “teachers need to design educational experiences to produce desirable learning outcomes and provide opportunities for them to demonstrate their success in achieving their expectations”. We make the assumption that teachers employed to teach in different programmes will have sufficient knowledge for their teaching - but what of their knowledge of classroom management? How do they want to manage their classrooms and resources, and what facilities and resources are available to them in terms of their professional development? It is assumed that the more the teacher is experienced, the more s/he is good at classroom management.

There is a close relationship between classroom management and professional development.

Recent literature on professional development emphasizes that educational leaders should promote and facilitate professional learning and development in their schools. We have established that effective professional learning is not necessarily confined to intentional development opportunities and events. We have accepted that it is often 'situated' (Hoekstra, Beijaard, Brekelmans, & Korthagen, 2005) and can occur implicitly (Eraut, 2004, 2007), often in unanticipated – and sometimes even unrecognized – ways, through social interaction (Temple Adger, Hoyle, & Dickinson, 2004), including 'communities (of practice)' (Whitcomb, Liston, & Borko, 2009). Marsick and Watkins (1990) and Smylie (1995) refer to this as 'incidental' learning, that 'takes place in everyday experience and occurs without intention, from "doing" and from both successes and mistakes. Besides, it has been realized that in order to understand peoples' behaviors it is essential to understand their thinking (Kaymakamoğlu, 2015, p.2). Therefore, when teachers engage into reflective thinking process, they can become more aware of their thinking and their actions in class.

This chapter tries to provide a new framework for both classroom management and professional development. A new model of classroom management is suggested in order to understand the existing teaching situations and desired requirements in classroom management and its impact on professional development.

The new model which is called *cooperative management* is a comprehensive framework for evaluating the impact of classroom management on professional development. Cooperative management is a voluntary, collaborative process in which a school leader, a teacher and a professional colleague explore and reflect on learning and teaching practice. Specifically, the suggested model which emphasizes the dialectic process with a teacher, a school leader and a professional colleague represents that core features of effective classroom management are based on three aspects; the teacher, the school leader, and the professional colleague as feedback receiver and provider. By reviewing the suggested model, we will examine whether it could be justified as a solid theoretical framework for evaluating classroom management. Although empirical research has been conducted for exploring the relationship between classroom management and teachers' outcomes in Cyprus, to the best of our knowledge, there is no literature which comprehensively describes three aspects which were shown above as a solid framework for evaluating classroom management. Therefore, this framework will help inform further evaluation studies of professional development and the evidence offered through this review of the research will help policy makers implement future professional development initiatives.

### **1.1. Cooperative Management**

Even though scholars have suggested diverse characteristics of effective classroom management, *cooperative management* has described *residual practice* as a core feature of effective classroom management. Cooperative management tries to achieve more effective and equitable systems of resource management. In cooperative management the trio the individual, the successful practitioner, and the school leader should share knowledge, power, and responsibility. It also means fostering free circulation of information within the school. The necessities of cooperative management are as follows:

- supporting each other and getting reward based on trust and mutual help,
- the best interest of teachers should go with the school to increase participation,
- all of the resources, such as financial, technical, administrative should be met to be able to reach the goals.
- human skills and in service training should be the focus of the school to reach the goals.

Cooperative management is not only beneficial from a human and social point of view, but also a key competitive asset for a school. Similar ideas were supported by different writers with different names. For instance, in 1987, Donald Schön introduced the concept of reflective practice as a critical process in refining one's artistry or craft in a specific discipline. Schön recommended reflective practice as a way for beginners in a discipline to recognize consonance between their own individual practices and those of successful practitioners. As defined by Schön (1996), reflective practice involves thoughtfully considering one's own experiences in applying knowledge to practice while being coached by professionals in the discipline (Schön, 1996). The difference between reflective practice and residual practice is the interaction pattern. In this model, not only the individual and the successful practitioner's consonance but also the school leader's contribution is appreciated in order to examine the classroom practice in detail. This trio - the individual, the successful practitioner and the school leader - is explained in greater detail below along with the empirical research that serves as evidence of the impacts of each of the three members.

The residual practice is the experience or practice left over at the end of the teaching process. The residual practice goes around five questions that the teacher is required to ask herself/himself; (1) What did you believe in? (2) What happened? (3) What's left over? (4) What would you do if...? (5) What will you do with what you learnt? In this learning process, both the successful practitioner and the school leader is expected to act as a feedback receiver or provider. It should be highlighted that the degree of formality among these people is required to be equalized by focusing on the actions not the individual teacher personally.

Residual practice is the concept that requires a learning community to recognize and engage difference and acknowledge and articulate their biases. A school leader, a teacher, and a professional colleague are required to take part in a learning community which provides opportunities to develop the presuppositions of the community, as well as a position that is present throughout life. The suggested model also fosters the members of the learning community because a residual outcome stays with the school leader, the teacher, and the professional colleague for the rest of their lives. In this model, the members are required to form bonds with each other and create networks. Schools are expected to build learning communities into their schedules to promote a deeper understanding of the practice the teacher has left over. The trio - the school leader, the teacher, and the professional colleague is expected to meet in regularly scheduled sessions gear toward gaining knowledge. Learning communities can help each other in academic issues if they learn to share their experiences. Such models relieve the trio from the burden of studying and getting ready alone. They may study together, share problem solving strategies and exchange ideas and information. Reflective practice is therefore not always an easy process and the evaluation process should be undertaken with educational supervisors. However, the process is not about writing down a list of dos and don'ts. For this to be a meaningful process the teacher will need to write down what s/he has done in the class and examine the

issues with the other members of the trio namely the school leader and the professional colleague. This form or report is designed to assist the teacher in the process. If s/he is involved in a difficult situation, s/he is required to record the event and the thoughts about it on the reflective practice form. Such a form can be designed as follows:

**Reflective Practice Form**

**Date and venue:**

**Learning event:**

**Member of the trio:**

<b>1. WHAT DID YOU BELIEVE IN?</b>
<b>2. WHAT WERE MY PERSONAL LEARNING OBJECTIVES FOR THIS EVENT?</b>
<b>3. WHAT HAPPENED?</b>
<b>4. WHAT'S LEFT OVER? AND WHAT KEY LEARNING POINTS HAVE I TAKEN AWAY FROM TODAY?</b>
<b>5. WHAT WOULD YOU DO IF...? AND WHAT CHANGES WILL I MAKE TO MY TEACHING PRACTICE AS A RESULT OF MY LEARNING?</b>
<b>6. WHAT WILL YOU DO WITH WHAT YOU LEARNT? AND WHAT FUTURE LEARNING NEEDS HAVE I IDENTIFIED AS A RESULT OF MY LEARNING?</b>
<b>7. ACTION PLAN</b>
<b>8. RESOURCES AND SUPPORT NEEDED TO IMPLEMENT MY ACTION PLAN</b>
<b>9. REVIEW OF PROGRESS IN E.G. 6 MONTHS</b>

Adapted from Professional development. (Attwood, Curtis, Pitts, & While, 2005)

The primary benefit of residual practice for teachers is a deeper understanding of their own teaching style and its impact on their classroom management. Another specific benefit may include the professional development process of teachers. Supovitz (2001) suggested that a logic behind professional development is that high-quality professional development will change teaching in classrooms, which will, in turn, increase student achievement. Moreover, recent literature has claimed that teachers' knowledge gained from professional development influences teaching practice (Blank, de Las Alas, & Smith, 2007; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

Literature has identified and described an array of management approaches that teachers employ for their professional development. Cooperative management can range from feedback receiver to feedback provider with a continuum of mixed roles in between. The cooperative environment that is required for the management would give the teachers a chance of sharing their reflective thoughts and thus help them achieve better management skills. Therefore it is believed that this dialectic process could contribute teachers develop professionally in teaching and learning.

## **2. METHODOLOGY**

This study consisted of two phases. In the first phase of the research, the views of the participant teachers and the school leader about the existing professional development activities were sought. The second phase of the study focused on the participants'

evaluations of the new model, cooperative management for their professional development. For this purpose, the following key research questions were designed:

1) What were the participants' views regarding the existing professional development activities?

2) What did participants gain from engagement with the new model, cooperative management process?

For this investigation, purposively selected five novice EFL teachers and a school leader participated voluntarily. Prior to the investigation, the informed consent of the participants were taken. In the first phase of the study, the school leader's and the participant teachers' views regarding the existing professional development activities were sought by interviewing them. The interviews were semi-structured for the purpose of probing whenever needed and every participant was interviewed for 30 minutes.

In the context of cooperative management model here, every participant teacher was asked to keep reflective reports daily. The participant teachers were also asked to keep notes based on their reflective reports, particularly about the classroom management issues and make a "dos and don'ts" list based on their classroom teaching experiences. Weekly meetings were held among the school leader and the teachers to receive and provide feedback to each other for the purpose of benefiting from the cooperative learning environment. During the meetings every teacher shared his/her notes based on the reflective reports she/he has taken with his/her colleagues and the school leader. This process took for 3 months.

At the end of this period, as the second phase of the study, the school leader and the participant teachers were interviewed again to evaluate the new model, cooperative management for their professional development. The second interviewing was also semi-structured for probing purposes if needed. The semi-structured interviews were recorded and later transcribed for the data analysis. The transcribed data were coded by using a broadly grounded approach (Strauss & Corbin, 1990) where the emerging categories were used for the purpose of comparison. I used a marginal note taking techniques (Patton, 2002, p. 463).

### **3. RESULTS AND DISCUSSION**

• *First Phase: the participants' views regarding the existing professional development activities.*

Analysis of the data showed that all the participant teachers engaged into traditional professional development activities which they did not seem to benefit from. They were required to attend the work-shops and seminars which were organized by some institutions or The Ministry of Education authorities. The emerged themes indicated that the existing professional development activities did not value them as individuals so they did not respond to their needs as practitioners. They also revealed the participants dissatisfaction with the existing professional development activities they engaged. It seems that most of the teachers needed more practical knowledge instead of theoretical knowledge. Janet explained:

"I don't think the training sessions I attended resulted in any change in my teaching. The theoretical knowledge given in the work-shops and the seminars I have attended so far did not provide me practical ideas to solve the difficulties I face in class."

According to Susan: “What I experience in class is important for me and every class differs. What I get in the seminars do not respond to the difficulties I experience.”

Emma stated: “Always the topics of the conferences and the seminars are imposed on us. We are not asked about the topics.”

Emily expressed her view as: “I wish these courses responded to our needs in class teaching. They are always theoretical. What I need is to know how to use theory in practice.”

According to Olivia: “I find most of these sessions boring and time wasting. It is a kind of certificate collection procedure because I cannot find answers to the problems I face in teaching when I attend them.”

The analysis of the data also revealed another theme that in their work context the teachers were required to engage in conventional peer observation with their colleagues and they were not satisfied with it. The peer observation that they got involved in was limited to observing one peer termly and filling in a form to submit to the school leader. It seemed that the teachers did not find this very realistic for some reasons. They thought that it should have been more supportive and constructive rather than judgmental. They did not think that the existing observation scheme was suitable to address all the issues of teaching observation. Besides, they emphasized that the need for a collaborative feedback and sharing environment with colleagues and their school leader.

According to Janet: “I see observation as ticking a form. The forms are filled in and later submitted to the school leader without discussing my views about my teaching. I don't find it fair.”

Susan explained: “We should observe more colleagues and discuss with each other the good sides and weak sides of our teaching. It shouldn't be so simple...just filling in and submitting the forms to the authority.”

Emma said: “Peer observation is something useful I believe...but you cannot learn from observing just once a term and I think it is not fair to judge a teacher just by observing once.”

Olivia stated that “I always feel nervous when I am observed because I am scared of getting a poor observation report. Evaluation of my teaching should have been different. I don't think one observation is enough. It doesn't change anything in my teaching.”

The problems in the existing system for the teachers professional development led to the design of the suggested professional development model, cooperative management.

• *Second Phase: evaluation of the new model, cooperative management.*

The analysis of the interviews conducted with the participants and the school leader revealed some important evidences for the benefits and satisfaction the participants experienced through the suggested new professional development model, cooperative management. Mainly the emerging themes were about the supportive nature of the process rather than judgmental; its positive contribution to their classroom practice; the cooperative environment with the colleagues and particularly with the authority (i.e. the school leader); the feeling of being responsible for self- development and as well as the colleagues.

The participant teachers articulated that it was the first time that they tried to keep reflective reports but they all emphasized their satisfaction with the process. They expressed how keeping reflective reports helped them become more self aware of their classroom practices and their needs related to teaching. They emphasized that this process enabled them to reflect, analyze and evaluate their practices critically which in turn had a positive impact on their classroom practices.

Susan explained that "...at the beginning I found keeping reflective reports after every lesson tiring. So I kept a notebook to note down some key words later to go back to remember what happened in class during the day. After some time I realized that keeping a journal made me think about my classroom experiences in depth and developed a critical look to self." Similarly, Emily stated that "...writing down the things happened during teaching, trying to remember what happened in class made me become more aware of my practices and helped me think of the alternatives I can bring into my teaching."

Emma's views were more focused on how the reflective reports helped her during the discussions with her colleagues and the school leader in their regular weekly meetings. She said: "...keeping reflective reports guided me in our discussions and sharings with my colleagues and the school leader because I was more aware of the points I wanted to get feedback and help about."

The school leader expressed his views about keeping reflective reports as:

"...at the beginning I thought keeping a reflective report would put extra work on the teachers and that they would not continue to keep them regularly because of their heavy teaching loads yet it was surprising to see that every teacher enthusiastically did it. I think they found it meaningful because of the weekly meetings we held because they provided the basis of our discussions for giving feedback and receiving as getting feedback from each other."

All the participants valued the weekly meetings a lot. Their views were all for the positive impact of those meetings on their teaching. They expressed how the meetings provided them a supportive, constructive and positive sharing and learning environment. The meetings did not only provide them a discussion platform but also a social interaction atmosphere for contributing to each other's critical reflection and learning.

Olivia stated that "...the meetings helped me to be in an environment where things are discussed openly without any hesitation that I would be evaluated negatively. We found such a nurturing environment to benefit from each other's views and experiences. I thought at the beginning having the school leader in those discussions would not benefit us but it worked just the opposite. The meetings were held in a very positive atmosphere. I used to be more nervous when I was peer observed because I always had the idea that the peer observation reports would be used for appraisal.

#### **4. CONCLUSION**

Successfully managing a school is crucial to the success of both the institution and the teachers. It is also crucial to the safety and understanding of processes and skills need for learning a foreign language in EFL classrooms. Research on teachers' beliefs, practices, and experience about teaching and classroom management will help teacher educators determine what experiences and knowledge included in foreign language education and professional development will best facilitate teachers' development of classroom management skills. Further research on the influences of cooperative management, such as the residual practice and collaborative process noted in this study, can provide an understanding of teachers regardless their experiences are supported in effectively managing their classroom and the ever-changing development of a teacher. These insights would be of value to teacher educators and school administrators in that they illustrate the need for administrative support in developing and implementing more dialectic processes to support teachers. Findings from this study also provide insight for school leaders and teachers on management approaches that have been suggested with this study as being effective and how to go about implementing these approaches. Since this study examines a



school leader's and five teachers' understanding and definitions of cooperative management to solve issues related to classroom management, it suggests the need for more extensive research on cooperative management approach in order to continue to examine links between their management style, understanding of classroom management, and teacher retention.

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## **Chapter #2**

### **"FATHERHOOD IN THE CLASSROOM": When Life as a Father meets the Teaching Profession**

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#### **ABSTRACT**

The current chapter deals with male-teachers perceptions of the meaning of being a father, in the teaching practice. The research is based on the reports of 43 Israeli teachers-fathers, using semi-structured interviews. The participants ages ranged between their early 30's and up to 60 years old. The age of their children ranges between children of a few months of age through adult children. Findings indicate that the main interviewees' perception, sees fatherhood as a significant experience regarding the teaching practice. The study presents 4 major ways these male-teachers see the use of their parenthood experience in their practice as teachers: 1. Recognizing different characteristics of their students; 2. Accomplishing better empathy toward the students; 3. Implementing parental personal-interaction experience with the students; 4. Understanding the students'-parents point-of-view. Implications for teachers'-training and counseling are discussed.

*Keywords:* male-teachers, teacher-father, teacher-student relations, fatherhood, work-family relations.

## **1. INTRODUCTION**

### **1.1. Teachers who are Fathers – Research Trends**

The current study focuses on a population, which in fact combines two separate issues, that are being widely dealt with in the professional literature: Male-Teachers and Fathers. The research that deals with male-teachers mainly focuses on Gender-aspects like men in a feminine professional-occupation (Armstrong & Crombie, 2000; O'Neil, 2008; White & White, 2006); Minority-majority relations (Kanter, 1981; Simpson, 2005); or Different professional practices among male-teachers and female-teachers (Drudy, 2008; Wharton, 1994). Another popular research direction is the shortage of male-teachers in most of the public education-systems in the Western-world (Azman, 2013; Cushman, 2005, 2010). The research that deals with fathers and fatherhood mainly focuses on Traditional fatherhood VS. The "New Fatherhood" trend (Beaupre, Dryburgh, & Wendt, 2010; Carpenter, 2002; Coakley, 2006; Doucet, 2006), Work-Family integration in a fathers' life (Cooper, 2000; Daly & Palkovitz, 2004; Miller, 2010; Marsiglio & Cohan, 2000; Segal, 1990) and different parental practice fathers articulate (Griggs, 2012; Hall, 2005; Lupton & Barclay, 1997).

## **2. BACKGROUND**

### **2.1. Parenthood among Male-Teachers**

Parenthood and professional-occupation are considered to be two of the most central roles in life. Parenthood among teachers is particularly interesting: review of the missions of the two practices, reveals a resemblance between them (responsibility for the

socialization processes, developmental aspects, role-modeling and caring for the well-being of the child). Due to the intersection of these two missions, it is intriguing to understand the meaning of their existence in the same person: a teacher who is a parent. Despite the potential interest in observing two such crucial social-roles together; there are not many research-papers on the subject. The studies which dealt with the issue, mostly focused on female-teachers (Cinamon & Rich, 2005; James, 2010; Sikes, 1997; Thomson & Kehily, 2011; White, 2008), apparently because of the social-identification of the teaching profession with the "natural" feminine tendency to care and nurture (Gieves, 1989; Sikes, 1997; Winnicot, 1964). Nevertheless, it is the fatherhood practice that is being increasingly addressed by a growing number of studies. Research in this area in the past twenty years, has been influenced by the transformation in the practice of fatherhood, among growing numbers of men in the Western world. This phenomenon, which has been called the "New Fatherhood", is characterized by the desire expressed by fathers to be significantly involved in raising their children (Beaupre et al., 2010; Carpenter, 2002; Coakley, 2006; Doucet, 2006; Griggs, 2012). From this point of view, the special characteristics of fathers who are teachers provide a unique case-study. It is interesting to understand the way these men, perceive the links between their similar tasks in these two different spheres. Do they find this resemblance helpful in coping with the missions of the two roles or is it rather confusing and laborious?

### **3. SAMPLE AND METHOD**

The present study focuses on the perceptions that teacher/fathers have of their parental practice and professional lives. The sample in this research included 43 fathers who teach in junior high and high schools and live in the central region of Israel. The ages of respondents ranged from 28 to 64 years, with an average age of 46.8 years. The average number of children per respondent was 2.1. The teaching disciplines of the participants were varied; two-thirds of them had additional positions within the same school (professional coordinator, assistant to the principal, etc.). More than a third of the respondents began teaching after having left a different profession; most of them are military retirees.

The methodology chosen for the present study is qualitative and the research tool used is in-depth, semi-structured interviews. It allowed us to get closer to the specific and unique perspective the participants had regarding the issues we were interested in (Josselson & Lieblich, 1996; Lincoln & Guba, 1985; Maykut & Morehouse, 1994; Stake, 1995; Strauss & Corbin, 1994). In the interviews, the participants were asked about their perceptions of their professional lives, their perceptions of being fathers and possible interfaces between the two areas. As expected in semi-structured interviews, some of the questions and issues, raised from the individual context of the interviewee's life formed the interview and where the issues we found to be relevant to the research. The interviews were recorded, transcribed and analyzed according to content-analysis techniques. After the initial reading of each interview, recurring themes were identified, defining the main themes of the study. The next step was to classify the various attitudes of respondents to the various themes. Once these attitudes were grouped and filtered, the categories that defined each theme were set (Pidgeon, 1996). The final stage of research included a thematic analysis conducted as a comparison, between the different aspects of the data, to find links, similarities or differences between them. (Lindlof, 1995).

## 4. RESULTS

The findings indicate that the main interviewees' perception sees fatherhood as an important experience that contributes to the teaching practice and their professional competence as teachers. The results are presented according to the 4 major ways in which these male-teachers expressed the meaning of being a father in relation to their practice as teachers:

### 4.1. Recognizing different characteristics of the students

In the eyes of the participants, one of the meanings of being "a teacher who is a father" is an increased sensitivity to the diversity of needs among the students. From this point-of-view, understanding the various characteristics (difficulties, different stages of development et cetera) of their own children helped them recognize those of their students.

*"I see in every child a whole world. Each and every one of them has its own needs and requests, every one of my students is like my-own child and I feel as attentive to my students as I am attentive to the different needs of my children."*

*"I am extremely sensitive to children with ADHD, much more than others...as I have experience with the issue. I am much more flexible than other teachers because of my son. You will never hear me shout, I will just tell the student to go and take a break of two minutes outside the classroom...I look at my son and I wonder how many times a teacher said a kind word to him..."*

### 4.2. "If it was my child" - Accomplishing a better empathy toward the students

The name of the category is actually a quotation of several of the interviewees. It means that sometimes thoughts about their own children formed the behavior of the teacher. It was a very dominant and clear voice regarding this issue. It includes *emotional aspects* such as the feeling that the fatherhood practice developed among the men sensitivity, forgiveness and patience towards their students. Some of the interviewees said that the experience as fathers enables them to be more responsible, understanding and encouraging as teachers.

According to the interviewees, their fatherhood emotional-experience helped them to establish a better emotional understanding (empathy) of their students. This empathy was frequently used to make professional decisions (academic, organizational and disciplinary).

*"I think that my private children made me softer...there is an interaction between my fatherhood and being a teacher. I am different now. I make a special effort, I am sitting with a student who is the same age my daughter is right now and I see that she is having the same problems with her math-exam, I see how frustrated she is...exactly like my daughter, so I could feel the need to help her once again"*

### 4.3. Implementing parental personal-interaction experience with the students

Fatherhood was often described as an opportunity for a practice-field for personal-interaction between adults and children. This gathered experience was used in professional situations.

*"I find myself many times during the day talking to students that I feel might need it...I don't have to do it, but I can see that something is wrong and I come to them and ask them about it. I became much more sensitive and I have experience in doing that. I think that I do it more because I have a son at home. I do not remember if I did things like that before I became a father..."*

#### 4.4. Understanding the students'-parent's point-of-view.

Another dominant voice expressed by the teacher-fathers was the way they feel that their parental experience contributed to their ability to understand their student-parents' point-of-view. Sometimes they felt that due to that experience, they can better advise the parents on how to act with their children.

*"When I interact with parents, I feel that I can see their point of view, I guess I can see myself in their position... I made a call to a mother of a student who had some discipline problems a while ago, and now she had started to get better, so I made that call, and I cannot forget how surprised and happy she was. I was very glad for her and I think that it is because of the experience I had with my own son this year. The same time I called that mom, I had some problems with my son at school and than his teacher called us and said that he is much better now. So I thought I might do the same..."*

In general, in some of the interviews, a few characteristics were mentioned as significant to understanding the meaning of fatherhood in the teaching practice.

For example, the *age of the children*. The closer the age of the teachers-children was to his students-age, the more he felt he can relate to his fatherhood practice as a useful component in his professional activity. Another characteristic was the teacher's age and his *fatherhood seniority*. Older and more experienced fathers were more convinced of the contribution of their fatherhood to the teaching and educating field.

Other teachers felt the fatherhood practice has an influence upon their discipline of teaching. Physical-Education teachers, for example, mentioned that watching their children play in the play-yard or in youth sport-activities, demonstrated for them the social and emotional importance of the Physical-Education classes.

## 5. CONCLUSION

A comprehensive view at the presented results, reveals a clear voice. The meaning of fatherhood practices in the teaching-profession has been described as a "*parental compass*". This compass is guiding teacher-parents and helping them demonstrate empathy for their students' difficulties and needs as well as assisting them in making professional decisions and serving as a basis for better understanding of their students' parents. These findings, regarding the contribution of fatherhood to the practice of teaching, join the existing literature, describing the parenting experience as having a significant emotional impact and being a practical catalyst for personal development in the process of maturing and the consolidation of the various areas of a person's life (Lupton & Barclay, 1997; Palkovitz, 2007; Sikes, 1997). This thought can be taken into consideration in pre-service teacher education and educational-counseling processes. Empathy is mentioned as an important component in creating a positive interpersonal communication between teachers and students (Cooper, 2010; Fresko, Reich, Sjo, & Lonroth, 2013; Stoilescu & Carapanait, 2011). Empathy is also described as relevant to demonstration of coping skills among teachers who have students with diverse needs (Bennett, 2008; Mowat, 2010; Washburn, 2008). Fresko et al. (2013) argue that consistent narrative-building activities, can contribute to improving empathy and enhancing communication skills for teachers. Parenthood is definitely a crucial component in a persons' narrative. From this perspective, it seems that turning into the teachers or trainees "parental compass" can be important when he or she needs to gain empathy towards their students' situation or needs. This training of professional intercommunication skills can be done in work-shop classes, during the training processes for teachers. The current study also demonstrates the way the "parental compass" helps teachers to better understand their students' parents. School-parent relations

are widely mentioned in the last decade as a challenging practice for both sides (Addi-Raccach & Ainhoren, 2009; Kikas, Poikonen, Kontoniemi, Lyyra, Lerkkanen, Niilo, 2011; Walsh, Harel-Fisch & Fogel-Grinvald, 2010; Yildiz, Yildirim, Ates & Rasinski, 2012). Hiatt-Michael (2006) proposed recommendations for future directions in development of family-school-community involvement programs. Two of them focus on explicitly incorporating family-community involvement knowledge, skills and values into pre-service teacher licensing programs. The "parental compass" can be used as a professional tool to establish better communication between teachers and parents.

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## Chapter #3

### GENDER DIFFERENCES IN THE IMPLEMENTATION OF SCHOOL-BASED ASSESSMENT IN A MALAYSIAN STATE

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#### ABSTRACT

This study aims to identify the differences in assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by male and female Grade 8 teachers who are involved in implementing School-Based Assessment (SBA) and the interrelationship among these five factors. In addition, this study explores the teachers' views with regards to these five factors. This study uses a quantitative questionnaire designed by the researchers, and a total of 243 Grade 8 teachers answered the questionnaire. Qualitative data was then collected via semi-structured interviews which were conducted with 20 teachers. The findings show that male teachers are more ready to implement SBA compared to female teachers. Compared to the female teachers, the male teachers view school support as more important. In terms of knowledge, skills and challenges towards the implementation of SBA, there are no gender differences. The findings also show that there exist significant relationships among the five factors except between school support and challenges faced in SBA. Although male and female teachers share many similar views, the predominant view among female teachers when compared to the male teachers is that many challenges and issues need to be addressed in the implementation of SBA. The findings from the interviews also suggest that male teachers are more willing to accept changes when compared to the female teachers. This study has implications for the implementation of SBA in Malaysia because 63% of the teachers implementing SBA are females.

*Keywords:* School-Based Assessment (SBA), gender, teachers' knowledge, school support, teachers' skills, teachers' readiness.

#### 1. INTRODUCTION

School-Based Assessment is a form of holistic assessment which assesses the cognitive (intellectual), affective (emotions and spirituality) and psychomotor (physical) aspects. "School Based assessment is regarded as a tool to more accurately reveal the true ability of a student, reduce the limiting effects of 'exam fright', and to increase the confidence of students as they have already learnt and brought to practice the examination contents and skills during the conduct of their SBA projects" (Barley, 2013, p. 24). SBA assesses the process and product of the learning process formatively and summatively based on the concept of 'assessment for learning' and 'assessment of learning'. In Malaysia, the earlier emphasis on an exam-oriented system is moving towards on-going assessment in which teachers continuously assess their students (Azlin-Norhaini, Ong, Mohamad-Sattar, Rose-Amnah, & Nurhayati, 2013). SBA is planned, evaluated and reported in a systematic manner according to procedures set by the Malaysian Examination

Council. In order to ensure the quality of the implementation of SBA, the mechanisms for coordinating and monitoring SBA were implemented to increase the reliability and validity of the assessment scores. Furthermore, the success of SBA is based on the assumption that teachers have undergone formal training and attended refresher courses to acquire skills in their professional development career .

Since the end of the 90s and the beginning of the year 2000, SBA has slowly made its way into the Malaysian education system (Chan, & Sidhu, 2012, p. 1). The assessment transformation that took place starting from 2010 marked a shift from an exclusively common centralized exam-driven system to one that partially introduced a school-based assessment system. SBA has been implemented for selected subjects such as Geography, History, English (oral), Science, Religious Studies and Living Skills. Within each of these subjects, SBA has been implemented partially, which is approximately 30% of the total marks. Thus, this shift should be understood in the larger context of the Malaysian education policy in which the Malaysian Examination Council and the schools cooperate to conduct assessments in a more holistic manner. Thus, SBA can be likened with a catalyst to reform the education assessment in Malaysia.

A new assessment approach called SBA was introduced in Malaysian secondary schools in 2011. It was launched with the intention to produce world class human capital. SBA consists of two components, that is, academic and non-academic. The academic category consists of School Assessment (SA) and Centralized Assessment (CA) whereas the non academic category consists of Psychometric Assessment (PA) as well as Cocurricular, Physical and Sports Activities Assessment (CPSAA) (Khodori, 2012). Hence, SBA has been integrated as a component of the school assessment system. The assessment is conducted on an ongoing basis by subject teachers according to the stipulations outlined by the Malaysian Examinations Board (Nor-Hasnida, 2012). However, the Malaysian SBA cannot be viewed as a new form of assessment in the global context as SBA has been accepted and implemented in countries such as Australia, New Zealand, England, Scotland, Canada and South Africa (Barley, 2013). Further more, study by Arsaythamby, Hariharan and Ruzlan (2015) shows that majority of teachers are knowledgeable in implementing SBA in Malaysia secondary school. SBA is seen to be advantageous as it can reduce students' anxiety because students would have obtained a certain percentage of their marks before they sit for the actual examination (Kerr-Phillips, 2007). Additionally, this strategy is based on an effort to make schooling more fun and mark a shift away from examination-oriented national educational assessments (Ministry of Education, 2009). Educational leaders, administrators, and teachers are faced with challenges regarding the best ways to motivate students and accurately report their progress (Popham, 2011).

It is widely accepted that teachers play a significant role in student assessment. Brown (2004) had conducted a study that investigated teachers' conceptions of assessment in the context of improvement of teaching and learning, school accountability, student accountability, and treating assessment as irrelevant. His findings indicated that teachers were frequently identified as having a positive or negative impact on students' achievements, attitudes towards mathematics or English, and on future career directions. Generally, male teachers perceived themselves to be more skillful in analyzing test results compared to female teachers. Although males reported a higher level of self-perceived assessment skills in constructing and administering tests than female teachers, the difference between male and female teachers was smaller. Female teachers perceived themselves to be more skillful in communicating assessment results than male teachers (Alkharusi, 2011).

### **1.1. Problem statement**

The implementation of SBA poses some challenges to teachers. Teachers are now required to use the online reporting system, document files and manage various forms of assessments. Teachers encountered problems in completing the assessment according to schedule and ensuring the authenticity of assessment; hence leading to the question of whether the teachers are capable and have sufficient knowledge to carry out SBA (Kamil, 2008). The overall impact of these new developments is that assessments for excellent students might not meet the original objectives of the SBA. Teachers could be satisfied with the implementation of a test at the highest difficulty level to determine the student's achievement. On the other hand, teachers who teach the low achievers or students from the weaker classes might feel more stress. Some teachers might take shortcuts by helping students to answer questions that are beyond the students' abilities and show this as evidence of high achievement levels (Utusan Malaysia, 2014). Furthermore, the weak implementation of SBA has led to more teacher criticisms because they are burdened with additional clerical work. This study considers gender differences in the implementation of SBA in Malaysia because from a total of 178,080 secondary school teachers, 69% of the teachers are females (Ministry of Education, 2013). Hence, it is deemed appropriate to consider gender in this study because of the large numbers of male and female teachers serving in Malaysian secondary schools.

### **1.2. Gender differences in assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by teachers**

Some research has been conducted to evaluate school support for the implementation of SBA based on gender. A study was conducted by Yusof and Mohd-Musa (2011) in all national schools in selected districts in Johor, the southern most state in Peninsular Malaysia. The aim of the study was to determine school head teachers' support to implement SBA based on gender. The findings showed that there were no gender differences. A study by Rosni and Siti-Fatihah (2010) on 60 secondary school teachers who taught examination classes in Grade 9 and Grade 11 in Kota Bharu (Peninsular Malaysia's north-eastern state) showed no gender differences in teacher readiness to implement SBA.

A study by Ikhsan, Norila and Nurul (2013) on 157 school teachers found that there were no gender differences for teacher knowledge in the implementation of SBA. This means that male and female teachers had similar perceptions on the implementation of SBA. The study conducted by Rosni and Siti-Fatihah (2010) with 23 male teachers and 37 female teachers showed that there were no gender differences in terms of readiness to improve knowledge, skills and develop expertise in the implementation of SBA. Ikhsan et al. (2013) conducted a quantitative study on challenges faced by teachers in the implementation of SBA. The sample comprised 61 male teachers and 96 female teachers. Gender differences were evident in the challenges as time was deemed to be insufficient to implement SBA.

## **2. RESEARCH OBJECTIVES**

Malaysia has implemented SBA since 2011 in public secondary schools. Teachers have been involved in the implementation of SBA for about five years. Hence, this study identifies the differences in assessment knowledge, school support, teacher readiness,

teacher skills and challenges faced by Grade 8 teachers based on gender. This study also identifies the interrelationship between knowledge, school support, teacher readiness, teacher skills and challenges that teachers face in the implementation of SBA. In addition, this study also explores these teachers' assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by male and female teachers.

### **3. METHODOLOGY**

This study adopts a mixed-method approach using the explanatory research design (Creswell, 2014), whereby the quantitative data is collected using a self-developed questionnaire and the qualitative data is collected via semi-structured interviews.

#### **3.1. Sampling**

A total of 243 teachers from the state of Kedah in Peninsular Malaysia, who taught Grade 8 in public secondary schools, were selected using systematic random sampling. These teachers comprised of 60 (25%) male and 183 (75%) female teachers who were involved in the implementation of SBA. This ratio of male to female teachers reflects the ratio of male to female teachers in Malaysia, which is 1:2.25 (Harian Metro, 2010). All the 243 teachers had responded to the questionnaire and 20 of them (10 males and 10 females) were then randomly selected to participate in the semi-structured interviews.

#### **3.2. Instruments**

The instrument used in this study is a questionnaire designed by a lecturer to measure the implementation of SBA on different dimensions. The questionnaire comprised items on the subject, gender, school support (12 items-  $\alpha = .90$ ), teacher readiness (20 items-  $\alpha = .90$ ), teacher knowledge (16 items-  $\alpha = .94$ ), skill (12 items-  $\alpha = .94$ ) and challenges (29 items-  $\alpha = .94$ ). A 5-point Likert scale was used in the questionnaire. Numbers were assigned to each of the options, which are, strongly disagree (1), disagree (2), moderately agree (3), agree (4), and strongly agree (5). The correlation coefficient for each construct shows a score level of .70 or more that is generally accepted as a good level of reliability (Litwin, 1995). Interview sessions were held according to a schedule drawn up by the researchers. The questions for the semi-structured interviews are based on five themes, namely, school support, teacher readiness, teacher knowledge, teacher skills and challenges.

#### **3.3. Procedure for collecting data**

The data collection process was meticulously planned so that the researchers could get the data they needed. Preference was given to teachers who had taught a SBA subject for more than a year. Every teacher was given a period of one week to complete the questionnaire. This duration of time was given so that teachers had ample time to think and respond to the questions. As for the semi-structured interviews, individual teacher interviews were conducted after class hours according to an agreed upon schedule. The interviews allowed the teachers to express their views on SBA based on the five themes. The five themes are school support, teacher readiness, teacher knowledge, teacher skills and challenges.

## 4. RESULTS

### 4.1. Gender differences towards school support, teacher readiness, teacher knowledge, teacher skills and challenges in the implementation of SBA

Levene's test shows no significant differences ( $p > .05$ ) between gender and school support, teacher readiness, teacher knowledge, teacher skills and challenges in the implementation of SBA. These results assume equal variances between male and female teachers towards school support, teacher readiness, teacher knowledge, teacher skills and challenges in the implementation of SBA. The independent t-test shows a statistical significant difference ( $t(241) = 2.76, p < .05$ ) between school support and gender. The mean score for male teachers (3.57) is higher than the mean score for female teachers (3.29) for the school support in the implementation of SBA (Table 1). The independent t-test shows a statistically significant difference ( $t(241) = 2.68, p < .05$ ) between teacher readiness and gender. The mean score for male teachers (3.47) is higher than the mean score for female teachers (3.23) for teacher readiness in the implementation of SBA (Table 1).

The independent sample t-test [ $t(241) = .61, p > .05$ ] shows that there is no significant difference in teacher knowledge towards the implementation of SBA based on gender. The independent sample t-test shows that there is no significant ( $t(241) = 1.75, p > .05$ ) gender difference in terms of teacher expertise and also no significant ( $t(241) = -1.01, p > .05$ ) gender difference in challenges faced by teachers in the implementation of SBA.

*Table 1. Results for male and female teachers towards school support, teacher readiness, teacher knowledge, teacher skills and challenges in the implementation of SBA.*

Themes	Gender	N	Mean	SD	df	t	p
1.School support	Male	60	3.57	.67	241	2.76	.01*
	Female	183	3.29	.69			
2.Teacher readiness	Male	60	3.47	.67	241	2.68	.01*
	Female	183	3.23	.57			
3.Knowledge	Male	60	3.64	.60	241	.61	.55
	Female	183	3.58	.58			
4.Teacher skills	Male	60	3.53	.72	241	1.75	.08
	Female	183	3.37	.58			
5.Challenges	Male	60	3.65	.50	241	-1.02	.31
	Female	183	3.71	.43			

$p < .05, p > .05$

### 4.2. Relationship between assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by teachers

The Pearson correlation test shows that there is a significant positive relationship ( $r = .40, p < .01$ ) between school support and teacher knowledge in the implementation of SBA. This positive relationship shows that strong school support will enhance the level of teacher knowledge in the implementation of SBA while weak support from the school will result in a lower level of knowledge in the implementation of SBA. The relationship between school support and teacher knowledge is low ( $r = .40$ ).

The Pearson correlation shows a significant positive relationship ( $r = .65, p < .01$ ) between teacher readiness and teacher knowledge in the implementation of SBA. This positive relationship shows that when the level of teacher knowledge is high, the level of teacher readiness is also high to implement the SBA, and vice versa. The relationship between teacher readiness and teacher knowledge is average ( $r = .65$ ). The Pearson

correlation shows a significant positive relationship ( $r = .65, p < .01$ ) between teacher skills and teacher knowledge in the implementation of SBA. This positive relationship shows that when the level of teacher knowledge is high, the level of teacher skills is also high, to implement the SBA, and vice versa. The relationship between teacher skills and teacher knowledge is average ( $r = .65$ ). The Pearson correlation test shows a significant negative relationship ( $r = -.15, p < .05$ ) between the challenges faced by teachers and teacher knowledge in the implementation of SBA. This negative relationship shows that when the level of teacher knowledge is high, the levels of challenges faced by teachers to implement SBA are low, and vice versa. Nevertheless, the relationship between challenges faced by teachers and teacher knowledge is weak ( $r = .15$ ).

*Table 2. Results for teacher knowledge, school support, teacher readiness, teacher skills and challenges faced by teachers in the implementation of SBA.*

	(1)	(2)	(3)	(4)
Teacher knowledge	.40**	.65**	.65**	-.15*
School support (1)	1	.54**	.52**	-.11
Teacher readiness (2)		1	.74**	-.26**
Teacher skills (3)			1	-.25**
Challenges (4)				1

\*\* $p < .01, p > .05$

### **4.3. Teacher Perception on school support, teacher readiness, teacher knowledge, teacher skills and challenges in the implementation of SBA according to gender**

Semi-structured interviews were conducted to elicit information on five factors in the implementation of SBA in Malaysian secondary schools according to gender. These factors are teacher knowledge, school support, teacher readiness, teacher skills and challenges. These themes run parallel to the themes investigated under the initial quantitative phase of the study. The responses of 10 male and 10 female teachers are discussed below.

#### **4.3.1. Teacher knowledge**

The responses of the teachers generally suggest that SBA is a good assessment approach for Malaysian secondary schools though most of them feel that there are certain gaps when it comes to its implementation. Most of the male teachers interviewed have a more positive view of SBA compared to their female counterparts who have several concerns regarding SBA. A majority of the male teachers see the benefits of implementing SBA, which is a shift away from the fully centralised examination-oriented approach. They feel that the implementation of SBA would be better if sufficient time is given for them to complete and manage the tasks related to SBA. Although female teachers, too, acknowledge the benefits of SBA, they raised several issues such as doubts about proper ways in implementing SBA, the need for a consistent system, the continuous preparation of assessment and the excessive homework that may result from its implementation.

#### **4.3.2. School support**

Male teachers perceive that their schools are trying very hard to help the teachers. They, however, do not deny that more needs to be done, especially with regard to facilities. The female teachers agree with their male counterparts. Nevertheless, they feel that they did

not receive enough inhouse training and all the necessary details they would like to haveregarding SBA. The female teachers perceive that even the school is not sure what needs to be done. Furthermore, female teachers raised more issues related to school support by giving more specific examples, such as updating information required and providing details where necessary. A major difference between male and female teachers is that female teachers see a greater need for more details in the actual prodecures and microlevel management. The male teachers on the other hand, though they do recognize problems with the implementation of SBA, feel that the prevalent problems are within manageable limits.

#### **4.3.3. Teacher readiness**

In comparison to the male teachers, female teachers mentioned more issues regarding their readiness to implement SBA. For example, female teachers are very concerned about the frequent changes that they haveto endure during the process of preparing and implementing SBA. The female teachers raised issues of tiredness among them. They also perceive that many students are not happy with SBA because they seem to have so many things to do for the assignments and there are so many subjects. The female teachers also think that SBA would result in students not being able to focus on learning. The female teachers expressed strong views which imply that the very purpose of SBA might not be achieved. Typical remarks express the core idea that there would be a shift from actual learning and understanding to completing the tasks assigned on time. On the other hand, male teachers, too, generally expressed their concern, but did not perceive the issues to be as severe as their female counterparts. Nevertheless, both male and female teachers believe that cooperation among teachers would contribute meaningfully to the implementation of SBA.

#### **4.3.4. Teacher skills**

Female teachers believe that they have the teacher skills because they are trained in marking and assessing assignments. However, they feel that the guidelines given to them are still unclear. Male teachers perceive that they had received appropriate training, although some SBA based practices are still unclear for them. Nevertheless, they generally feel that they could adapt themselves to meet the requirements of SBA. Thus, it can be seen that most of the female teachers emphasize the need for more guidance if they are required to conform to SBA requirements.

#### **4.3.5. Challenges**

Male teachers accept the fact that they would face challenges in implementing SBA. They have the general view that any new system will definitely face some problems. Notably, they acknowledge that things would improve after a series of discussions among the policy makers. They remain optimistic that eventually, better solutions would be found. The female teachers see the challenges in the implementation of SBA whereby some feel that parents still give importance to final scores. Several female teachers also feel that there is less purpose or motivation to learn for the students, because there are no terminal examinations. Hence, the pressure to academically perform is lacking.



## 5. DISCUSSION AND CONCLUSION

This section discusses the findings from the quantitative and qualitative investigations. The discussion focuses on gender differences in assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by Malaysian secondary school teachers in implementing SBA. It also discusses the relationship between school support, teacher readiness, teacher skills and challenges faced by them towards teacher knowledge in the implementation of SBA.

### 5.1. Gender differences in assessment knowledge, school support, teacher readiness, teacher skills and challenges faced by teachers

The results show that school support is very important in the implementation of SBA. Male and female teachers view school support differently. Male teachers feel that school support is more evident in the implementation of SBA, unlike most of the female teachers. The semi-structured interviews provide further evidence that female teachers have more issues regarding the school support that they receive or expect to receive. This result contradicts with the findings of a study conducted by Yusof and Mohd-Musa (2011) which showed that there were no gender differences among teachers in Johor, the southernmost state in Peninsula Malaysia. The level of teacher readiness, too, shows differences. The results show that male teachers are more ready to be totally engaged with the SBA when compared to female teachers. Additionally, the semi-structured interviews lend support to this view. This finding contradicts with the findings in Rosni and Siti-Fatihah's (2010) study.

Table 2 shows that there are no gender differences in terms of knowledge. This shows that the teachers involved in SBA have the experience and knowledge in their respective subjects. This finding concurs with the findings in Ikhsan et al. (2013) study which show that male and female teachers have the same perception on the implementation of SBA. The findings show that there are no differences in terms of teacher skills in the implementation of SBA based on gender. These findings are similar to the findings in a study conducted by Rosni and Siti-Fatihah (2010).

According to McMillan (2000), teachers who are knowledgeable on assessment are able to integrate assessment effectively in their teaching and plan their teaching strategies well. Furthermore, they are able to motivate their students. The findings show that there are no significant gender differences in the challenges they face.

### 5.2. Relationship between school support, teacher readiness, teacher skills and challenges faced by teachers towards teacher knowledge in the implementation of SBA

The results of the Pearson correlation test shows a weak or average positive test between school support, teacher readiness, teacher skills and teacher knowledge in the implementation of SBA. The only negative relationship is between challenges faced by teachers and teacher knowledge in the implementation of SBA and the negative relationship is weak.

SBA is a form of holistic assessment which assesses the cognitive (intellectual), affective (emotions and spirituality) and psychomotor (physical) aspects. "School based assessment is regarded as a tool to more accurately reveal the true ability of a student, reduce the limiting effects of 'exam fright', and to increase the confidence of students as they have already learnt and brought to practice the examination contents and skills during the conduct of their SBA projects" (Barley, 2013, p. 24).

SBA is seen to be advantageous as it can reduce student anxiety because students have obtained a certain percentage of their marks before they sit for the actual examination (Kerr-Phillips, 2007). Additionally, this strategy is based on an effort to make schooling more fun and mark a shift away from examination-oriented national educational assessments (Ministry of Education, 2009). Educational leaders, administrators, and teachers are faced with questions regarding the best ways to motivate students and accurately report their progress (Popham, 2011).

SBA has been designed and implemented so that the standard of education in Malaysia is able to further improve and meet world standards. The results of this current study show that there are weaknesses in the implementation of SBA. The responsibility to ensure that quality measures are maintained in the development and implementation of educational assessment lies with all the stakeholders who are involved with this system. Policy-makers can make use of the results in this study to make appropriate changes or amendments to existing processes and procedures in the implementation of SBA so that teaching and learning in schools are aligned to the assessments that are conducted. Instruments used in the assessments, too, can be further improved so that teachers are able to contribute more to the teaching and learning experience of students.

Teachers on the whole are aware of their role in the implementation of SBA. The successful implementation of SBA will be determined by the commitment shown by teachers and the cooperation of all the stakeholders in the Malaysian education system. Similar to many other parts of the world, female teachers make up a larger proportion of the Malaysian teaching force when compared to the male teachers. The implication here is that if female teachers are not prepared or sufficiently ready to implement SBA, the implementation of SBA could be adversely affected.

All stakeholders, especially teachers are responsible and play a critical role in the implementation of SBA to ensure the quality and standard of assessment. A combination of a dual system in assessment poses new challenges. The interviews reveal that in principle, most of the male and female teachers are in agreement that SBA should be implemented. However, female teachers express more reservations and are less positive compared to their males counterparts.

If implementation is guided by the objectives and appropriate practices to achieve SBA, it will create a positive school environment in which students will be able to realize their potential in a harmonious environment. The positive school environment will be conducive to reduce social problems that are prevalent among school-going children and encourage school attendance. This will be a meaningful transformation to the educational experience in Malaysia. Moreover, studies such as this will provide additional input that can be used by curriculum designers, policy-makers and administrators to continually make improvements to the SBA.

## 6. FUTURE RESEARCH DIRECTION

The study points to a need to be more sensitive towards the challenges faced by teachers in the actual implementation of SBA in classrooms as there seems to be a gap between the aims of the SBA and the requirements to fulfill its noble objectives. This is prevalent in the in-depth views expressed by teachers regarding the challenges they face in the implementation of SBA. Hence, further studies, comprising larger samples of Malaysian secondary school teachers is deemed necessary. The results from these studies could inform the stakeholders and policymakers in planning and implementing relevant strategies towards the enhancement of SBA according to Malaysia's needs.

There is evidence from the responses in the interviews that both male and female teachers are concerned about the implementation of SBA and generally express their willingness to support the implementation of the new approach to assessment in Malaysian secondary schools. Future research on whether or not there exist significant differences between male and female teachers in their assessment strategies within the context of SBA could provide more insights on the role of gender in SBA.

Improved educational assessments will result in more accurate information on the level of student achievement while information on the challenges faced by teachers will provide useful input to improve on SBA practices. Hence, future studies related to assessment materials and challenges that teachers face in the implementation of SBA need to be conducted so that the quality of assessments carried out by secondary school teachers, irrespective of gender, can be improved.

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## Chapter #4

# INQUIRY-BASED SCIENCE EDUCATION MODULES AND THEIR EFFECTS ON TEACHER EDUCATION

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### ABSTRACT

Inquiry-based science education (IBSE) is currently rated as a promising educational method in science education. Science teachers should be provided with specific IBSE teaching/learning methods, techniques and tools, especially as teacher education for the implementation of IBSE in instruction is not yet sufficiently provided. The objective of this research is the development of an IBSE teaching method, based on modules in IBSE. The second objective is the implementation of this educational method into science teacher education. This research was conducted within the PROFILES project in the European 7<sup>th</sup> Framework Programme. The basic methods of the research were design-based research and the curricular Delphi study. The outcome of the PROFILES curricular Delphi study is a set of concepts in science education which were used as the theme for the overall design-based research. The main outcomes of the design-based research are the IBSE modules, which were used as the basis for training teachers in IBSE implementation. Emphasis was given to the teacher ownership and creativity. These modules were verified by teachers in practice through their action research. The PROFILES module “Safety of the human body: swimming and diving” is shown as a specific example of the research outcomes. An important research finding is that teachers educated in this way continue to implement this innovative educational method, which they acquired during their specific training in the project.

*Keywords: IBSE, module, science education, teacher education.*

### 1. INTRODUCTION

Nowadays science, as a core part of STEM (Science, Technology, Engineering and Mathematics), pervades many aspects of human lives. STEM is vital to our future and especially to the future of today’s children. For this reason, STEM is considered to be a crucial part of education for the current and future population. There is also expert consensus that science education should be a compulsory part of the education of all children. School science education does not perform this role (Osborne & Dillon, 2008) as some curricula are conceived as basic preparation for the minority of students who will become future scientists. This approach to science education is not appropriate for the majority of students who require a broad overview of the main ideas that science offers to help them acquire an understanding of the contemporary world. This conception of science education does not support the involvement of young people in the further study of science either, due to its lack of motivation.

Educators have the task of developing effective educational methods which are appropriate for innovative teaching/learning science and including practices that promote the learning of scientific concepts and processes as well as student inquiry, thus acquainting students with scientific methods showing how scientists study the natural world.

These hands-on and minds-on practices typically fill this role in inquiry-based science education (hereinafter IBSE), which is considered a suitable method for science education (Osborne, Ratcliffe, Collins, Millar, & Duschl, 2001; Osborne & Dillon, 2008; Duschl & Hamilton, 1998; Bell, Smetana, & Binns 2005; Banchi & Bell, 2008; Marshall & Horton, 2011). IBSE is a pedagogical approach which utilizes a constructivist theoretical framework to promote student learning. The core principles of IBSE are the involvement of students in discovering natural laws, linking information into a meaningful context, developing critical thinking and promoting positive attitudes towards science.

It is now necessary to develop specific IBSE methods and tools for teaching/learning in school practice as well as suitable teacher education for their implementation, which is crucial for the effective application of IBSE. The importance of high quality science teachers was, is and will be undisputed, but the most effective ways to prepare science teachers for implementing new methods into their practice are currently under discussion (Osborne & Dillon, 2008; National Research Council, 2010; Duschl & Grandy, 2008). Based on research findings (Osborn et al., 2001; Darling-Hammond & Bransford, 2007), teachers more easily accept changes to the curriculum than demands for transformation of their teaching style; they take a stand against adapting their teaching methods (Osborne, Duschl, & Fairbrother, 2002). They have built-in beliefs about ways and what to teach which are not easy to change. The issue of teacher education became one of the issues dealt with within the project PROFILES in the European 7<sup>th</sup> Framework Programme. The ways in which to implement continuous professional development (hereinafter CPD) in order for teachers to change their beliefs and ineffective teaching methods have been investigated. Science teacher education in the frame of the PROFILES CPD was implemented over three years because most teachers require a considerable amount of time to adopt the roles, beliefs and practices that are required in IBSE. The effectiveness of the created PROFILES CPD was verified in practice. This chapter presents the research results of the implementation of innovative methods and tools in IBSE into science teaching/learning and into science teacher education (CPD).

## **2. BACKGROUND**

Current science and technology are developing rapidly and they deeply affect our everyday lives and education, which has to face economic, environmental, and social challenges, to an even greater extent. Therefore, it is necessary to prepare today's students for interaction with new science and technology ideas and their applications in the future. But there are some opinions (Robinson, 2009) stating that schools educate more for the past than the future. It was always difficult to define what knowledge and skills young people would need in the future, but in this era of rapid technological development, it is even more difficult. It is necessary to consider what science education students should receive that is appropriate with regard to content and format for their future life. In this context, the structure of the curriculum, educational methods and also motivation of students are discussed. To achieve their full potential as adults, children need to develop not only a range of skills and knowledge of school subjects but also skills such as problem solving, critical thinking, communication, collaboration, and self-management, which are often referred to as "21st century skills", and which business and political leaders would like to see developed in schools. Students should acquire a set of skills including critical thinking,

problem solving, cooperation, communication and self-education (Pellegrino & Hilton, 2012). Because the socio-economic success of Europe 2020 depends on the education of the new generation, new ways of science teaching/learning which should prepare today's children for their adult roles as citizens, employees, managers, parents, volunteers, and entrepreneurs, are being sought.

In the twentieth century educators have defined several science concepts as pragmatic, humanistic, scientific, etc. But these concepts are outdated and unsatisfactory. It is necessary to find a new concept, which would meet the current educational requirements. The effort to create a new paradigm comes from the need to change science education. The current science education should be focused on the design of instructional environments that involve students' scientific inquiry, supporting understanding of science and the interest of students. An inquiry approach, if carried out effectively, offers the promise of achieving crucial aims like understanding fundamental scientific ideas; of the nature of science, scientific inquiry, reasoning; scientific competences of gathering and using evidence; scientific attitudes, both attitudes within science and towards science; skills that support learning throughout life; the ability to communicate using appropriate language and representations to a greater degree than traditional approaches to teaching and learning science (Bell, Smetana, & Binns, 2005; Banchi & Bell, 2008; Marshall & Horton, 2011). Engaging students in inquiry-based instruction dates back to Dewey (1938), who believed that students learn from their experiences gained through activities or real world problem-solving and discussion with others. This constructivist view of learning gives theoretical support to teachers in facilitating students in developing their own knowledge through the process of interacting with objects in the environment and engaging in higher-level thinking and problem solving (Driver, Asoko, Leach, Mortimer, & Scott, 1994).

As mentioned above, IBSE is currently considered to be an appropriate method that matches the constructivist principles of science education and meets the requirements for innovative science education. Students identify a problem or pose a question, propose an explanation or solution, choose a method to test their proposal or answer their question and, through the process of inquiry, extend their knowledge and develop deep conceptual understandings (Bell, Smetana, & Binns, 2005; Banchi & Bell, 2008; Marshall & Horton, 2011; Osborne, Duschl, & Fairbrother, 2002). These activities are more student-centred than teacher-centred and are related to issues of everyday student life, therefore they support the intrinsic motivation of all students, not only those who are interested in science. With regard to teacher and student involvement, it is possible to define four levels of IBSE: confirmative, structured, guided and open (Banchi & Bell, 2008). The extent of teacher direction in inquiry based learning is a critical factor in determining the level of the inquiry. All inquiry levels include the same basic features – a central question or problem, an information-seeking phase and a concluding stage, but IBSE is arranged on a continuum, with confirmation inquiry at one end of the spectrum and open inquiry at the other (Bell, Smetana, & Binns, 2005; Banchi & Bell, 2008), which illustrates how inquiry-based learning can range from highly teacher directed to highly student directed. To keep students optimally challenged, it is crucial that teachers adjust their role while directing students from structured inquiry towards open inquiry.

However, it is necessary to educate teachers in the implementation of IBSE into student science education, because the quality of teachers is one of the most important factors influencing educational outcomes (Darling-Hammond, 2000; Hanusek, Kain, & Rivkin, 2005). In order to be successful IBSE has to be accepted by teachers, because research findings show that teachers are reluctant to accept the changes of teaching



activities, practices, and curricula which are forced upon them by administrators, policy-makers, etc. (Pajares, 1992; Raymond, 1997; Richardson, 1998; Lederman, 1999; Powers, Zippay, & Butler, 2006). Findings substantiate (Pajares, 1992; Powers, Zippay, & Butler, 2006; Marshall & Horton, 2011) the close relationship between teachers' beliefs and their school practice. Teachers have to believe in IBSE and accept it as their own teaching style. But according to Raymond (1997), there is inertia in teachers' beliefs; therefore it is important to prepare effective science teacher education in the form of CPD. If teacher education is to be successful, it is necessary to know teacher beliefs and attitudes towards science education, which is why some specific research was undertaken – a curricular Delphi study.

The development of innovative teacher education respecting new trends in science education was involved as a core issue in the PROFILES project (**P**rofessional **R**eflection-**O**riented **F**ocus on **I**nquiry-based **L**earning and **E**ducation through **S**cience) in the European 7th Framework Programme (PROFILES, 2015). The aim of this project was to find a method of teaching/learning that meets the principles of IBSE and to prepare a suitable method of science teacher education. A *PROFILES module* was developed as an appropriate specific teaching/learning instrument. Project activities also focused on teacher-participant CPD aimed at the implementation of PROFILES modules in IBSE. Teachers and participants in this CPD went through the following roles:

- *teacher as learner* - mastery of knowledge related to modules
- *teacher as teacher* - recognizing and meaningfully adopting teaching strategies for student inquiry learning and an IBSE approach to teaching
- *teacher as reflective practitioner* - developing and adapting modules based on cultural and gender needs, promoting student cooperative learning, development of strategies for intrinsic motivation, open inquiry learning, student learning classroom climate, meaningful assessment/feedback strategies
- *teacher as leader* - guiding the development of innovative pedagogical practices by other teachers, especially to stimulate autonomous learning, to guide teachers to recognize the need and approach to enhancing scientific literacy for responsible citizenry and careers

Detailed description of the objectives, methods and outputs of the project PROFILES can be obtained from <http://www.profiles-project.eu/>.

According to (Harlen & Allende, 2009), when teachers are learning to use new materials and pedagogy, their needs are similar to those of any learners, particularly the need to communicate with and have feedback from others and to have time for reflection as learners. These are more likely to be provided, and teachers are more likely to develop ownership of their learning, when professional development sessions take place intermittently over a period of time, with opportunities between sessions for teachers to practice what they have learned in their own classrooms and to share experiences from their roles as teachers or reflective practitioners with others. Implementation of this way of CPD assumes a change in teacher beliefs.

### 3. OBJECTIVES AND METHODS

Research questions were based on the project objectives, which were to develop an effective IBSE special teaching/learning method and to develop a teacher training method for appropriate implementation of this educational method. The first research question concerning the IBSE educational method was: *Which innovative educational method of teaching/learning science meets school practice needs and complies with the principles of*

*IBSE?* The second research question aimed at teacher training was: *Can teacher training in IBSE implementation affect teachers' professional and personal development?*

To address the research questions, two main research methods used were: design-based research (Reeves, 2006) and the curricular Delphi study (Osborn et al., 2001; Bolte, 2008). The main reason for choosing BDR as a research method was its close link to school practice and its developmental character. The PROFILES project was focused on the research and development of fundamental problems of school practice, specifically on innovation in science education. The main products of the research had to be verified in practical action research. The teacher-participants of the project were members of the research team as well as research objects.

Design-based research (hereinafter DBR) can be described as a cycle analysis of a practical problem, development of solutions, testing of solutions, reflection and implementation (Reeves, 2006).

In this case, DBR has the following structure:

(1) *Analysis of practical problems*: the existing educational problems in the implementation of IBSE and teacher training were identified especially by use of the curricular Delphi study which was adapted for the PROFILES project (Bolte et al., 2012). Detailed description of the PROFILES curricular Delphi method can be obtained from PROFILES (2015). The main objective of this curricular Delphi study was to find out the views of different groups of respondents-stakeholders in science education to the contents and objectives of science education in general as well as to engage them to express an opinion on IBSE and motivation. Four groups of respondents-stakeholders in the Czech Republic were questioned: 56 upper secondary school students (age 14-16), 30 science teachers (secondary school teachers), 28 science educators (university teachers) and 25 scientists (university researchers). The Czech part of the PROFILES curricular Delphi study on science education was carried out in three rounds between the years 2011-2013. The output of the second round of the PROFILES curricular Delphi study was three concepts of science education and the third round was aimed at the opinions of respondents-stakeholders on them. The views of the respondents were examined from two perspectives: reality (practice) and priorities (wishes) of science education in schools.

(2) *Development of solutions with a theoretical framework*: a special teaching/learning method based on all IBSE principles (IBSE module) was developed and teacher training courses for module implementation were created. At this stage, specific development of IBSE modules was conducted.

(3) *Evaluation and testing of solutions in practice*: In this step of the DBR several research methods were used. Teachers-participants of the PROFILES CPD verified the appropriateness of the modules using action research, which allowed testing and also development of modules. After implementation of the PROFILES modules, teachers-participants were asked to find out their beliefs regarding their ownership and improvement of their competences. The research PROFILES team from Weizmann Institute (Israel) developed a questionnaire with a 9-point Likert scale of responses (1 point is the minimum, 9 points is the maximum) for identifying these teachers' opinions (Bolte et al., 2012).

(4) *Documentation and reflection to produce "Design principles"*: The final stage was the documentation and the establishment of new principles for the implementation of the PROFILES modules.

Within the DBR partial additional quantitative and qualitative research methods such as an interview and tests were also used.

#### 4. RESULTS

The research results presented in this chapter were developed within the frame of the PROFILES project; however, they were acquired, processed and modified by the authors of the chapter in specific conditions in the Czech Republic. These creative research outputs include in particular the findings of the role of experiments in IBSE and their taxonomy (Trna, 2013), development of special IBSE methods for gifted students (Trna & Trnova, 2014), studying the development of teacher creativity during the PROFILES CPD courses (Trnova, 2014), etc.

When implementing the first step of the DBR (*1. Analysis of practical problems*) the curricular Delphi study was used. It brought about many findings, the main ones being the three innovative approaches to science education that the stakeholders recommended for the future. In the following part three concepts of science education as the outcome of the curricular Delphi study are presented. Brief characteristics of the particular concepts are introduced:

(A) Awareness of science in current, social, globally relevant and occupational contexts in both educational and out-of-school settings, enhancing emotional personality development and basic skills

(B) Intellectual education in interdisciplinary contexts refers to an engagement with science, its terminology, methods, basic concepts, interdisciplinary relations, findings and their perspectives, which enhance individual intellectual personality development

(C) General science-related education and facilitation of interest in the contexts of nature, everyday life and living environmental issues which take up and promote students' interests, enhancing general personality development and education

These three concepts of science education are an appropriate contribution to the current debate about the future STEM paradigm. According to some experts, we live in an era of multi-paradigms, which corresponds to our findings about the discovery of the three concepts. At this point the role of these concepts is not discussed, but it will be supplemented by stating the views of the stakeholders of the curricular Delphi study on the role of concepts (A), (B) and (C) in teaching/learning at various educational levels: pre-schools, primary schools, lower secondary schools, and upper secondary schools.

The results include descriptive-statistical analyses of the third round of the curricular Delphi study with regard to the *priority* and *reality* assessments as well as to the identified *priority-reality differences*. The analyses and descriptions are made on the basis of the total stakeholder sample (139 respondents) consisting of different sample groups (56 students of upper secondary schools, 30 secondary school teacher, 28 education researchers and 25 scientists). A questionnaire with a 6 point Likert scale was used (Bolte, 2008; Bolte et al., 2012). Respondents were asked to sign their opinion in two cases: (1) their priority and (2) their assessment of the reality of the use of the science teaching/learning concepts (A), (B) and (C). As a test to identify statistically significant differences between the assessments of the three concepts, the Wilcoxon signed-rank test was applied. Table 1 shows assessments from the priority (wishes) point of view, Table 2 shows assessments from the reality (practice) point of view and Table 3 shows assessments of the priority-practice differences of all respondents.

*Table 1. Mean values of the priority assessments by the total sample regarding different educational levels and significance test values (Wilcoxon signed-rank test).*

N = 139	Mean values (Likert scale: 1 = very low; 2 = low; 3 = rather low; 4 = rather high; 5 = high; 6 = very high)			Significance values		
Educational level	Concept A: Awareness of the sciences in current, social, globally relevant and occupational contexts relevant in both educational and out-of-school settings	Concept B: Intellectual education in interdisciplinary scientific contexts	Concept C: General science-related education and facilitation of interest in contexts of nature, everyday life and living environment	A/B	A/C	B/C
Pre-school	3.1	2.4	4.2	<0.001	<0.001	<0.001
Primary schools	3.8	3.2	4.4	<0.001	<0.001	<0.001
Lower secondary schools	4.6	4.1	4.8	<0.001	0.008	<0.001
Upper secondary schools	5.2	4.9	4.9	0.010	0.003	0.85

It can be seen that, overall, the averages of the mean values were higher the higher the educational levels are. Most of the assessments differed from each other in a statistically significant way.

*Table 2. Mean values of the reality assessments by the total sample regarding different educational levels and significance test values (Wilcoxon signed-rank test).*

N = 139	Mean values (Likert scale: 1 = very low; 2 = low; 3 = rather low; 4 = rather high; 5 = high; 6 = very high)			Significance values		
Educational level	Concept A: Awareness of the sciences in current, social, globally relevant and occupational contexts relevant in both educational and out-of-school settings	Concept B: Intellectual education in interdisciplinary scientific contexts	Concept C: General science-related education and facilitation of interest in contexts of nature, everyday life and living environment	A/B	A/C	B/C
Pre-school	2.1	2.0	2.8	0.238	<0.001	<0.001
Primary schools	2.8	2.7	3.2	0.284	<0.001	<0.001
Lower secondary schools	3.4	3.4	3.3	0.927	0.345	0.555
Upper secondary schools	3.7	3.8	3.4	0.713	0.003	0.002

The highest overall average of the mean values in the assessments occurred for upper secondary education. The overall averages of the mean values for the other educational levels were gradually lower. Only a few assessments differed from each other in a statistically significant way.

*Table 3. Mean values of the priority-reality assessments by the total sample regarding different educational levels and significance test values (Wilcoxon signed-rank test).*

N = 139		Mean values (Likert scale: 1 = very low; 2 = low; 3 = rather low; 4 = rather high; 5 = high; 6 = very high)			Significance values		
Educational level	Concept A: Awareness of the sciences in current, social, globally relevant and occupational contexts relevant in both educational and out-of-school settings	Concept B: Intellectual education in interdisciplinary scientific contexts	Concept C: General science-related education and facilitation of interest in contexts of nature, everyday life and living environment	A/B	A/C	B/C	
Pre-school	1.0	0.4	1.4	<0.001	<0.001	<0.001	
Primary schools	1.0	0.5	1.2	<0.001	0.064	<0.001	
Lower secondary schools	1.2	0.7	1.5	<0.001	0.007	<0.001	
Upper secondary schools	1.5	1.2	1.5	0.025	0.888	0.046	

The mean values of the (A) and (C) concepts were higher than (B) for most educational levels. Only A/C concepts did not differ from each other in a statistically significant way. Also, there were no statistically significant priority-reality differences in upper secondary schools.

With regard to the assessments of the three concepts by the total sample regarding different educational levels, the analyses reveal that the concepts are seen as more important the higher the educational level is. The concept assessed as most important is the concept referring to general science-related education (Concept C). The priority-reality differences indicate that for all educational levels the concepts' assigned priority is not reflected in reality (school practice).

The results in the form of these three concepts and relevant educational content were used as a starting point in the following step of the DBR (2. *Development of solutions with a theoretical framework*). The main outcome of these steps of the DBR is the **PROFILES module** as a core unit of IBSE. The **PROFILES module** has been developed on a 3-stage model (Bolte et al., 2012):

(1) Initiation of the learning happens in a familiar and student-relevant situation when students identify with this socio-scientific situation and feel that it is within their sphere of interest and action. Teachers stimulate students through a scenario. This is a narrative (story) based on everyday problems. It is designed to evoke interest and to raise questions in order to find answers.

(2) In the second stage the students' triggered self-motivation encourages them to be involved in the IBSE learning process. Students realize their own inquiry-based learning cognitive activities.

(3) In the third stage, the students transfer their inquiry-based learning to the relevant socio-scientific situation encountered in the scenario and develop reasoned justification for decisions.

The PROFILES module is based on motivation and a problem scenario (Trnova & Trna, 2015). The scenario brings scientific-social issues to teaching/learning. The students create questions and problems, which are solved with the use of their own inquiry. Structured and guided inquiry of IBSE is used. Students' experimentation is usually applied. Finally, the students return to the initial scenario through which they make decisions and recommendations. Formally, the PROFILES module consists of materials for student activities and teacher guidance.

These PROFILES modules were used as the core of teacher education in the PROFILES CPD. The teacher-trainees in the project were familiarized with the PROFILES modules and their roles, and they implemented these PROFILES modules into their teaching. In doing so, the teachers modified these modules and at the end of the training they made their own PROFILES modules. The PROFILES modules were then verified by the teachers in practice through their action research. Emphasis was given to teacher ownership and creativity. The role of teacher creativity was especially supported by the creation of their own PROFILES modules. Following the PROFILES module: "*Safety of the human body: swimming and diving*" may serve as an example of developmental product of the whole DBR. This PROFILES module was developed by the authors of the chapter:

***Scenario: Death when diving***

*News from a TV broadcast: Yesterday the famous singer D. N. tragically died when scuba-diving at the seaside resort of H. A local police spokesman said that the exact cause of death would be clarified by means of autopsy ordered by the court. Senior instructor in diving L. T. answered our query as to what can cause a tragedy when diving - it may be a small injury, e.g. a ruptured eardrum. Details will be included in subsequent news.*

In this case, students usually ask the following questions:

- *What properties of water can cause health risks or even the death of a person?*
- *Which organs of the human body can be damaged when swimming and diving and why?*
- *What kinds of swimming and diving in the water are risky?*
- *Which rules of safe swimming and diving do we follow?*

The next step is students' activities where students research, seek information leading to a solution, discuss with peers in groups and perform experiments. Example of the experiment:

***Experiment: Modeling of ear-drum rupture under high water pressure***

*Instructions for students' experimenting:*

- *The basic experiment aid is a plastic bottle with a wide neck. The bottle cap is drilled and the valve of a tire is screwed into it. Overpressure in the plastic bottles in all experiments is achieved by pressing with hands or with a small bicycle tyre-pump.*
- *Instruments in plastics bottles are fixed on stands made out of copper wire, a metal stick and small wooden plates (see Figure 1).*

• Cover the mouth of the test tube with the rubber membrane (of an inflatable balloon) and secure with a rubber band. Connect the bicycle to the valve and pump - you produce overpressure of air in the bottle. The membrane under the influence of pressure is bent into the test tube. The deflection of the membrane increases with increasing overpressure (Figure 2).

Figure 1. Instruments in a plastic bottle.



Figure 2. Plastic bottle with a test tube covered by a rubber membrane.



• Replace the rubber membrane with a thin plastic membrane. Under the influence of pressure it is also bent into a test tube (Figure 3). If overpressure in the bottle is sufficiently great, the plastic membrane ruptures (see Figure 4).

Figure 3. Plastic bottle with test tube covered by a plastic membrane.

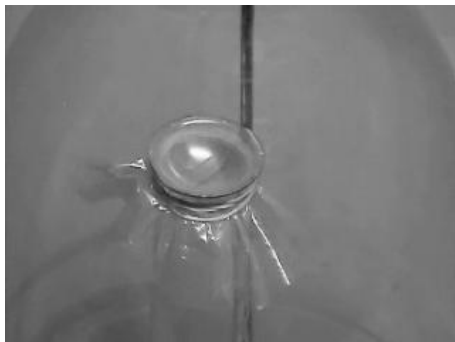
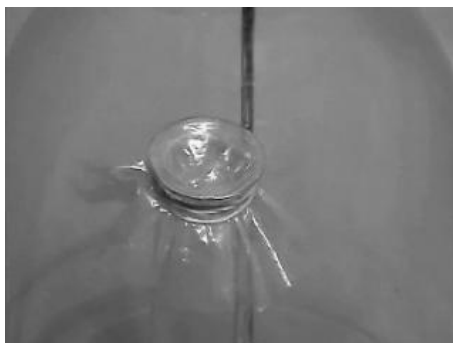


Figure 4. Plastic bottle with test tube covered by a ruptured plastic membrane.



The rubber and plastic membranes simulate the behavior of the ear-drum when swimming, bathing and diving. Water in the ear (ear canal) pushes on the ear-drum similarly to the air on the membranes in the case of our experiment. The result of this pressure is deformation of the eardrum and in the case of high pressure (overpressure) rupture of the ear-drum.

The third and the final phase was student decision-making. In this case, students, using inquiry, came to the following conclusion:

- The deformational effect of overpressure force is demonstrated by the rupture of the membrane covering the test tube made out of a piece of a plastic bag.
- The plastic membrane simulates the terminal behavior of an ear-drum when swimming, bathing and diving. Water in the ear canal pushes on the ear-drum by a heavy force. The result is the rupture of the ear-drum. The implication of this rupture is acute pain and the loss of ability to find direction. This means danger of death for the diver.

The research results of the third step of the DBR (3. Evaluation and testing of solutions in practice) also include a teachers' evaluation. After being involved in PROFILES CPD including implementation of the PROFILES modules, teachers were asked to find out their beliefs regarding their ownership and improvement of their competences. The research PROFILES team from Weizmann Institute (Israel) developed a questionnaire with a 9-point Likert scale of responses (1 point is the minimum – “very low”, 9 points is the maximum – “very high”). Table 4 shows selected items from the questionnaire and their mean values. This questionnaire was distributed to 50 teachers-participants of the project PROFILES in the years 2013-2104 in the Czech Republic.

Table 4. Mean values of teacher beliefs after PROFILES modules implementation.

Teacher Beliefs N = 50	Mean values (9 point Likert scale; 1= min.; 9 = max.)
How well can you identify a PROFILES module which is relevant to your students?	6.9
How well can you use the PROFILES modules to promote inquiry-based learning by your students?	6.5
How well can you guide students towards justified decision-making?	6.8
How well can you make an adaptation of a module to your class?	7.6
How well can you design a new module for your class?	6.8
How well can you perform reflection on your teaching?	7.0



On the base the results mentioned above, it could be concluded that teachers are satisfied with the implementation of the PROFILES modules into teaching. They believe that there has been development of fundamental student skills such as inquiry, decision-making, etc. It is very important that teachers feel an increase in their ownership and improvement of their competences. They are able to design a new module relevant to their students.

The fourth step of the DBR (*4. Documentation and reflection to produce "Design principles"*) may be summarized in several major conclusions, which are simultaneously answers to research questions:

- Implementation of the PROFILES modules is an appropriate innovative educational method of teaching/learning science; it meets school practice needs and complies with the principles of IBSE
- The scenario with a socio-scientific situation is an effective motivational tool of the PROFILES modules
- Implementation of IBSE modules into teaching/learning science meets many current science education requirements
- The implementation of IBSE modules leads to increased motivation and ownership of teachers

These design principles are supported not only by the above presented research outcomes, but also by other studies of authors of the chapter (Trnova & Trna, 2015) and their collaborators in the project PROFILES (Bolte, Holbrook, Mamlok-Naaman, & Rauch, 2014).

## 5. DISCUSSION

The PROFILES modules have an important role in the CPD of teachers. The project aims to improve the preparation of teachers in strengthening their competences in IBSE. The aim is also to motivate them and strengthen their ownership, as a prerequisite for professional and personal development.

Special research was focused on the development of the creativity of teachers as a significant personal and professional component and an important part of their CPD. According to Sternberg & Williams (1996) and Amabile (1998) a creative teacher is necessary for developing students' creativity. Teacher creativity is one of the core teaching factors. Quality development of teacher competences cannot exist without creativity. A hypothesis for future research is that high quality of CPD is determined by the development of teacher creativity. As creativity is a crucial factor in the multidimensional development of teacher professional competences, the role of creativity was examined in a number of partial dimensions within this development.

The extent to which the implementation, modification and creation of new modules affected the creativity of teachers was investigated through conducting a case study of teacher-participants of PROFILES CPD (Bolte, Holbrook, Mamlok-Naaman, & Rauch, 2014). Creativity plays a decisive role in this development (Lin, 2011), and as this case study documents all creativity, elements mentioned by Guilford (1980) were developed:

- Resourcefulness (the ability to create a wide flow of ideas): *The teachers themselves demonstrated their development from self-efficacy from the CPD to teacher ownership of the PROFILES ideas evidenced by creating a new module.*

- Readiness, perceptiveness (the ability to modify ideas or jump from one idea to another): *The teacher was able to exhibit sufficient ownership of PROFILES ideas changing the form of experiments and worksheets according to changing conditions when testing out the new module.*

- Originality (unusualness of ideas): *The teacher created a completely original PROFILES module, which was still related to the underlying philosophy.*

- Imagination (production of ideas that are not obvious at first sight): *The teacher created a new PROFILES module with a difficult connection of the topic with daily life.*

- Endeavour (creativity is not only inspirational, but also hard work): *The teacher worked all the time with passion, alone and very hard.*

The research has led us to conclude that PROFILES CPD can affect not only the development of professional competences of teachers, but also the development of major components of their personality, including creativity (Trnova, 2014). The outcomes of the research confirm that using the PROFILES modules during teacher CPD may cause positive changes in the development of teacher creativity and ownership.

## 6. CONCLUSION

It was confirmed by the use of the curricular Delphi study that current science education needs innovation and that IBSE seems to be a suitable innovation because of strong motivational and constructivist effectiveness. It arouses intrinsic motivation among students and supports them in learning about scientific inquiry and the nature of science. Similarly, it can be concluded that the education of teachers for IBSE is a suitable method for their professional and personal development.

The main outcome of the presented design-based research is the development of the PROFILES module as an important tool of innovated science education. This research has enriched the theory of IBSE by developing of the rules to which belong in particular:

- implementation of the PROFILES modules with the scenario with a socio-scientific situation is appropriate innovative educational method of teaching/learning science meets school practice needs and complies with the principles of IBSE

- implementation of IBSE modules into teaching/learning of science meets many current educational requirements and leads to increased motivation and ownership of teachers

Based on the presented design-based research outcomes, two important roles of the PROFILES modules were verified:

- streamlining of science education students, with an emphasis on their motivation and activity

- development of teacher professional competences and personality

The results of the research should be implemented in the theory of science teacher education. In the preparation and implementation of training courses for teachers attention should be paid not only to innovative educational methods for students, but also to teacher professional and personal development.

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## Chapter #5

### PROCESS OF CONTINUING EDUCATION IN THE PROGRAM SCHOOL MANAGERS OF PUBLIC BASIC EDUCATION

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#### ABSTRACT

This study aimed to understand the meaning and importance of training under the National Program School Managers of Public Basic Education for the participant teachers from the perception and reflection of each other on their practice. We tried to understand how this training is manifested during the course and at the end, in practice teachers, but especially as these teachers participate, through their reflection on their practice as agents acting within their classroom, the school and the community. This field research was carried out with five tutors and ten course participant teachers of that program and engaged in the teaching profession, particularly, the educational coordination in public schools in cities of Minas Gerais - MG enrolled at the Federal University of Viçosa, using one semi-structured interview and document analysis. We concluded that the participant teachers have done and still do a brainstorming exercise on their training and on their practice in the classroom, and in the pedagogical actions at school, in view of what was proposed by the course, the development in the practice of action-triad reflection-action.

*Keywords:* teacher education, National School Program Managers, teaching practice, reflective teacher.

#### 1. INTRODUCTION AND OBJECTIVES

This study addresses the training and pedagogical practice of teachers who underwent a course of Post-graduation Lato Sensu offered in the distance mode, by the Federal University of Viçosa (UFV). This course, offered under the National School Program Managers of Public Basic Education, developed by the Ministry of Education in partnership with the Federal Universities, designed for teachers who work as school managers in the early years of primary education in public schools of Brazil.

Specifically, what was intended in this study was to discuss the training of teachers under the National School Program Managers in order to identify the perception of participant teachers on the influences of this course in their teaching during the course and at the end. This research was developed through a qualitative approach.

We tried to see how participation in a course of in-service training specifically in this program, involved and still involves reflections on the teaching practice of the participant teachers, through an interview with ten course participant teachers and five tutors belonging to the Federal University of Viçosa.

The school manager stands out in the promotion of public school, but requires the exercise of multiple skills and various matrices, because the educational systems and educational institutions are living and dynamic organisms characterized by a network of relationships between all elements that act on them.

## **2. BACKGROUND**

Teacher education in Brazil was linked to several conceptual proposals that vary according to the educational policy of its time, ranging from educational technicality, the market logic to the state neglect that left the training of teachers at the mercy of the private sector without an effective social control. That neglect comes whether by government, or by the corporation, allowing the formation of basic education professionals is that a minimum quality conditions which are not linked to teacher training to the investigative nature of the research and development in education (Cioffi, & Bueno, 2011).

In the formative context, it is worth noting that professional contentment, which is a multifaceted concept embraces personal, vocational and contextual aspects regarding the reality of work. "The figure of the teacher built throughout the history of mankind is present in the learning records of each of us under the most different guises" (Seidmann, Thomé, Di Iorio, & Azzollini, 2012, p. 43).

The pursuit of continuing education from the perspective of post-graduation distance courses noteworthy, according to Candeias (2013) by the concrete fact that we have a growing contingent of teachers who will make the choice of a training linked to a course graduate broad sense. It is not decontextualized reality of basic education, which is configured as a constant and it seems that "here to stay", imposing the universities and especially the Graduate Programs throughout Brazil the debate about its social role.

## **3. METHODOLOGICAL RESEARCH ROUTE**

This work was developed through a qualitative approach. The qualitative methods have as a contribution to the research, methods to provide better understanding of the phenomena (Moreira, 2010). The qualitative research works with beliefs, meanings and values. It answers to particular questions, in order to understand a specific phenomenon in depth, instead of statistics, rules and other generalizations. It also works with descriptions, comparisons and interpretations, worrying in the social sciences with a level of reality that cannot be quantified (Minayo, 2004). A particular feature of qualitative research is data collection through direct interaction of the researcher with the phenomenon at hand.

This work involved obtaining verbal data and interactive processes through the direct relationship of the researchers with the situation studied in order to understand the phenomena according to the perspective of the subjects. For the purpose of obtaining a thorough and systematic study of research theme, we made an investigative path, at first, with the bibliographical survey, with a survey of publications about the education of teachers and their conceptions. To the extent that the study was being thorough, we mobilize to understand the design of the research subjects in relation to its course, which contributed to the choice of conducting an interview with the students, to obtain a more descriptive study. Upon completion of the field research, we began to analyze the data obtained in partnership with the collected material, seeking to characterize the perception that students have in relation to their course.

The discursive responses were subjected to content analysis performed from the initial reading of each answer, in order to establish a first contact with the material, the exploitation of data for each question was held, with its decoding in order to select the units of meaning, and subsequently we made the categorizing of elements and grouping of sense units based on what they had in common. Through the grouping of sense units we got to emerging categories, that are not unique, professing a criterion in which we contemplate, as analysis categories, the continued education, the activities held during the course and the relationship with teaching and also the pedagogical practices.

#### **4. CONTEXTUALIZING THE NATIONAL PROGRAM SCHOOL MANAGERS IN THE FEDERAL UNIVERSITY OF VIÇOSA**

The National Program School Managers has the basic objective of contributing to the effective training of educational managers from public school, so they have theoretical and practical elements that enable a basic school education with social quality.

This program is part of All for Education Commitment, a target plan that integrates the Education Development Plan (PDE) and concerns the mobilization around the improvement of basic education in Brazil, contributing to the improvement of the schools' IDEB – Basic Education Development Index – and education systems. The policies related to the joint development and strengthening of educational systems and schools are being produced and implemented with the participation of several institutions. It is important to note the dialogue with entities and organizations, supported by the principle of decentralization and partnership in its formulation and implementation, considering the multifaceted reality that defines education in our country. To implement the Lato Sensu course in Pedagogical Coordination, there were expected five integrated systems in order to ensure their implementation in all organizational levels. They are:

Instructional System - responsible for the operation of the curriculum - define areas, subjects and work load, seeking to ensure the use of instructional materials defined by the MEC, but with autonomy given to the Federal Institutions of Higher Education (IFES).

Operating System - responsible for the arrangements for carrying out activities - general selections (candidates, tutors, additional materials) planning and coordination of activities (individual and collective).

Mentoring system - responsible for establishing the pedagogical support for activities (individual, at distance, oriented teaching practice), planning and implementing remedial learning activities, development of materials to support the participants, planning and monitoring of tutors.

Monitoring and Performance Evaluation System - responsible for evaluating the program, its quality and to verify the learning of teacher students - collecting data: deployment processes, expected results, impacts on pedagogic practice, besides the development of evaluation tools.

Communication and Information System - responsible for contacts and information flows - organizes face-to-face and distance service centers. This UFV computing core will provide access to the Internet, the learning platform, with information regarding the course, the tutoring, the news, the school program, agendas and records of evaluations. It should be noted that the course offers a set of activities, interaction strategies that are developed through individual and group activities, some face-to-face and others at distance.



## **5. PRACTICE REFLECTIONS PEDAGOGY TEACHERS INSERTED IN SCHOOL PROGRAM MANAGERS**

Understanding the teacher as a reflective practitioner, the context is fundamental to the process of formation. And this reflection must be made in sharing with other teachers, the exchange of experiences, the look on the action itself as a teacher, in dialogue with the theories, methods and standards of their field. Viewed from this perspective, continuing education advances in the interests of initial and continuing training, where the school-space context and the role of the teacher become privileged locus of such training.

Based on these principles, we analyzed the data obtained from this research that gave voice to tutors and participant teachers aiming to identify the established relationships between the obtained training and everyday teaching practice, focusing on the importance of the collective reflection to the reconstruction of the teaching practice itself and for the development of the educational context. We analyzed, also, the social and political implications of the reflexive practice on the actual educational context.

In addition to changes in teaching practices, the course also led some participants to study more, seeking new opportunities for continuing education, as highlighted by the tutor:

We realize the reorientation of practice of course participants, both in monitoring their memorials, and in the reorientation of their practices. We already have several teacher students in graduate school, for example, a gain beyond higher education and this is an important development milestone (Tutor "Jasmine").

The course participants emphasized that there was freedom of opinion and dialogue among course participants, tutors and coordinators of the project, as they were free to provide feedback and were heard when they did not agree with some work methodology.

We questioned the course participants about how it was obtained in training program and analyzes made by them highlighted advances in their practices and changing attitudes in the educational work of these:

I changed, grew after having completed the School Managers Program, my students tell me that I changed and I realize that in the classroom, and in my own life, an advance that I sought and found in the Project, the experience with the fellow students, tutors and exchange of experiences. I moved into the house, and now I've learned to look for new ways to help students advance when they cannot learn in a way (Cursista "Bromelia").

As can be observed in the speech of Cursista "Bromelia", changes occurred not only in the classroom, but in your life as a whole, affecting domestic space.

In the case of the evaluation process they went through in School Program managers, the course participants reported that, and have been observed during the course, made several reviews and papers. Said that despite the new methodology of work, because it is a distance learning course, were being evaluated in a comprehensive and integrated manner:

With the tutor in the classroom observing the lesson the teacher seeing how he put into practice what they had studied in the guides. This happened once during the semester. So the teacher would have the notes in accordance with the attitudes, procedures, plans, everything which would take the student to have a significant learning (Cursista "Rosa").

The course participant "Margarida", in the following quote, brings a critique of a certain type of assessment that prioritizes memorization, which is already ready, made by people not involved in that group:

The assessment has for the teacher, to the student and the institution, where all are valued in the teaching-learning process and should this assessment be continuous. But the problems were more personal and yet were heard and respected, the biggest problems we observed were in some tests per module, the coming of Belo Horizonte to do like an entrance exam. Some questions were of pure memorization there did not like, but over time has improved, the course was therefore constructed from the development (Cursista "Margarida"). This report shows the ability of course participant criticize their own training process, reflect on the type of evaluation used, which leads necessarily to reflect on their own practice, leading to changes in how these course participants analyze and act on their practices evaluative as teachers.

[Rate] is diagnose what the student has learned or did not learn while you could teach or not and that this evaluation should be done, because that's how we know our students, but there are several ways to assess and teachers must use all (Cursista "Hortência").

The ability of the teacher to reflect on their actions takes you to redraw a new knowledge, a new business strategy from the challenge presented here. The proposal of the School of National Program Managers realize the teacher as a reflective practitioners able to think about your practice and through the combined studies acquired with their experience, redesign new knowledge, new knowledge-doings and new practices.

Through the data collected, it can be noticed that for the investigated group, the training received in the course broad sense of the National Program of School Managers offered at UFV favored a link between the theoretical principles studied and the pedagogical practices developed by these teachers.

## **6. FUTURE RESEARCH DIRECTIONS**

Establishing an analysis of the continuing education of teachers of Basic Education articulating with the Information and Communication Technology and Post-graduation has been the challenge at the present time. The importance of the relationship between these issues meets the Mill's view (2012) that investigated the data from CAPES, theses and dissertations that bring tangent points to the growth in the country about the appearance of the Information and Communication Technologies (TICs). The author noted that few academic papers relating to continued education of teachers from Basic Education with the Information Technologies and Communication and the Post-graduation and most initiatives are restricted to specialized or advanced courses. Therefore, this theme is an indicative for further development in future researches.

## **7. CONCLUSION**

The National Programme School of Basic Education Managers shall base the teaching paradigm or the practical rationality paradigm, it strengthens the importance of reflective teacher, whose main axis the redefinition of teacher professional identity. This paradigm is opposed to the paradigm of technical rationality and values the pedagogical experience and practice, considering the knowledge constituted by the people, their knowledge of luggage for experienced teaching practice.

We realized, research carried out here, that course participants and tutors stressed that the course provided the emergence of new perspectives on their teaching practices. The knowledge and the process of acquired training and reworked through the course seem

to provide these teachers a sharper critical sense, offering them useful intellectual tools to understand and interpret the most complex situations in which a link between intellectual knowledge and the practice every day in the teaching profession in public schools. The reality walks in order to allow the emancipation of these people and not just instrumentalize them technically to "pass on" content and this involves rethinking their actions in the classroom, their professional behavior, their own school.

The most important finding was the need for a practice whereby, according to Schön (2000, p.30), action and reflection must go together, contributing to the dialogue and overcoming "practical situations that are unique, uncertain and conflicting". Certainly, action and reflection-in-action are able to give real support to the changes in the educational field, political and social.

Based on the positive experience they had with the offering of the first class, we certified that the University cannot exist without its social and production of knowledge functions. The partnership between several institutions, effected in the course broad sense not only helps in the formation of the course participants, but it has been a meaningful experience for all involved, promoting changes in teaching practices at all levels, highlighting the ever pressing need to link theory and practice in order to build an inclusive and quality education.

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## Chapter #6

### THE REALITIES OF TEACHING ADULT LEARNERS AT THE HIGHER EDUCATION LEVEL

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#### ABSTRACT

Teaching adult learners, though challenging, can also be exciting and fulfilling when the right teaching methods are applied. This chapter discusses the issue of lifelong adult education in Botswana's institutions of higher learning. It goes on to examine the challenges and the nature of the teaching and learning process in adult education, while also examining the experiences of adult learners and the teachers of adult learners. The chapter further discusses the methods which can be used to enhance the teaching of adults. A qualitative research approach was used in this research. With the use of semi-structured interview questions, ten teachers of adult learners were interviewed, while twenty adult learners were interviewed through the focus group discussions. Adult learners come to class with a wealth of knowledge, life experience, and some challenges too. The teachers of adult learners should therefore, embrace and apply the right teaching methodologies in order to overcome the challenges of teaching adult learners so as to facilitate effective teaching and learning in an adult education class.

*Keywords: adult learners, teaching, lifelong learning, challenges, higher education.*

#### 1. INTRODUCTION

Adult education has gained prominence in the 21<sup>st</sup> century and Africa as a continent has not been left out in this quest for the acquisition of knowledge. Contemporary higher education in Africa has witnessed a tremendous increase in student enrolment over the years and the adult learners are not left out in this endeavor to acquire knowledge and qualifications at the higher education level. More and more adult learners are embracing education at a higher level, which is quite demanding on the teachers of adults and the learners themselves. Even though, the adult educators have some basic skills of teaching adult learners, because, they teach some regular students who are young adults, they still have the need to master the right approaches for teaching and handling much older adult students. The institutions of higher learning have the important responsibility to focus on the different ways of teaching the different ages of the students they enroll. This is very crucial to ensure the attainment of desirable learning outcomes in the teaching and learning process.

Adult learners in the context of this chapter are a diverse group of learners whose ages range from 25 years and above. They typically comprise of people with a wide range of abilities, educational and life experiences, and diverse cultural backgrounds. Adult education here refers to a field of educational practice in higher education which is organized to address the learning needs of persons whose cultural, socio-economic and political roles define them as adult students, mature and nontraditional. Adult education helps to promote learning in adulthood and empowers adults to live a successful life. It therefore, contributes immensely towards increasing competence and a sense of personal

fulfillment in the lives of adults and their relationship with other people. Most adults would prefer to pursue their academic studies on a part-time basis, while maintaining alternative instructional delivery systems, such as online learning, blended and distance learning or learning by correspondence (Jarvis, 1995; Maruatona, 2006).

This chapter focuses on examining the methods of teaching adults in two selected tertiary institutions in Botswana. It examines the experiences of adult learners, the challenges faced by teachers of adult learners and the approaches to be used in order to encourage and attain effective teaching and learning in an adult education class. It discusses adult lifelong education aimed at acquiring degree qualifications for continuous professional development. The need for education and the quest for an improved standard of living associated with being educated, have driven adults to continuously upgrade and improve themselves. In the context of this chapter, lifelong education covers the whole spectrum of formal, non-formal and even informal learning activities. Adult lifelong learning enables adult learners to acquire that extra and relevant knowledge geared towards the improvement of their professional qualifications. Consequently, the adult learners develop positive attitudes and skills needed for progress and self-fulfillment in all aspects of life (Hall, 2001; Gouthro, 2007).

### **1.1. Adult Basic Education and Lifelong Education**

Basic education is not limited to children. The goals of the Jomtien conference (1990) and Dakar conference (2000) emphasized the provision of basic education to children, youth and adults. In promoting Basic Education for All (EFA), the goals of the Jomtien conference addressed the need for a reduction in the adult illiteracy rate to about one-half of its 1990 level by the year 2000. Emphasis was laid on the promotion of female literacy, in order to reduce the current disparity between the male and female illiteracy rates. The Dakar goals called for a 50% improvement in the levels of adult literacy by the year 2015. This is geared towards alleviating the disparity between male and female literacy rates, and the encouragement of equitable access to basic and continuing education for adults (Jomtien, 1990; Dakar, 2000).

In the context of this chapter, adult basic education is education designed to teach adults the basics, foundations or essentials. It is a form of education designed to meet adults' basic learning needs for human fulfillment and fundamental educational development. Adult basic education may include: learning how to read and write, recognizing the importance of documents such as maps and catalogues, making simple compilations and arithmetic. On the other hand, adult lifelong learning goes beyond basic education. It involves: going to college at an adult age, returning to college to finish or complete a degree, working toward a university degree, being involved in continuous professional development and taking classes as an adult for the sake of keeping oneself busy (Collins, 1991; Ozuah, 2005). This study is centred around adult lifelong learning at a higher education level. It hinges on the realities of teaching and learning in adult classes in a country in Africa.

## **2. BACKGROUND/THEORETICAL PERSPECTIVE**

### *Adult Learning Theory (Principles)*

The general belief is that adults learn differently from children. There are propositions concerning adult learning which have influenced the art of teaching and learning in higher education (Fry, Ketteridge, & Marshall, 2009). Adult learning theories are essential in understanding how adults learn and the educational implications thereof. Adult learners are

self-directed, problem oriented, internally motivated and independent learners (Knowles, 1984; Merriam, Caffarella and Baumgartner, 2007).

Andragogy is simply the art and science of helping adults learn (Knowles 1984). Although andragogy has been criticized by some teachers, it is still very useful in the field of adult education. Many university teachers acknowledge that they have seen the characteristics of adult learning principles being manifested by their learners. The theory of Andragogy was based on six main principles, namely:

- a) Self-concept: adult learners are self-directed, independent and autonomous
- b) Experience: Adults learn by drawing from their previous experiences
- c) Readiness: Adults are ready to learn what they feel they need to learn
- d) Orientation to learning: Adults believe their learning should be problem-centred, task-oriented and life-long/focused
- e) Internal motivation: Adults are more intrinsically motivated than extrinsically motivated
- f) Need to know: Adults are interested in knowing the value of learning and the need for them to learn (Caffarella et al, 2007; Forest and Peterson, 2006).

The theory of Andragogy has, to a large extent, influenced teaching and learning, especially in higher education. Many types of learning used at a higher education level, such as experiential learning, student autonomy, discussions and self – directed learning, are derived from the principles of adult learning. The principles of adult learning emphasize that adult learners like planning and carrying out their own learning experiences, that they would like to contribute to the learning experience as much as they deem it fit; that they enjoy being involved in assessing their own personal goals against their goals of learning; and that they want an environment of respect , recognition and freedom when they learn.

Andragogy has become popular among educators and researchers worldwide, being adopted by some European countries such as Germany, England, Poland, France, Finland, Netherlands, Czechoslovakia, Russia, Hungary and Yugoslavia. Interestingly, the andragogical approach has been recognized and adopted in disciplines such as education, medicine, management, criminal justice education, among others (Savicevic, 1991; Bolton, 2006; Bedi, 2004; and Birzer, 2004). The experiential learning principles derived from andragogical approach to teaching, makes it very useful to adult learners in various fields of study at the higher education level. Andragogy improves the interaction between the learners and facilitators, as they work together as partners, establishing trust and rapport to enhance self-awareness in the learners.

Emphasizing on the importance of andragogical theory to teachers and trainers of adult learners, Merriam (2001) states that, Andragogy contributes to the understanding of how adults learn, the context and process of learning. It is a theory of adult education, technology of adult learning and method of adult education. Bedi (2004) asserts that, Andragogy helps educators to understand their learners more and be able to encourage learners to realize their innate potentials. Although Andragogy has been criticized by some theorists, it remains a guiding principle in the teaching of adult learners. Andragogy has a profound influence on the teaching of adult learners in many parts of the world (Cretchely and Castle, 2001) as evidenced by the inclusion of adult education in the curricular of many countries .



### **3. METHODOLOGY**

A qualitative approach was used to carry out this research. It involved the use of interpretive methodologies to discuss the phenomenon of teaching adult learners. The use of a qualitative research approach made it possible for the participants to explain and give their own interpretations of the phenomenon from their own subjective position. (Marshall and Rossman, 1995; Weirisma, 2009) posit that qualitative research gives opportunities for exploratory and descriptive research that assumes the value of context and setting, and allows the researcher to experience a deeper understanding of the participants. Similarly, Onwuegbuzie and Leech (2006) state that qualitative research gives room for the participants to freely express themselves and interpret the phenomenon under investigation. The question of how easy it is to teach adult learners in Botswana can best be researched by the use of a qualitative approach, which allows for an in-depth and detailed description of events. Structured interviews, focus group discussions and document analysis were utilized as data collection instruments.

This research was informed by the adult learners that the author taught at the post graduate level in two institutions of higher learning in Botswana. The time period covered by the study is from 2009 – 2014, a time during which I experienced the difficulties of being an adult learner myself, and a tutor and teacher of adult learners. Due to time and financial constraints this research was limited to the institutions in the capital city of Botswana, which is Gaborone, where I currently reside and have worked in the past ten years.

A total of ten lecturers of adult learners were interviewed. The interview questions centred around their experiences in teaching adult learners , the challenges of being a teacher of adults, and the approaches to be used to encourage effective teaching and learning in an adult education class. Through the use of focus group interviews, twenty adult learners were interviewed. The focus group interviews focused on the challenges and advantages of being an adult learner. The essence of the focus group interviews was to find out from adult learners, how challenging and worthwhile it is to acquire qualifications as adult learners. Most of the adult learners combine work and study, along with other personal and community commitments. As such, it was of great importance to get a sense of their own views, as regards the issue of adult teaching and learning.

### **4. RESULTS AND DISCUSSION**

The findings from this study have been recorded in three sub-sections. In sub-section one, the experiences of adult learners are discussed. Sub-section two focuses on the challenges of teaching adult learners at a higher education level, while sub-section three discusses the approaches to be used to encourage effective teaching and learning in an adult education class.

#### **4.1. Being an Adult Learner**

In Botswana, adult learners constitute a substantial proportion of students at tertiary level. These learners enroll in institutions of higher learning for different reasons. They are inspired either by the acquisition of qualifications that will help them boost their socio-economic status, improve their chances of getting well-paid jobs in the labor market, to get promoted to better positions while on the job, or simply to acquire more knowledge.

How does it feel to be an adult learner? What are the ups and downs experienced by adult learners? From the perspectives of adult learners that I interviewed during this study,

the need to acquire more qualifications as adult learners emanate from the premise that, the more highly educated one is, the better the chances of getting better paying jobs. In this day and age of economic meltdowns, people want to earn higher education qualifications either as part of continuous professional development to keep them on the job or to get very good jobs to guarantee them the earning of higher incomes. Furthermore, the adult learners interviewed, indicated that being an adult learner is quite encouraging. Factors such as being mature, experienced and focused, along with the capacity to effectively comprehend subject matter, were highlighted as reasons why being an adult learner is rewarding. The respondents noted that as adult learners, they are driven to take their studies seriously, since they are responsible for paying their own fees and they have a clear understanding of why they have chosen to pursue further qualifications. They are not forced to seek further education in most cases, so, they are focus driven. It is therefore, their ultimate desire to work hard and achieve. This is a different scenario from young learners, some of whom are still too young to decipher what exactly they will gain from higher education qualifications. It is even worse with young learners, who do not know the consequences of not taking their studies seriously or care about the effects of low academic achievements at a higher education level.

Adult learning also comes with a number of challenges for the adult learner. When asked about the challenges involved in adult learning, the adult learners expressed the view that, it is not easy to be an adult learner. Adult learning involves making a lot of sacrifices in terms of time management, in order to grapple with other commitments, which the adult learner has. Most adult learners are employed as full-time staff in their respective places of work. The result is that majority struggle as they combine work, family responsibilities and their studies. Assignments and examinations are part of their study obligations on the academic front, while on the social side of things; many have the usual social activities which include attending weddings, meetings, school plays or special events for their children. The responses revealed that it is inevitable that these activities will at times clash with their hours of study and other academic obligations. As one of them stated, "I live in my home village, work and attend lectures, it is very tiring to combine school, work and social obligations."

Apart from time-management and clashing of events, other challenges of life affect adult learners as they struggle to make ends meet. Health problems, financial problems and a limited attention span, due to high stress levels, can be a severe source of hindrance to effective learning by adult learners. The demands from various activities which some adult learners engage in, make them too exhausted to effectively put in their best in their studies.

In this day of the 'digital natives', adult learners face challenges of adapting to the use of new technology. Some of the adult learners that I interviewed expressed their views on the difficulties they face in getting used to the introduction of new instructional technology. New technology comes with new demands and some adults are 'techno-phobic'. The 21st century adult learner has these issues to contend with, and attempts must be made to establish solutions to the problems; if the adult learner is to succeed in the academic goal he/she is aiming at. This, in itself, is not an easy nut to crack. One of the interviewees said, "I do not like technology, but I am forced by circumstances to use it, so, it is not easy at all."

#### **4.2. Teaching Adult Learners: Really Challenging?**

Teaching Adult learners can be very interesting and quite challenging at the same time. Adult learners bringing a wealth of knowledge and information to the class which enhances the process of teaching and learning. In most cases where adult learners take their

academic work seriously, they bring in different forms of learning to the classroom and their teachers can learn from them, they can make the teaching and learning environments very lively. The teacher of adult learners therefore, should be prepared psychologically, to face the advantages and disadvantages of teaching adult learners. The first step should be to have a very good understanding of the adult learners and, consequently, direct teaching to their needs.

Findings from the study indicate that, one of the major challenges experienced by the teacher of adult learners is the frustration caused by adult learners not having enough time to attend to school work because of the many commitments they are faced with. The teachers of the adult learners that were interviewed indicated that lack of time on the part of most adult learners, is a major constraint. In cases where the adults are expected to attend classes regularly, one finds it difficult to have a full class attendance. They miss classes and expect the teachers to understand and bear with them. Some adult learners insist that since they are adult learners, class attendance should not be made compulsory for them. This is a very big challenge and it is quite a concern.

Adult learners also have the tendency of not meeting deadlines for the submission of their assignments. The respondents indicated that most of their adult learners have the tendency of asking for extended deadline dates because they are unable to meet the stipulated deadlines. While this is a common problem experienced in teaching adult learners, some adult learners do take their assignments seriously. It depends on the goal and target of the adult learner. What exactly does the adult learner need the knowledge and qualifications to be earned from the institution of higher learning for? Is the adult studying to improve his/her standard of living or studying simply to gain recognition in the society? These of course, are some of the pertinent questions which address the seriousness or lack of commitment on the part of the adult learner. Studies have shown that adult learners are mostly self-directed and they prefer a learning environment that is practical and relevant to their academic needs and desires. The self-directed learning of the adult tends to be systematic and independent, with minimal focus on the instructor or the classroom. The self-directed learner chooses the mode of learning that suits him or her. Where these attributes are lacking, the learners lose interest and sometimes withdraw from the institution (Weimer, 2003; Merriam, 2001). It is therefore necessary, that the teacher of the adult learners, know the salient characteristics of their learners and how to address the situations.

Due to the fact that adult learners come to class with a wealth of life experience and knowledge, it could be a plus or a minus for the teacher of adults. A plus, because it would be easy to teach them, as they comprehend the subject matter well and contribute meaningfully during the teaching and learning process. Most adults like to be appreciated and respected by their teachers. They see themselves as equal to their teachers. If their teachers understand them from this perspective and accord them the respect and recognition that they seek, then all will be fine. On the other hand, if the teachers try to exert too much authority over the adult learners, problems often do arise.

Some adult learners have attitude problems and they bring this to the teaching and learning environment. While some adult learners get sponsorship to pursue their studies, majority of them pay their own fees and have other financial commitments to meet. These social and personal problems take their toll on adult learners and negatively affect the way they handle the teaching and learning process. They want value for their money and time, and the teachers are the direct victims of their discomfort and complaints.

Despite all the challenges and complexities associated with the teaching of adult learners; one cannot deny the fact that the maturity, sense of responsibility and focus found in some adult learners, enhance teaching and learning. In this day of the use of technology

in teaching and learning, some adult learners struggle to embrace the introduction of new technology. While some take long to master the use of modern technology, others are techno-phobic. At the university where I teach, new technology teaching aids such as Blackboard and Turn-it-in are used to enhance teaching and learning. While some adult learners are happy and eager to embrace new technologies some complain that they do not like technology.

#### **4.3. Towards Effective Teaching and Learning for Adults**

Teaching adults can be made easier and more worthwhile if the teachers of adults could use the right approaches when teaching adult learners. In this regard, the teachers should find out why the adult learners enrolled for the course of study and their different backgrounds. This will guide them to figure out the expectations of the adult learners and how to help them realize their goals. The idea of establishing a learning contract with the adult learners would help each party understand the expectations from the onset. It is also very important for the teachers of adults to get acquainted with the interests of various students and be able to develop the assessment techniques suitable for the learning styles of the learners. The learning environment should enhance, mutual respect, trust, comfort and collaboration.

Findings from the study indicate that adult learners do not like to be treated like children. Teachers should accord them the respect they deserve, and allow them to be interactive during lessons. When they are involved in the learning process, they should be allowed to own the session, to develop a sense of belonging and confidence. The teacher should help to establish an atmosphere that is conducive to learning, while taking cognizance of individual differences among learners. Adult learners would enjoy a well organized classroom, free from noise and distractions. Teachers used to motivate adult learners to learn, because, they learn effectively when they want to fulfill their inner desires, develop new skill and improve professional competence.

Discussion groups should be used to encourage adults to participate actively during lessons. The use of tutorial groups will go a long way in bringing out the best from the adult learners. Opportunities should be provided for the adult learners to work together and share different ideas in group discussions. Sharing their experiences with one another will contribute effectively in the enhancement of teaching and learning for the adult learners. However, teachers are advised to be cautious when using discussions, to avoid a situation where the discussions will be taken out of the context of the topic at hand. Effectively, the topic should be introduced and facilitated by the teacher as the right time. Allowing adult learners to share the stories of their experiences with their course mates brings the lesson to life and creates a feeling of collegiality amongst them; the quiet students will be encouraged to interact with their course mates.

It is important to direct adult learners to the right resources for effective teaching and learning. The use of modern technology such as the Blackboard, Moodle, ClickUP, among others will help adult learners to access education from any part of the world. Efforts should be made to help them familiarize with the use of modern technology. It is imperative that teachers of adults understand the challenges that the adult learners face and encourage them to forge ahead. They should be positively reinforced whenever they do well, and politely corrected when they are at fault.

Discovery learning should be used to help adult learners develop critical thinking skills. Teaching and learning should be geared towards allowing the adult learner to have a critical reflection of what learning is and the different perceptions of content learned. By creating an atmosphere where the adult learner is appreciated and allowed to take

control of his/her own learning, the teacher develops a relationship of trust, respect and cordiality between him/her and the learners. The teachers should be facilitators of learning and not controllers, in order to encourage effective teaching and learning in an adult education class.

## 5. FUTURE RESEARCH DIRECTIONS

It has been established through this research that teaching adult learners at a higher education level can be both exciting and demanding. The teacher of adults should put into considerations the fact that adult learners come to class with a lot of experiences. They should be provided with the right environment to enable them enjoy the learning and teaching process. This research makes a major contribution to the body of knowledge in the area of teaching adult learners at a higher education level in Botswana. It is a qualitative study and cannot be easily generalized. Perhaps, future researches could be carried out in other parts of the world, to provide a comparative analysis of the realities of teaching adult learners at the higher education level.

## 6. CONCLUSION

Findings from this study indicate that adult learners engage in lifelong learning for different reasons. The main driving force in enrolling as an adult learner comes from the desire to acquire more advanced qualifications, in order to improve the learner's standard of living. Adult education comes with challenges for the learners and the teachers. The learners have time constraints, financial difficulties, societal and family commitments, and the use of modern technology for learning, as problems to contend with. The teachers of adults have to face the challenges of the overbearing attitudes of some learners.

Teaching adult learners can be very rewarding. The adult learners are focused and well determined. They bring in a wealth of knowledge and life experience to the classroom. All the teacher needs to do is to tap into the positive aspects of adult learners, establish a good rapport, engage them in classroom discussions and bring out the best in them. Teachers of adult learners should give them opportunities of being involved in evaluating the progress of their learning. The challenges of teaching adult learners can be overcome and well managed, by using the right methods to facilitate the teaching and learning processes.

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## Chapter #7

# EVALUATING PROGRAMMING COMPETENCE FROM EXPLANATIONS

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### ABSTRACT

With a prolific amount of computer code available on the web, students are able to use the Internet as a compendium of solutions to computer programming problems. Web search is not only a problem-solving strategy with which students are familiar with and have highly developed skills from years of practice and implicit cultural knowledge, it is also an approach anticipated in real-world contexts for computer programming (Treude, Barzilay, & Storey, 2011). This chapter is an account of the author's transition from pedagogy disallowing the use of solutions copied from web pages to a pedagogy which encourages students to incorporate found solutions into their work. Instead of penalizing students for "cheating" when they adopt other programmer's solutions to computer programming problems, emphasis is instead placed on student's explanations of the solutions they provide regardless of their origin. The effectiveness of this approach is predicated on the idea that the ability to produce comprehensive explanation of a programming solution is a good indicator of programming competency. Otherwise, there is no reason to think adopting someone else's code is a valid learning activity. There is literature to support the idea that explaining and studying (sometimes characterized as reading) existing solutions and program code significantly improves students learning and development of problem-solving strategies (Corney et al, 2014). This chapter suggests similar benefits may accrue from code that is not selected as part of the curriculum, but found by the individual students. More speculative aspects of the approach are the absence of specific instruction in specific problem-solving skills, and absence of a requirement that students eventually shift to independent composition of code as a later stage of demonstrating programming competence. Emphasis is shifted away from the text of computer code solutions, towards student description and assessment of computer code solutions. Students provide their descriptions in a combination of natural language and Unified Modeling Language. Thus design and implementation is separated as advocated by Falkner, Vivian, and Falkner (2014), and the Internet no longer serves as a compendium of pre-packaged solutions. Informal observations regarding a one semester application of this approach conclude the chapter. This chapter is an extended version of Brown (2015).

*Keywords: Problem-solving, Programming, Pedagogy*

## 1. THE INTERNET SEARCH STRATEGY

Students have been practicing Internet skills for most of their lives; whereas learning a new problem-solving strategy and trying to apply it to assigned school work may be an inherently bad approach from the student's point of view: difficult, time-consuming and prone to failure. Searching the Internet for a completed answer that is a close enough fit to the problem is quicker, more efficient and likely to be more successful. Circumventing new intended or incidental learning may not be terribly relevant if the student's personal objective is effective and efficient solution to an assigned problem rather than learning or practicing new skills.



Computer programming is one discipline with a heavily problem-oriented curriculum. Programming problems are often assigned to encourage students to develop their programming skills. Curricula, at least at collegiate level, have been criticized for not providing specific problem-solving instruction, instead relying on sequencing of problems to progress the curricular topics. (Guzdial, 2015). However, if we expect students to regulate their own learning strategies, appropriate domain-specific knowledge about solving problems is a prerequisite (Winne, 1995). Veenman, Elshout, and Meijer (1997) note that novices are “restricted by a poor working method which stems from a lack of domain-specific knowledge” (p. 188) and they resort to a cycle of ‘impasses and local repairs’ without specific strategies to tackle conceptually difficult problems. They tend to delay problem solving until absolutely necessary, resulting in a need to rely on a general mega-strategy that can solve their entire problem in one operation. Given that students without substantial tutelage in solving programming problems are reduced to adopting a general strategy, it should not be surprising that students would retreat to using a familiar Web search strategy for solutions in preference to attempting to decompose and analyzing an unfamiliar programming problem.

In introductory computer programming, the particular strategy for producing a program is seldom assessed: instead, the quality of software submitted is the measure of student performance. An analogy in a math class might be to only assess the final answer, without considering the validity of a student's “workings” that get them to a particular answer. We might tell our students not to copy answers from the Internet, that solving the problem independently is important learning exercise, but seldom review what programming skills the student actually has acquired. No one objects if students seek alternative explanations of course topics, or review elements of a problems already discussed, yet the same students are expected to curtail the kind of investigation they undertake and assistance they accept at some vague point with respect to assigned problems. This contrasts dramatically with industrial or working environments, replete with on-line communities that provide solutions and colleague helpers. Programmers in industry are expected to use these resources (Treude et al., 2011).

There are advocates of unconstrained access to the Internet. Professor Sugata Mitra, (Mitra, 2015) for example, has popularized the concept of minimally invasive education. This includes encouraging students to develop their own learning strategies in an environment enriched with materials (particularly Internet access) and with minimal instruction.

The pedagogical shift advocated in this chapter is substantially a question of evaluation. If performance is about a good problem solution, then access to the Internet should be a non-issue; only the quality of the student solution is relevant. If the solution or answer is used to assess the student's independent competence or comprehension, then allowing the student to tap a community of knowledge is problematic. However unique the assigned problem, the global community can eventually produce a high level of assistance, through user groups, social networks and contact with students in similar programs. This is poignant in Computer Science, which relies on canonical problems that are easily recognized and paired with solutions on the Internet. The proposal advocated in this chapter is to stop attempting to deny students access to a global community of help, instead to shift the emphasis in evaluating their performance.

## 2. PROGRAMMING CURRICULA ARE A SEQUENCE OF PROBLEMS

An early problem in computing curricula is *sorting*; it is part of the implicit canon of knowledge in Computer Science, and incorporates both programming and algorithm design, two problem-solving contexts within the discipline. A typical statement of the sorting problem is: “Write a program which takes an arbitrary sequence of integers as input, and outputs the same integers in ascending sequence”. As a problem in algorithm design, solution strategies for sorting should be compared and contrasted. This will often be undertaken as lecture or presentation material in computing curricula; but some variant of the sorting problem might be given to students as an algorithm design and/or programming assignment.

Explanations, solutions and program code for solving this problem are extensively available on the Internet. An instructor might try to avoid the more popular solutions by assigning a more obscure approach for the student to examine. However, even less popular solution strategies (such as the ShellSort algorithm, cf. Sun Microsystems, 2008) have exhaustive source material and solutions on-line. A student can easily produce a computer program without studying or understanding the problem; they can usually by-pass the explanation part of the solution material and simply copy the program code. (While also true regarding textbook sources, searching tools make the Internet a more attractive option.)

Mark Guzdial (2015) characterizes typical curricula with “most of the learning is expected to occur through the practice of programming”, and that there is an assumption that students benefit most by being forced to construct their own solutions, despite longstanding evidence that this is not an effective way to learn programming. Drawing on Kirschner, Sweller and Clark (2006), Guzdial suggests the “minimal instruction” approach denies the student direct instruction on how experts program, while expecting them to develop expertise independently.

Kirschner, Sweller and Clark (2006) is in part a rejection of the constructivist approach to teaching computer programming. Leveraging off the notion that knowledge is personally constructed, constructivism views the students' programming activities as an opportunity to diagnose and correct student misconceptions about programming (Ben-Ari, 1998). Delivery of knowledge in the form of a exiting solution to a problem (according to constructivism) would preclude that opportunity. Since this chapter proposes that student explanations of solutions (which they may acquire from sources such as the Web) might replace student code composition as assigned work, it excludes the use of programming as constructivist activity.

## 3. THE MEANING OF PROBLEM-SOLVING

It appears that problem-solving skills are typically missing as content from curricula focused on having students practice writing programs. One possible reason for this oversight is the characterization of problems and solutions in computer science, which creates ambiguity around the term *problem-solving*.

In the example offered previously, the problem was sorting, and one possible solution to this problem is embodied in a program. This is typical of the definition of a problem in computing: a problem is defined as creation of a specific algorithm or program to transform of a sequence of symbols (input) to another sequence of symbols (output). A solution (that is, a program that is a solution to the problem) holds no semantic value in the sense that humans might attribute to a problem solution; to give them meaning, input and output

symbols require interpretation, which may be provided by humans looking at the data, or by connecting them to actuators, sensors or robots that interact with the real world. The symbols may indeed mean something – a bank balance, facts, or other abstract concepts - but it requires a human interpreter to infer this meaning from symbols; it is not part of the algorithm “solution” itself. Nor does the program “understand” the input or output, or even its own solution, in any manner that a human might consider “understanding”. In fact, when computer scientists talk about program semantics, they are referring to the symbol manipulation that is done by the program, not the “meaning” of the inputs or outputs, the latter being *semantics* as a human might use the word.

As a consequence, a *problem* in computer science is what a program is intended to solve, and the term *solution* is applied both to the program, and the output from a particular run of the program (which solves one instance of the problem represented by one particular set of program input); a *solution strategy* is the algorithmic approach used to solve the problem, and may involve techniques that go by familiar names to expert programmers, such as backtracking, dynamic programming, greedy, branch and bound, and so on. (cf. Cormen, Leiserson, Rivest, & Stein, 2009).

This is distinguished from what we conventionally mean when we talk about problem-solving by humans (or students). Programming or algorithm instructors may wish students to acquire knowledge and expertise of algorithmic solution strategies (such as backtracking, and so on), which may be discussed and illustrated by examples. But this is where confusion in terminology may obscure the curricular objectives. General skills for learning how to create programs from such algorithmic strategies are generally not part of computing instruction. What we want to induce is a process competence for addressing new situations or unseen problems and coming up with solutions (Sternberg, 1995). In the context of learning to program, *problem-solving* is this student's process of creating a program, a *learning strategy* is a particular human skill supporting acquisition of competence in that process, one or more *problem-solving strategies* may be applied during the human's problem-solving process, and a *solution* includes not only the program, but the human interpretation of the semantics of the program.

In computer science jargon, a program *solves* a *problem*, but does not use the *problem-solving* process or strategies engaged by the student to write programs. We don't want the student to simply be able to do what the computer algorithm they create does – a semantically vacuous kind of problem solving that manipulates symbols. We want the student to be able to create new programs with new semantics. As far as that process may involve learning or problem-solving strategies, they would be entirely distinct from strategies employed by an algorithm/program.

The distinction is fairly obvious when it is attended to, but can be obscured in particular context. Exacerbating the situation is the fact that programming problems are often posed using natural language, and then the task of the student is to reduce the problem to symbol manipulation, and then produce the correct symbol-manipulating algorithms as a solution. In producing the algorithm that solves a problem, following instruction in algorithmic strategies for solving problems, the students are doing a different kind of problem solving which involves different kinds of strategies and skills. The terminology is confounded.

Another relevant distinction between these two meanings of “problem-solving” is that the algorithmic solution strategy is observable in the program code. By looking at and studying the program, the solution strategy may be extracted and studied. The skills and strategies for learning to create a program, however, are not self-documenting: they are not

present in the program code, but have hopefully been induced in the student's skill set by making the student write programs. It would be natural for a programming expert, when discussing solutions or methods, to refer to the code as an illustration of the solution technique, rather than to refer to programming skills that are not part of an inspectable software artifact. Thus, relevant skills may be overlooked. This makes it difficult to distinguish the artifact (code or algorithm) from the act, process or skill of creating the artifact. For example, an evaluator or grader will be aware that a student's program solution to the sorting problem needs to solve all possible sorting sequences, not just a specific sorting sequence (what computer scientists call a problem instance). If a student has produced such a correct program, a grader may infer the student has applied and internalized an abstract problem-solving strategy: otherwise, (goes the faulty reasoning) the student could not have produced the program.

Further conflating the problem-solving needed to create programs with the program solution are learning theories that attempt to relate the two (cf. Robillard, 1999). Wing (2006), for example, posits that learning skills can be structured in an algorithmic manner using the moniker "Computational Thinking" (Michaelson, 2015). Literature on the psychology of programming also brings together the psychological aspects of programming and the computational aspects of psychology (cf. Coles, & Ollis, 2015). While including skill acquisition, more of this work relates to modeling expert behavior than to learning.

The type of learning strategies advocated by learning theorists are easily distinguishable from what computer programs do. Falkner et al. (2014) adduce self-regulatory skills computing students need to learn computer programming, such as planning, time management, identifying sub-goals, problem decomposition, task difficulty assessment, knowledge building, as well as meta-strategies such as strategy assessment. They also cite the ability to separate program design from program coding activities as a computer programming skill. Bergin, Reilly, and Traynor (2005) provide evidence of connection between general meta-cognitive strategies and computer programming performance, while Lichtinger and Kaplan (2011) claim self-regulated learning strategies are domain specific. (Caruso, Hill, VanDeGrift, & Simon, 2011) provides evidence that successful student programmers develop their own individualized and idiosyncratic application of problem-solving and learning strategies. None of these are discussing algorithmic strategies embedded in the code of introductory computer programs.

#### 4. INSTRUCTIONAL APPROACH

We address the concern regarding student finding assignment solutions online, in part by recognizing that the programming strategies themselves do not represent program *creation* or problem-solving skills. As pedagogy, this draws on observations that studying (or "reading" code) produces many of the learning outcomes conventionally pursued by assigning programming tasks to students (e.g. Corney et al, 2014; Kirschner, Sweller, & Clark, 2006; Guzdial, 2015).

Direct instruction of meta-cognitive learning skills, self-regulatory skills and problem-solving strategies is advocated by some researchers, and they develop explicit instructional materials for those objectives. Allwood (1986), for example, suggests scaffolding techniques to help students to explore new problem-solving strategies instead of relying on familiar approaches.

However, adoption of such instruction places two important demands on instruction: a particular theory and approach must be selected among competing learning theories, yielding particular strategies to be included; and scheduled time must be available to include new instruction on problem-solving strategies in the course work. The approach discussed here avoids explicit instruction in learning skills or problem-solving strategies, but still attempts to move away from reliance on programming practice as the means to develop programming expertise. A main objective is to reduce the utility of students copying solutions “from the web” without comprehension of the underlying code.

The adopted approach requires students to explain their program-code solutions in a different form than they can readily find on the web. This intentionally separates the comprehension or understanding of a solution from its expression as program code. The following or a similar address to students is repeated during the course: “*Unlike other programming courses you may have done, I don't care how you get the code you use, as long as you have permission and you attribute it appropriately in compliance with copyright and other legal requirements. While you might benefit more from composing your own, you can get code from friends, off the Internet or even purchase it. The quality of the code you submit is important, but your evaluation will be based on the understanding and explanation of the code provided in your submission. I will be calling this aspect of submission the code design.*”

By shifting evaluation from the quality of the program code to the competency reflected in the individual student's explanation, we attempt to effect two things: (1) eliminate students obtaining credit for code they can acquire but do not understand and (2) force some (perhaps implicit) attention by the student and the instructor on how the student develops an understanding of the program code. In other words, we attempt to engage problem-solving strategies even if they are not explicitly discussed.

In itself the emphasis on design or an abstract description of program code is not innovative. Descriptions of software design are essential in advanced computer subjects such as software architecture. The innovation here is using design descriptions rather than implemented program code as evidence of programming competency, even in more introductory courses where it is not usual.

Work in concept mapping (Novak and Gowin, 1984) supports the belief that students are forced to engage and reify new knowledge when they have to express textual material in a different (diagrammatic) form. Here we pursue an analogous outcome using program design descriptions as the expression of the text of computer program code. Concept mapping has been applied for diagnosing student misconceptions (Sanders, Boustedt, Eckerdal, & McCartney, 2008) and for teaching programming concepts using Unified Modelling Language (UML) (Ferguson, 2003; Tabrizi, Collins, Ozan, & Li, 2004). Essentially, the claim is that in representing program code in a different form (UML), students will have to form a deep understanding of the source material.

Using UML to create abstract models of software systems would be a skill introduced to students at some point in an academic degree stream for computer programming. The difference here is to treat tools such as UML as a way to establish student comprehension of other academic material, rather than as part of the material themselves. To illustrate the difference in using these representations, consider the JAVA program code snippet shown in figure 1.

Figure 1. Taken from openjdk JAVA 6b14 listing for `AbstractCollection.contains` method.

```

public boolean contains(Object o) {
    Iterator<E> e = iterator();
    if (o==null) {
        while (e.hasNext())
            if (e.next()==null)
                return true;
    } else {
        while (e.hasNext())
            if (o.equals(e.next()))
                return true;
    }
    return false;
}

```

Figure 1 is an example of a code segment provided with the standard JAVA libraries used by virtually all JAVA programmers. In this case, it provides an example of *iteration*, a sequential programming construct easily expressed in consecutive lines of code. It is difficult to imagine a more concise representation of iteration than the original source code. Depicting this concept in UML would be less concise or expressive than the original code.

Figure 2. UML representation of JAVA interfaces in the Collections framework.

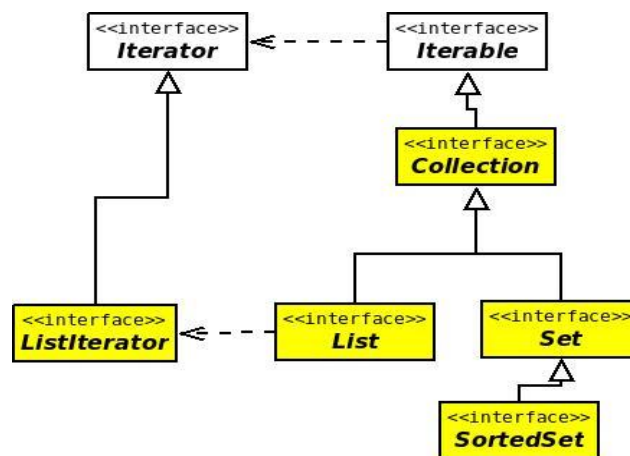


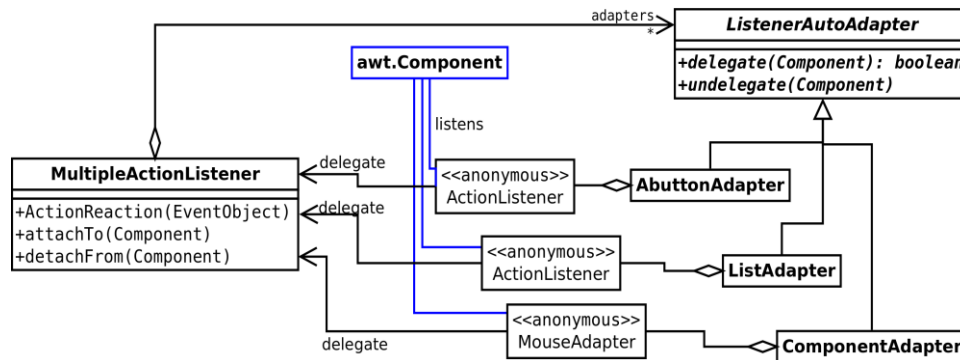
Figure 2, in contrast, uses a notation called a UML class diagram to depict relationships between a set of code constructs called *interfaces*. In the JAVA code, these relationships are scattered throughout the standard JAVA libraries, in lines of code that are non-consecutive and span many pages. It requires some minimal competence to find and conceptually synthesize the relationships depicted in figure 2. UML is much more concise than the original code in presenting this design aspect of the program code.

Our conceit is that requiring students to translate or express aspects of their program solution into UML encourages understanding and thinking about the program code. Efficient expression of programming concepts is not the point, although that helps motivate student use of the notation. Forcing the students to produce correct representations and

make choices about what code aspects to convey means they have to study and understand the code, even if it is not their own original composition. Rather than simply mimic or cut-and-paste from a compendium of coding solutions, students have to internalize the solution well enough to express it in a radically different notational form. The struggle to acquire new understanding is forced on them in a way that cannot be circumvented by generalized learning strategies. It is not the graphical depiction that is important, any more than it is the running program that is important: it is the students' understanding that is engendered by the task of producing an original explanation of the code that is important.

Although our hope and belief is that students adopt successful problem-solving strategies without them being explicitly taught or evaluated, the need to model the use of notational explanations for the students is clear. Figures 3 and 4 are typical classroom materials involved in such modeling. Figure 3 depicts some aspects of a programming solution to a posed problem. In addition to discussing and critiquing the solution depicted, the choices made in constructing the diagram are also discussed with the students: what elements are included, and what is left out for clarity. What unimportant details are omitted. What structures are important to include and which are not. How additional concepts might be included. Certainly such discussion implicitly engages *some* relevant domain-specific problem solving skills, such as problem decomposition.

Figure 3. A UML diagram of a code solution that was critiqued with students. Diagram illustrates one particular design concept used in the coded solution. Students use similar diagrams in their own submissions.



Since UML is poor at presenting certain aspects of programming solutions, (as discussed with respect to figure 1), programming code is still discussed and analyzed as part of class presentations where they are the better choice for representing solution concepts. Figure 4 shows some code used in class presentation to discuss different aspects of the same solution depicted in figure 3. For other aspects, natural language is more effective than either UML or th programming language, and students are directed to consider what is best conveyed by these alternatives: UML, program code excerpts, and natural language. Choice of these alternatives representational choices is also incorporated into class presentations and discussion, impressing on the students that these choices also reflect their understanding and the quality of their work submissions.

Figure 4. Part of the code solution represented in figure 3.

```

/**
 *
 * This adapter sticks to any component and captures mouse click events.
 * This should be the last one tried.
 * @author brown
 *
 */
class ComponentAdapter implements ListenerAutoAdapter {
    MouseAdapter adapterToDelegateListener;
    public ComponentAdapter() {
        adapterToDelegateListener = new MouseAdapter() {
            @Override
            public void mouseClicked(MouseEvent e) {
                MultipleActionListener.this.actionReaction(e);
            }
        };
    }
    @Override
    public boolean delegate(Component j){
        j.addMouseListener(adapterToDelegateListener);
        return true;
    }
    @Override
    public boolean undelegate(Component j){
        j.removeMouseListener(adapterToDelegateListener);
        return true;
    }
}

```

## 5. CONCLUSION/DISCUSSION

The described approach was piloted in a third year course titled “COMP3718: Programming in the Small” at Memorial University, Canada during the first semester January-April of 2015. The primary changes from previous course offering were (1) the emphasis on analyzing and understanding program code rather than composing code; (2) evaluation based on students' original explanations of programs rather than the quality of student-authored programs; and (3) the provision that student may incorporate code recruited from any legitimate source rather than having to compose their own.

The principle distinctions from pedagogy reported in the literature which also emphasize student analyzing and reading (as opposed to only composing) program code are (1) there was no explicit instruction related to problem-solving skills or learning strategies other than algorithmic-programmatic solutions to software problems (2) while coding standards were part of the course, the code explained in student assignments was sourced (chosen or created) by the students themselves, instead of being selected by the instructor for its instructional merit (3) there was no staging that required students to advance past a “code reading and comprehension” stage to a nominally advanced “compose your own” stage in learning programming (Guzdial, 2015).

No formal data collection occurred during this pilot, but some general observations are offered. Compared to previous offerings, both student grades and institutional student evaluations of course instruction were slightly improved. Without controls over other instructional factors, improvement cannot be attributed to any particular cause; however,



there is at least a subjective impression that the modifications discussed in this chapter did no noticeable harm to student performance.

One informal observation is that many students had difficulty adjusting to the shift in evaluation criteria. At mid-term, (after half the assignments were completed), some students' comments on their assignment evaluations reflected conventional expectations. A paraphrase of one comment is "My code works perfectly, so I don't understand how I can have a fail on the assignment". Similarly, a student who lost marks for inadequate explanation wrote "How do you know I didn't do that?" The point that the scheduled marks were for explanation of the code, not for code quality, had not been understood. In personal communication reviewing this issue with some students, several agreed with the suggestion that their expectations were driven by experience in prior courses. An alternative suggestion, that students enjoy programming code and not creating descriptions, was generally rejected as an explanation of student expectations by those interviewed. These comments warrant additional effort to address student expectations regarding evaluation. The following modifications are planned for future instruction: (1) some assignments which involve NO code submission, only description of existing code, will be used to prime student expectations, (2) specific introduction to evaluation schemes, (3) an example of a completed and graded assignment will be provided early in the semester, (4) lecture time modeling the practices of describing and evaluating code will be increased and further integrated into the programming elements of the curriculum.

A further unprompted comment from several students was that the course was challenging in ways they did not anticipate, and in particular that they had difficulty "finding examples on the Internet". This provides some hope that the approach is achieving its material purpose of removing the Internet as a compendium of solutions, forcing students to apply cognitive effort in study of their submissions.

A parenthetical observation is that although students were not required to author their code submissions, a substantial amount (more than half) of submitted code was indeed authored by the students. One speculative suggestion is that it is easier to explain your own code than to study, understand and explain someone else's code. It is also commonly asserted that programmers enjoy and feel accomplishment in the act of producing their own programs.

This project could now move past a pilot stage, entertaining data collection for several outstanding questions. A comparison to approaches that adopt specific learning theories and explicit instruction in specific problem-solving skills (e.g. Falkner et al., 2014) could be assessed by identifying the problem-solving strategies students are adopting under this approach. It would also be interesting to determine how students are sourcing the computer program code used in their submissions, to assess how code creation and associated programming skills are impacted.

If generalization of this approach to subject matter other than computing is warranted, a difficulty is analogizing the act of describing code to some activity in another discipline. The author tentatively suggests that student self-critique and self-evaluation of solutions may provide similar constructs, and the general literature on student self-regulated learning (cf. Lichtinger & Kaplan, 2011) could be interpreted as supporting this view.

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## Chapter #8

### THE QUALITY CHAIN IN EDUCATION – A GRID APPROACH

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#### **ABSTRACT**

The increasing demand to provide students-and learners in general-with an effective and motivating educational environment has increased the demand for quality management to deliver high-quality results and thereby meet the growing requirements of “customers”. The adoption of total quality management in education is a relatively recent manifestation and has been treated with enthusiasm by a number of researchers and with scepticism by others. One of the difficulties in a service-oriented environment such as education is the complexity of its stakeholders, process and, consequently, the definitions and interpretations of different relationships within the educational organization. The present review defines the quality chain in education by examining the basic stakeholders of the educational sector: the teachers and the learners. It then proposes a methodology based on the managerial grid model developed by Blake and Mouton (1964a), which is based on a concern for people as well as for production. Additionally, it explores the ways in which this model can be applied in the quality chain of education while using basic principles of total quality management. Ultimately, the aim is to examine the potential for improving the educational quality chain and also to provide a personal improvement tool and thereby enhance the overall concept of continuous improvement.

*Keywords:* quality chain, education, total quality management, grid model, continuous improvement.

#### **1. INTRODUCTION**

Today’s economy is globalized, competitive and knowledge-based. Education is in the midst of a reform in which it endeavours to rediscover itself, to develop and test new methods and techniques and to produce standards and processes that will meet the objectives of the new era. Education professionals seek to produce students that can learn how to learn, are capable of solving problems and of thinking critically while synthesizing without prejudices, are able to work in teams and, consequently, are able to meet the demand for an efficient and dynamic workforce that includes the entrepreneurs of tomorrow, as well as those individuals who will comprise the larger working communities. Educational communities, such as schools and universities, are complex organizations based largely on a number of interrelated systems and relationships; thus, various parties may have different needs, attitudes and goals which do not always converge (Saiti, 2012). These differences are quite likely to prevent the smooth functioning of the educational process; in this respect, the role of quality management in education is expanding. As Stukalina (2010) maintains, one of the major issues in educational organizations is that of managing for quality. Indeed, as the author explains, education managers are faced with the challenge to provide learners with an effective and motivating educational environment. This means that each student-or learner, in the broader context-is a unique individual that needs to be given particular attention to his or her needs in an attempt to improve educational practice and to enhance the quality of education.

A number of questions surface at this point. Is the current educational system adequately preparing students for work and for life outside school? Can we improve the ways in which we prepare students for the challenges they will face in any and all circumstances?

Does the educational environment motivate students to continue learning in a lifelong learning context, and do students appreciate knowledge as a commodity? Understandably, addressing all the above issues in this review would be far too ambitious. In the following sections, the review will consider and investigate, from a narrower perspective some quality and total quality management (TQM) issues and will focus on strategies that can be used by teachers and education managers to better understand the relationship between the educator and the learner. Human behaviour must be regarded as an important element for the improvement of any educational environment and as a part of the wider set of quality objectives. In order to improve the quality of the educational environment and provide qualitative changes, it is important to observe and to understand different attitudes and be ready for change and evolution.

## **2. TOTAL QUALITY MANAGEMENT AND EDUCATION**

Quality in general has been a popular idea for a long time, now, and its continuous development over the years has been driven largely by the growing requirements of customers. As Weckenmann, Akkasoglu and Werner (2015) claim, to constantly improve and satisfy the requirements of the quality triangle (cost, quality and time), the perspective of quality management has to be constantly widened. In this respect, there is a shift in perspective from what *is* done to *how* it is done. The evolution of quality management over the years has given rise to total quality management (TQM) as a wider application being implemented not necessarily by market pressure but by the imperative to deliver high-quality results. Consequently, the concepts of quality and TQM have found application in areas with no direct competition but which have an urge for self-improvement, such as education and public administration (Weckenmann et al., 2015).

The concept of TQM can be defined as a systematic management approach to long-term success through customer satisfaction by the commitment of all members of the organization to participate in the continuous improvement of processes, products, services and the culture as a whole (Deming, 1986; Juran, 1999). Although the idea of continuous improvement is clear and perhaps easy to comprehend, it must not be overlooked that TQM is a system; as such, it is a holistic approach that requires the development of a system-wide culture (Doherty, 2008). In such a holistic culture, everyone, irrespective of roles and positions in the organizational hierarchy, is responsible for the management of his/her contribution to the whole, which justifies the term “total”. Indeed, a large number of researchers support the idea that one of the most significant impacts of TQM is on the human resource dimension rather than on machines or other technical components (Deming, 1986; Mullins, 2007; Weckenmann et al., 2015). As such, it is a profoundly integrated management philosophy that promotes the employee dimension and enhances collaboration. Understandably, in this way, the human resource becomes the asset of the organization. It is therefore effective human resource management and quality management that combine to converge on total quality, which essentially provides, amongst other benefits, a challenging and satisfying working environment, personal development through training, active involvement and the participation of all parties involved (Crawford & Shutler, 1999; Deming, 1986; Mullins, 2007; Saiti, 2012). The need imposed by TQM for the commitment of all employees within an organization to high standards of quality recognizes the importance of relationships between leadership, employees, processes, customer satisfaction and business results (Weckenmann et al., 2015).

The correlations of TQM and business excellence have formed several models and standards that have subsequently led to a number of awards. Some of the well-known quality awards and standards include the Malcolm Baldrige Award (United States), the Deming Prize (Japan) and the European Quality Award, developed by the European Foundation for Quality Management (EFQM). On a more international level, there is the International Standard ISO9000 series. All of these awards have been introduced in recent years to promote quality and excellence in a wide range of industries and services. Indeed, winners of awards, such as the Baldrige or EFQM, represent world-class organizations in which quality has been rigorously assured but also which have been acknowledged by their peers to be outstanding (Doherty, 2008).

As mentioned previously, the adoption of TQM is relatively recent in the education sector. Considering that in the past few years, educational units, in one form or another, have been required to examine and to review practices to ensure that they offer quality services, TQM seemed to be an obvious solution. Much of the work with respect to TQM in education started in 1990 in the United States and in the United Kingdom (Sallis, 2005). Although TQM concepts were developed by Deming (1986) and Juran (1999) to increase industry's productivity, as Deming argued, TQM principles could equally be applied to the service sector, including education (see also Militaru, Ungureanu & Chenic, 2013). As Saiti (2012) further claims, considering that the vast majority of organizational activities depend on the capabilities of human resources, there is no obvious reason for not applying TQM to a school system. Ah-Teck and Starr (2014) further demonstrate that TQM may be an appropriate framework for change and improvement in the school environment.

The quality criteria in education necessary for the development of a productive education system have been investigated by a number of researchers. These criteria may include the following: educational leadership commitment and the support of educational leaders in the quest for quality; quality consciousness by establishing a vision and objectives that encourage a commitment to the school's mission; leaders' and teachers' continued training and development and motivation of educators and learners to ensure high standards and continuous improvement (Crawford & Shutler, 1999; Deming, 1986; Hargreaves, 2009; Leithwood, Day, Sammons, Harris, & Hopkins, 2006; Saiti, 2012; Sallis, 2005). As Crawford and Shutler (1999) accurately observe, a school that adopts total quality aims not only to continuously improve the learning process but also the school management's aim to support the school processes.

Although there is much discussion on the importance of TQM and its contribution to education, as examined in the previous paragraphs, a number of researchers have been acknowledged as remaining sceptical about its application in school units. One of the arguments advanced by these researchers is that this is a philosophy originally developed for the business sector, and, as such, its acceptance in education seems inappropriate (Ah-Teck & Starr, 2014). Another argument developed by Reed, Lemak and Mero (2000) questions whether the absolute reduction of mistakes and errors, although feasible in an industrial production context, is equally applicable in an educational environment. In contrast, Ah-Teck and Starr (2014) claim that a strong movement towards quality processes in education, since, as demonstrated by the Organisation for Economic Co-operation and Development (OECD; 2011a, 2011b), education needs dynamic quality models, which may be provided through TQM. Such models will allow for a well-structured, interconnected and integrated education system which enables management, evaluation, motivation and improvement in student performance, as well as self-awareness of all stakeholders through the continuous improvement concept (Sallis, 2005).

### **2.1. The quality chain in TQM and education**

One of the main principles that lie at the heart of TQM is the collection and analysis of data to investigate initially and act consequently over time on the needs and expectations of all parties involved in the process (Ah-Teck & Starr, 2014). As Deming (1986) said almost 30 years ago through his PDCA cycle (plan-do-check-act), applying your plan and understanding where it needs to be modified by obtaining data and acting upon feedback is considered to be a major difference between TQM and other management theories (Sallis, 2005). One of the difficulties in applying TQM in education is the intangibility of the service provided and the transformation towards the client-oriented culture-and thus the definition of the parties that constitute the quality chain. Despite the many and different definitions, it can be said that, in education, the product/service is the education, advice, assessment and guidance that are offered to the pupils/students/learners; the supplier, depending on how wide the system examined is, is the school or the educational unit in general, the teacher or the educator, the head of the unit and the administrative staff. Finally, the client is, again depending on how wide the system under examination is, the student or learner, the parents, sponsors, employers and the society in the wider context. The concept of the customer-supplier chain in the education sector is debatable since it has a commercial tone that is not considered to be appropriate for such an area. Thus, as Doherty (2008) explains, it is the word “stakeholder” that is preferred, as it raises fewer objections and is a milder approach to the receiver of service. Irrespective of the terminology, however, it is clear that educational organizations have a diverse range of stakeholders with diverse, and sometimes conflicting, expectations.

Further discussion on the distinction between primary and secondary customers, internal and external customers and stakeholders is beyond the scope of the present review. What is important, however, is to understand the importance of the role of the teacher in the quality chain and, consequently, the impact of his or her behaviour on the educational environment. The significance of teachers to the structure of the learning environment and to students’ achievement has been consistently reinforced (Harford, 2010; Saiti, 2012). As Chong (2014) explains, if there is a will to improve the quality of the education system, it is important to ensure that the teachers are well prepared and assisted in their self-awareness and that the overall strategy is designed by the leader of the school and the rest of the stakeholders. It is the essence of the relationship between the basic stakeholders-the teacher and the learner-that, in the present review, we wish to evaluate in an attempt to improve, ultimately, the educational quality chain while providing a framework for personal improvement. First, however, theories, models and styles that describe teachers’ behaviours and leadership attitudes will be examined as important elements of quality.

## **3. TEACHERS’ BEHAVIOURS AND LEADERSHIP ATTITUDES**

Modern educational reforms confirm the idea that there is a strong relation between leadership and school improvement (Harris, 2004). This view is further supported by Saiti (2012), who reports that the effectiveness of the school unit is frequently linked to the quality of its leadership. Over the years, there has been a significant turn towards what is called “distributed leadership”, where leadership is shared or distributed among teachers, students, parents and other stakeholders in the school environment, as a sustainable means of building the type of a learning-focused school climate (Spillane, 2006). Although there has been considerable research on the actual implementation of school leadership and its contribution towards sustaining improvement (see, for example, Harris, 2004), there is little evidence with respect to the kinds of leadership that can be distributed across the stakeholders of a school

unit, such as teacher leadership, although the concept is not new and has been well accepted in the United States and Canada (Harris, 2003).

Teachers might wonder about the applicability of management and leadership theories in the area of education. Understandably, a teacher is the leader of his or her class and, in part, a leader of the school community. As Burns (1979) claims, leadership is leadership wherever you find it, and power and leadership are not concentrated in a few but are widely distributed. The author continues that leadership can be taught in the sense that great teachers are leaders and, vice versa, are joint seekers of truth. Taking this view, leadership is about learning together and constructing meaning and knowledge collectively and collaboratively (Harris, 2003). Despite the resistance to the idea of teachers being viewed as leaders, strengthening the teachers' leadership role within and outside the classroom can only positively reflect on the effectiveness of the school and its improvement (Bennett, Wise, Woods & Harvey, 2003; Fullan & Stiegelbauer, 1991; Harris, 2003).

Historically, Lippitt and White (1943) have distinguished three leadership styles in the classroom: the democratic, which creates a positive atmosphere and brings positive results even in the absence of the teacher; the authoritarian, which creates a hostile climate but entails productivity; and the delegative (*laissez-faire*), which creates friendly relations in the group but does not lead to the effective achievement of objectives. Later, Bales (1951) defined two orientations of the educational leader (work and emotion), stressing, however, that the leader cannot accommodate both orientations simultaneously. This view was overturned by Stogdill (1981) and by Sorrentino and Field (1986). McLaren (1993) distinguished teachers in despotic that teach from the front of the classroom; entertainers, who do not really care about learning but focus on how students will spend time pleasantly, and critics, who emphasize quality teaching and encourage student self-motivation as well as the development of their critical thinking.

A plethora of management and business models are currently being applied in the educational context (see, for example, Harris & Muijs, 2002). Some of the well-known models include the X and Y theory of McGregor (1960), the effectiveness theory of Fiedler (1967), the transformational leadership models of Burns (1979) and models by Lewin (1997) and Likert (1967). However, many of these and others theories, not illustrated herein, are founded in the classical theory of Blake and Mouton (1964a).

The managerial grid model developed by Blake and Mouton (1964a, 1964b, 1968) is a situational leadership model which originally identified five different leadership styles based on a concern for people as well as for production. The grid theory continued to evolve and developed into two additional leadership styles that feature a new element: resilience (Blake & Mouton, 1984, 1985). The managerial model is represented as a grid with a concern for production as the x-axis and a concern for people as the y-axis; each axis ranges from 1 (*low*) to 9 (*high*). The resulting original leadership styles, which are shown on the grid, are

- the indifferent style (1,1): evade and elude;
- the accommodating style (1,9): yield and comply;
- the dictatorial style (9,1): control and dominate;
- the middle-of-the-road style (5,5): balance and compromise;
- the sound style (9,9): contribute and commit.

The opportunistic style (exploit and manipulate) and the paternalistic style (prescribe and guide) were added to the grid theory at a later stage (Blake & Mouton, 1984; Blake, Mouton & McCanse, 1989).

Through this managerial model, an analytical approach has been developed that is suitable for a variety of contexts (e.g. sales, supervision, media and marriage). Practically,



this approach can be applied in any human activity that concerns at least two persons and the production-supply of a product or service. It is further acknowledged that there are a large number of leadership styles, models and theories that interpret human behaviour, as mentioned previously. It is the intent of this review to focus on the grid model and examine further its applicability and implications in the educational sector. The implementation proposed by the present research is demonstrated in the following section.

#### 4. RESEARCH METHODOLOGY

The aim of the present review is to examine the potential for improving the educational quality chain but also to provide a framework for the personal improvement of the basic stakeholders of the educational quality chain: the teachers and the learners. Considering the complexity of the school environment and the variety of stakeholders involved, it is important to further understand the needs and attitudes and to try and move towards a common vision. Giannias and Sfakianaki (2015) introduced and defined teachers' styles within a grid framework based on the methodology initially proposed by Blake and Mouton (1964a). Understanding teachers' styles is clearly important and useful for the overall evaluation and strategy of a school. Thus, the methodology provides interest, as well as the opportunity to define the learners' respective behaviours through the use of the same grid and, consequently, the interaction of the different behaviours of teachers and learners.

This behavioural approach is used to help evaluate the relationship and thus improve the relationships of those comprising the quality chain. It can then be used as a tool for educational managers and other leaders who can align/*plan* together with teachers (or class leaders) with respect to the school mission and objectives: *do* (implement); *check* and *act* upon feedback (PDCA cycle) in the context of the continuous improvement of any quality management process.

#### 5. IMPLEMENTATION

##### 5.1. The GRID model in education: the teachers' perspective

To present our model, we take the view that "teachers" and "learners" are involved in the education quality process. Both terms are used in their widest sense and are specified according to the level of education considered. For example, if the model is applied at the third (university) level education system, the "teachers" are professors, and the "learners" are students. Following a behavioural approach, Giannias and Sfakianaki (2015) introduced the characteristics of successful teachers and identified two fundamental drivers of teachers' behaviour:

- concern for providing education (getting the job done)
- concern for the learners (as people)

These two fundamental drivers of teachers' behaviour imply the classification, which is illustrated in Table 1. A teacher's type is specified by a pair (x and y) of numbers (scores), where x is a measure of a teacher's concern for education, and y is a measure of a teacher's concern for learners. Both x and y scores range from 1 (*low*) to 9 (*high*). In our model, x and y specify types of teacher behaviour. Given that the x and y values range from 1 to 9, there are 81 (= 9x9) combinations of types, which are shown in Table 1. Each cell of Table 1 represents a specific x-y combination. Table 1 illustrates the five representative types (1,1), (1,9), (9,9), (9,1) and (5,5), as well as type (9,2).

Table 1. The Teachers' Grid.

*Teachers' concern for learners*

1,9									9,9
				5,5					
									9,2
1,1									9,1
1	2	3	4	5	6	7	8	9	

*Teachers' concern for education*

Giannias and Sfakianaki (2015) identify the five types of teachers' behaviour that are discussed in the following paragraphs. The bottom right corner of the grid represents a (9,1) style of teaching-maximum concern for the efficient accomplishment of education but minimum concern for human relationships with learners. This pattern corresponds to the old style of authority-based teaching, which is characterized by command and control of the class.

The dictatorial (9,1) style of teaching finds learners' needs unimportant; teachers who practise this style provide learners with a great deal of educational material and expect performance in return; they also pressure students to learn through the use of rules and punishments. Teachers who practice other teaching styles usually use a (9,1) approach when they realize that their primary style is unsuccessful.

The (1,9) style (top left), in contrast, focuses on human relations with learners at the cost of efficient education and has been called the "nursery school" style of education. The (1,9) style is based on the principles of yield and comply. This style has a high degree of concern for people and a low degree of concern for production. The (1,9) type of teachers pay much attention to the security and comfort of learners in hopes of increasing their performance in class. The resulting atmosphere in a class with a (1,9) teacher is usually friendly but not necessarily very efficient in terms of education.

The (1,1) teaching style (minimum concern for either production or people) is characterized by a desire to avoid responsibility and to exert minimum effort. The indifferent style (1,1) of teaching is characterized by the terms "evade" and "elude". In this style, managers have low levels of concern for both people and production. Accordingly, teachers use this style to preserve their jobs and their job seniority while protecting themselves by avoiding getting into trouble. The main concern of the manager is not to be held responsible for any mistakes, a strategy that results in less innovative decisions or activities.

The (5,5) teaching type attempts to maintain a balance between both concerns. The status quo, or middle-of-the-road, style (5,5) is characterized by balance and compromise. Teachers using this style try to balance the goals of education with learners' needs. By giving some concern to both learners and education, teachers who use this style hope to achieve suitable performance; doing so, however, gives away a bit of each concern so that neither education nor learners' needs are met.

The (9,9) type of teaching integrates maximum attention to both learners and education and is put forward as the most effective approach. The sound, team style of (9,9) teaching is characterized by contribution and commitment. In this style, a high degree of concern is paid both to learners and to education. A teacher choosing to use this style encourages teamwork

and commitment among learners. This method relies heavily on making learners feel themselves and being constructive parts of their class.

Using standard, grid-based analytical–methodological approaches, the five representative types of Table 1 can be studied in depth to clarify their advantages and disadvantages, as well as for their comparable evaluation. This information is valuable at both personal and organizational levels for the following reasons: A teacher using grid tools (e.g. a personal self-evaluation test) identifies his or her type as, for example, (9,2). This implies that among the five representative types, the (9,1) style is closer to his or her teacher-behaviour and effectiveness. Thus, a thorough study and understanding of the five representative types can be a useful tool (methodology) for self-development. For example, if this teacher has realized that the best type for him/herself is (5,5), he/she cannot be satisfied with a (9,2) positioning on the grid. In this respect, the grid tool, in essence, suggests those personal changes the teacher must develop in order to change his or her position on the grid and to thus achieve self-improvement. Further, in an organization such as a school, a grid-based research, as will be further explained in section 5.3, can identify what the best/ideal type of teacher is for the organization. Given this, a plan can be designed to help and to motivate the teachers of the school (each of which has his/her own type) to move towards the best/ideal type of the organization and thereby enhance the school's mission and objectives. As Filiz (2013) states, it is important for teachers to receive feedback on their work and on the level of service they provide. Equally important for the teachers is an understanding of how their work is acknowledged and perceived by the head of the unit, learners and other colleagues.

## **5.2. Classroom behaviours: the learners' perspective**

Teachers cannot predict the specific behavioural issues they will need to address in class. In some instances, they may experience few disruptions or problems, and in others, it may seem as though every learner is devising a way to distract, disturb, disrespect or otherwise cause problems for their fellow classmates and teachers. McKeachie and Svinicki (2014) identify the following four types of students, characterized by the challenging behaviours they may exhibit in a classroom:

- Attention-seeking, discussion-dominating students: students who want to be heard and heard often.
- Inattentive students: students who are apt to drift off into their own thoughts, stare into their smartphones or talk with classmates in the middle of a lecture.
- Unprepared students: students who make a habit of skipping the reading, viewing, listening or other assignments intended as pre-class work.
- Uncivil and disrespectful students: students who disrespect the time, feelings and thoughts of their teachers and their fellow students; their rude behaviour has a negative impact on the entire class.

The effectiveness of each type of teacher with respect to managing the learners' classroom behaviours, as provided by McKeachie and Svinicki (2014), constitutes an interesting subject that needs to be studied further through empirical research, which is not within the scope of the present review. Towards this direction, however, a grid-based typology of learners' styles, as is presented in the following section, might be equally appropriate.

## **5.3. The learners' grid**

Following the grid approach discussed in section 5.1, the learners' grid is presented in Table 2; in this grid, also, the x-axis represents a concern for education, and the y-axis represents a concern for teachers.

Table 2. The Learners' Grid.

<i>Learners' concern for teachers</i>								
1,9								9,9
				5,5				
1,1								9,1
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<i>Learners' concern for education</i>								

More specifically, the two variables of *concern for education* and *concern for teachers* are plotted on a grid (Table 2) showing nine degrees of concern for each, with 1 indicating a low level of concern and 9 indicating a high level of concern. Five positions on the grid represent five differing behaviour patterns of learners. In Table 2, the following learners' styles are identified as follows:

The (9,1) style (the push education orientation): This approach (lower right corner of the learners' grid) involves complete concern for education, with little or no regard for the teacher.

The (1,9) style (the teacher orientation): This approach (upper left corner of the learners' grid) involves little or no concern for education and maximum concern for the teacher.

The (1,1) style (understand it or leave it): This approach (lower left corner of the learners' grid) involves little or no concern for either education or for the teacher.

The (5,5) style (the educational routine orientation): This approach (middle of the learners' grid) involves an average level of concern for education and average concern for the teacher.

The (9,9) style (the problem-solving orientation): This approach (upper right corner of the learners' grid) involves maximum concern for education and maximum concern for the teacher.

Using the grid typology for teachers and learners that was introduced above, the effectiveness of teachers' types can be identified within a school environment, as is explained in the following example. Suppose that in a specific school, a grid-based research has identified the effectiveness (using as a criterion the final objective, which is education) of each type of teacher on each type of learner. The results of this research are presented in Table 3, in which the following coding is used:

- (+1): A rather effective combination
- (0): Neither an effective or ineffective combination
- (-1): A rather ineffective combination

Table 3. The Effectiveness of Teachers' Types.

<i>TEACHERS' GRID</i>	<i>LEARNERS' GRID</i>				
	<b>1,1</b>	<b>1,9</b>	<b>5,5</b>	<b>9,1</b>	<b>9,9</b>
<b>9,9</b>	1	1	1	1	1
<b>9,1</b>	-1	-1	1	1	1
<b>5,5</b>	0	0	1	1	1
<b>1,9</b>	-1	-1	0	-1	1
<b>1,1</b>	-1	-1	0	-1	1

After incorporating in the analysis all relevant cost aspects, the information in Table 3 indicates what the best type of teacher is for the specific school; (9,9) is shown to be the best type of teacher for the school. However, this type of teacher may be too expensive to hire or maintain and the school management may decide (after taking into account all cost aspects of the alternative choices) to take the necessary actions for hiring or maintaining in the school teachers of type (5,5). Naturally, in public schools, there is no real choice as to the type of teacher that will be employed, since in most countries they are appointed directly by the state; however, even in this case, the head of the school can, together with the teachers, work out a policy towards which the school wishes to move. Ensuring that the teacher is compatible with the school policy and is willing to work towards implementing the school strategy can only affect him or her positively, thereby representing a significant aspect of job satisfaction, which in turn affects, implicitly, the learners (Reilly, Dhingra & Boduszek, 2014).

## 6. CONCLUSIONS

Education institutions of all levels are being pressured to become more efficient and responsive to their “customers” needs by offering an effective and motivating educational environment. With a variety of stakeholders and relationships in educational environments, integrating different needs and attitudes is a challenge. Quality is vital and can contribute significantly through its focus on continuous improvement. In the present review, the model proposed by Blake and Mouton (1964a) was employed in the context of the quality chain, as defined in education, between the basic stakeholders: the teachers and the learners. In the analysis, the teachers’ and learners’ styles were examined separately and were also viewed in relation to each other.

Human behaviour, an important element in the improvement of any environment, is also an important element of TQM. There are meaningful lessons that can be learned from the present review, even if one does not adhere (at least not completely) to a TQM approach. The advantage of the proposed grid-based approach has several applications. It can be used by educational management teams to review and assess an overall educational strategy and provide feedback to the teachers. Teachers can obtain a realistic assessment of their work and what is expected of them. The grid-based approach can also be used as a self-assessment tool for the teacher and the learner and provide feedback with respect to a personal PDCA cycle. It can be used by the teacher to improve the quality of learning within the class. In conclusion, the grid-based approach can improve the quality chain as defined in this chapter, since it capitalizes on existing knowledge (originated from management) to develop diagnostic tests for identifying (through empirical research) the teachers’ and learners’ types within a specific educational environment. The next step in this evaluation process is to collect empirical data in order to test, verify and modify the proposed methodology.

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**Section 2**  
**Projects and Trends**





## Chapter #9

### HYBRIDIZING L2 LEARNING: AFFORDANCES OF THE INVERTED CLASS APPROACH WITH ONLINE TASKS

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#### ABSTRACT

Based on the assumption that both knowledge of English and digital literacy are important to access information online (Finardi, Prebianca, & Momm, 2013), the present study investigated the impact of a hybrid approach to English as a foreign language teaching in an intact class in Brazil. Hybrid approaches have been described as the combination of face-to-face classes with online instruction, (Graham, 2005), and in this study it was operationalized as an inverted class approach, that is, the combination of face-to-face classes with computer-mediated activities performed in an online environment, outside the class. Twenty male participants were recruited in an intact class in the Brazilian Navy Academy Boarding School to participate in the study. Data includes class observation, questionnaires and interviews, analyzed qualitatively to evaluate the impact of online tasks in L2 learning, as well as in the development of students' autonomy and digital literacy. Three tasks adapted from Finardi and Porcino (2013) using different sites on the internet were administered, followed by a questionnaire after each task. Overall results of the qualitative analysis of students' perceptions of the tasks performed in the online environment revealed that the L2 hybrid approach used may contribute to the development of students' autonomy, motivation, digital literacy and L2 development through extended contact with and in the target language.

*Keywords:* L2 teaching, hybrid approach, inverted class approach, L2 tasks, internet tools.

#### 1. INTRODUCTION

Technology in general and the internet in particular have a key role in connecting people and widening access to information. Yet, and despite the fact that most schools in Brazil are equipped with computers and computer labs, teachers do not seem to make the most of the pedagogical potential of technology in education (e.g. Prebianca, Cardoso, & Finardi, 2014; Finardi, Teixeira, Prebianca, & dos Santos Júnior, 2014; Finardi, 2012). According to Finardi et al. (2014), this is due to the fact that many teachers still believe that incorporating technology in education equals more work for teachers, many times inconsistent with the investment in the teaching profession in Brazil.

However, Finardi et al. (2014) showed that, contrary to what teachers may think regarding the use of new technologies in education, students believe that a technological approach, particularly for teaching English, allows greater interaction in the language and renders the learning experience more dynamic, authentic and motivating. In short, the study suggested that there is a gap between students' needs and expectations and teachers' beliefs regarding the use of technologies for additional language (hereafter L2) teaching-learning. Additional languages include all the languages except the first, native language (L1).

The search for new teaching methodologies that can meet teachers' and students' expectations is therefore a need in the current educational landscape. One possibility of enhancing the use of new technologies for educational purposes is to use hybrid approaches such as the one known as the inverted classroom or flipped classroom. The concept of inverted classroom was proposed by Lage, Platt and Treglia (2000) to counteract the negative effects of the gap between teachers' teaching styles and students' learning styles. Lage et al. (2000) proposed the inverted classroom as a teaching approach that uses a variety of teaching styles with the use of multimedia. The basic idea of this approach is that events traditionally made inside the classroom are made out of it and vice versa (Lage et al., 2000, p. 32).

Based on the assumptions of the inverted classroom approach to meet learners' and teachers' styles and expectations, this study sought to examine the possibility of developing L2 linguistic competence and autonomy by means of online tasks performed in a hybrid approach environment which combined face-to-face classes and online activities carried out in the lab in the inverted classroom approach. The main motivation for the study was to reflect about teaching methodologies which combined internet use in an inverted classroom format with traditional classroom activities so as to expand learners' contact with the target language while also solving some problems of traditional face-to-face teaching approaches, such as temporal and geographical limitations, expanding teaching/learning time and space (Hardagh, 2009).

Internet has been claimed to expand learners' access to information (Finardi, Prebianca, & Momm, 2013) and to have changed the way we use, teach and learn L2s (Finardi & Porcino, 2014) but the extent to which it has actually been used to access relevant L2 information is still unknown. What is known, in the case of Brazil where the study was conducted, is that internet is ubiquitous and very used in that context, but not necessarily for educational purposes. According to the Wall Street Journal and the Forbes magazine, Brazil is the capital and future of social networks. With a population of over 200 million people, in 2013 there were over 80 million web users, 78% of whom access some kind of social network on a daily basis. Yet, in a report carried out by Brazilian newspaper *Jornal da Globo*<sup>1</sup> we see that seven out of ten Brazilians did not read a single book in 2014. What these numbers seem to show is that Brazilians use the internet but mainly for entertainment, not to access relevant information and contents in L2, as suggested by Finardi, Prebianca and Momm (2013). Based on this evidence, the present study had a two-fold aim: 1) to reflect on L2 teaching approaches that could help Brazilians access relevant L2 information online while also developing autonomy and motivation to learn English as an L2 in an inverted classroom format, and 2) help Brazilians to develop L2 and digital literacy through an increased contact with the target language in and out of the class.

In order to achieve these goals, three tasks (Ellis, 2003) adapted from Finardi and Porcino (2013) were tailored to be used by L2 students outside the class, in a hybrid approach to L2 teaching where students would carry out L2 tasks in a lab with the use of internet tools in addition to having L2 classes in the Navy School where the study was carried out. In what follows, the theoretical underpinnings of the study with the concepts of hybrid approaches, inverted class and task based language teaching will be reviewed before describing the methodology used to achieve these goals.

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<sup>1</sup>Available at <http://g1.globo.com/jornal-da-globo/noticia/2015/04/70-dos-brasileiros-nao-leram-em-2014-diz-pesquisa-da-fecomercio-rj.html>, accessed on May 1st, 2015

## **2. HYBRID APPROACHES**

The term hybrid approach (Graham, 2005) is usually associated with traditional face-to-face classes and instruction in a virtual learning environment. However, the term has evolved to define wider teaching dimensions, such as the combination of face-to-face classes with online classes, structured learning, that is, previously planned classes, and non-structured classes – classes planned according to the interest and need of learners, following the pace of each individual (Wilson, 2011).

Graham (2005) documented four levels of hybrid approaches, namely, the activity level, the course level, the program level and the institutional level. The inverted classroom approach can be considered a type of hybrid approach and was selected for this study based on the assumption that it could foster the development of student autonomy and motivation to learn English as an L2. Bishop and Verleger (2013) conceptualize the inverted classroom as including questions and answers and group-based/ open-ended problem solving inside class, and video lectures and closed-ended quizzes and practice exercises outside class, precisely the types of activities which were used in the present study.

## **3. TASK-BASED APPROACH**

Ellis (2003) defines a pedagogical task as a plan that forces learners to process language in a way that resembles the use of language outside the class, in the real world. According to Larsen-Freeman (2000), the Task-Based Approach (TBA) aims at providing learners with a natural context for L2 learning. In this approach, learners have several opportunities to develop communicative skills that will allow them to participate in real world situations, as they need to interact with others while they work to accomplish a task, as in Task Two presented in the fifth section of this chapter, where learners have to decide on a present to buy for the family. During these interactions, the focus is on meaning and not on form, and learners receive L2 input that will help them perceive gaps in their L2 language system. The fact that the focus of tasks is on meaning and tasks do not demand a specific structure or form from the participants renders the interaction during tasks more authentic as they resemble real interactions. The tasks allow participants to use their creativity and imagination and provide them with guidance to solve real world tasks.

Ellis (2003) draws some relevant distinctions between unfocused and focused tasks. Whereas unfocused tasks do not demand any specific grammatical structure from the learner, focused tasks “aim to induce learners to process, receptively or productively, some particular linguistic feature, for example, a grammatical structure” (p. 16). Both unfocused and focused tasks aim to stimulate the use of communicative language, but only focused tasks have the objective of inducing learners to implicitly use a predetermined grammatical form. In this study, both kinds of tasks were used in the methodology created for the inverted classroom approach.

Ellis (2006) provides two basic types of activities for the tasks: a) the teacher plans how the task will be accomplished, considering the number of participants; and b) the teacher and learners are involved in the decisions made throughout the task execution. In this study, the former option was chosen, as the tasks were previously planned by the teacher and were divided in steps which learners had to follow strictly, within their own pace, accessing the internet and tools, out of class, in the inverted class approach.

#### 4. METHODOLOGY

The methodology used in the study was that of action research (Dörnyei, 2007) and aimed at reflecting about the potential of internet tools to develop learners' autonomy, L2 skills and digital literacy in an inverted class approach. Twenty male participants aged between 18 and 22 years old were recruited from an intact English (L2) class in the Brazilian Navy Boarding School for Seamen Apprentices (Escola de Aprendizes-Marinheiros do Espírito Santo), by the researcher-teacher. Participants performed three tasks with the use of online tools in a hybrid environment, as described in the following paragraph, during their regular English classes. They had face-to-face traditional classes as part of the school curriculum and performed the three pedagogical tasks with internet tools after class, without the researcher-teacher's presence and interference, in a computer lab, in the school premises, once learners are only allowed to leave school on weekends. The purpose of these tasks was to involve learners in the class topic by means of making them responsible for preparing discussions and using the grammar situations of each task so as to be prepared to explain the grammar rule through the inductive method, eventually, in face-to-face classes. In essence, learners would function as the instructor during the corresponding face-to-face classes. This way, the researcher-teacher would analyze the responses and provide immediate feedback and perspective on their discussions and grammar rule explanations.

The three pedagogical tasks were adapted from Finardi and Porcino (2013). The first task (Table 1) involved the reading of a journalistic text, chosen by each participant from the site [www.newsmap.jp](http://www.newsmap.jp). Participants read the text in English with the help of a journalistic text in Portuguese (the participants' L1), also chosen by each participant and which contained the same theme as the English one. The online tool [www.translate.google.com](http://www.translate.google.com) was suggested for the translation of words and parts of the reading. The second task (Table 2) presented a more interactive focus once it had the objective of stimulating participants to qualify and select products found online for shopping. Participants had to access the site [www.amazon.com](http://www.amazon.com) with the aim of purchasing three presents for friends or family, using the online dictionary [www.pt.bab.la](http://www.pt.bab.la) to check for unknown L2 words. The third task (Table 3) consisted of using a social relationship site, the [www.hipenpal.com](http://www.hipenpal.com) to make friends (pen pals) with a foreigner. The task required participants to read the texts presented on the site home page using the suggested translation tool [www.linguee.com](http://www.linguee.com) as a support for translation. Participants had to write a short paragraph in English (L2) about them to be posted in the site to contact a possible pen pal match.

It is important to emphasize that participants had to follow the tasks instructions, using the suggested translation tools and online dictionaries, but they had the freedom to use other tools in case they wished to. A time limit was not set so that the participants could do the tasks in their own time, giving more emphasis to accuracy when performing the tasks (Ellis, 2006). The three tasks were performed throughout the academic semester, on varied days, following the school syllabus content.

## 5. DATA COLLECTION

Three questionnaires and interviews were administered after each pedagogical task so as to gather data regarding participants' perceptions on the tasks and the hybrid approach used in the inverted class mode. A researcher-teacher's diary was also used to record observations made during participants' performance in class. The data presented comprises questionnaires and interviews carried out with participants after each task execution and the researcher-teacher's diary.

## 6. RESULTS AND DISCUSSION

The aim of Task 1 was to check participants' skill in interpreting a journalistic text prior to the corresponding face-to-face class. The participants' understanding of the basic concepts of the reading task was assessed by the researcher-teacher as they mediated a discussion on the topic and new vocabulary in the face-to-face class. The researcher-teacher invited answers from the participants, analyzed them and provided immediate feedback.

The task authenticity was highlighted by means of allowing participants to choose the text they thought that would interest them the most. Once the inverted class mode shifts instruction to a more learner-centered approach, these participants' discretion in choosing their own text paves the way for the learners to be more actively involved in knowledge construction as they participate in and evaluate their learning in a manner that is personally meaningful. The fact that the learners prepared their text discussion out of class allowed more in-class time dedicated to exploring the topic in greater depth, creating rich interaction opportunities, as well as a means of involving learners in a critical discussion. As an example of an activity to be developed in class would be to invite learners to draw a graphic about the violence rate in their country according to an official site and demonstrate it to their peers, or read and tell their peers about what has been done to reduce crime in certain regions.

The task used in this study was characterized as unfocused (Ellis, 2003), since it did not demand any specific grammatical structure from the participants. Analyzing the first part of Task 1 performed by participant A, we observe that he was able to use the association strategies for the task execution. Despite the difficulties in finding a similar piece of news, since the piece of news chosen by him was local and not international, participant A was able to complete the task, as can be seen in Table 1 below with the transcription of this participant's performance.

*Table 1. Excerpt of participant A's first task.*

<b>Instructions for Task 1</b>	<b>Participant A's answers</b>
1) On this page, select and read a piece of news that you find interesting; copy and paste it here.	Gunman arrested in Dallas after standoff with police
2) Go to the news section about Brazil and try to find a similar piece of news to the one you have just read. If you find it, read, copy and paste the news headline here.	Man confesses having raped and killed 9 year old girl, says police
3) After you read the piece of news again, answer the following question in Portuguese. What's the news about?	A man in his forties, hidden in an apartment downtown Dallas was arrested
4) Did you find a similar piece of news on the Brazilian page? Did the piece of news helped you understand the selected one in English?	Yes. It kind of helped me because it's about a man who was arrested too, but for another reason, for having raped and killed a 9 year old girl.

As it can be observed in Table 1, the task had a learner-centered approach and active learning strategies, being the kind of material learners should explore on their own, with the help of the internet tools, out of class, in order to maximize classroom time, enabling the inverted classroom approach to occur.

Table 1 shows that Participant A was able to perform the task by using the strategy of cognate words association and translation with the use of the Google Translator, the tool suggested for this task. It is possible that Participant A associated the word ‘police’ with ‘polícia’ (in Portuguese), and translated the word ‘arrested’ so as to find a similar piece of news in Brazil.

The following excerpt offers an example of the stimulus that the online environment offered participants to provide structured and well-thought-out answers prior to the following face-to-face class, according to their report in the questionnaires and recorded interviews. The aim of Task 2 was to encourage participants to use adjectives to describe products to be purchased online and also to learn about adjective order. The task was considered focused (Ellis, 2003), as it had the purpose to induce participants to process a specific grammatical form. It can be observed that learners were able to produce the right order of adjectives, such as “favorite songs” and “rubber sole”. It was expected from them to prepare the grammar rule explanation to be presented and discussed in the next face-to-face class, with the researcher-teacher’s aide and feedback.

*Table 2. Excerpt of participant B in Task 2.*

Write the price and two characteristics of the selected products, in Portuguese and English			
Product	Price	Characteristics in English	Characteristics in Portuguese
Nokia Lumia 521 (T-Mobile) (my mother)	R\$69,99	Dual Core (1GHz) Processor Listen to your favorite songs with Nokia Music	Possui dois processadores Ouvir suas músicas favoritas no Nokia música
Nintendo 3DS XL – Blue/Black (my brother)	R\$180,99	Supported Flash Memory Cards: Secure Digital (SD). Graphic Quality: 240 p	Suporta cartões memória: Seguro Digital (SD). Qualidade de Gráfico: 240p
Reef Men's Leather Smoothy Sandal (my father)	R\$57,00	Leather Rubber sole	Couro Sola de borracha

The excerpt also illustrates Participant B’s interest in completing the online task whose purpose was to choose presents online to give to people who were important for him. Participant B described the main characteristics of each product he chose, the cell phone for his mother, the Nintendo game for his brother and sandals for his father. Participant B performed the task completely, mentioning all the necessary characteristics to justify his choice for the product. The task develops not only the L2, but also motivates participants to develop their autonomy, by means of providing an authentic context and online tools to help them learn and use the L2 as this is a context in which they will probably use the L2 in real life interactions. As a result of the success in the this task implementation, it was expected that the face-to-face class content could be offloaded, and, as a result, learners would be equipped with more opportunities to engage their class time in more learner-centered activities, such as problem-based learning.

The promotion of a more contextualized teaching which addresses the internet users' daily routine corroborates the description of the importance of online tools for the learning process in an inverted class mode. According to Kern, Ware and Warschauer (2008), so as to render the internet mediated teaching successful, teachers and researchers have to assure that new habits develop autonomy, creativity and critical view of language, technology and culture being stimulated in learners.

It is important to highlight that the answers required in the task do not depend on a stereotyped view, such as those found in pedagogic books. The task provides myriads of options that may be adjusted by the digital natives, or "globalized generation" as put by participant B, "[...] it cannot be denied that my generation is the generation of globalization". This view is also shared by the inverted class approach, which allows for a variety of learning methods, with the help of technologies. Teachers create flexible tasks, which provide learners the opportunity to choose, thus exercising their autonomy.

Although the internet tool suggested for the third task, the *linguee.com* was not enjoyed by most participants, they were able to perform the task as can be seen in the excerpt of Participant C below. In the third task, participants had to choose a pen pal in the designed site for the task and justify their choice. In this excerpt, the participant performs a previous step to choose his pen pal. The third task was also considered a focused task (Ellis, 2003), as its execution would lead participants to use the simple present tense.

*Table 3. Excerpt of participant C's in Task 3.*

Using the site <i>linguee.com</i> , select two parts of each pen pal's text (maximum of five words to make the translation easier) that you did not understand, and try to find a better translation	
PARTS IN ENGLISH	TRANSLATION (PORTUGUESE)
I'm not very good at speaking English	Eu não sou muito bom em falar inglês
I need to practice more	Preciso praticar mais

According to participant C's report, he did not like the site *linguee.com*. As reported by all the participants, the Google Translator tool was the internet tool most frequently used by them. The analysis of the data suggests that the use of internet resources promotes not only digital literacy, but also autonomy in the case of L2 access since learners would be able to read L2 contents of their choice and in their own time with the help of internet translation tools used for the inverted class mode proposed in this study.

According to the instructions of the third task, participants had to write a paragraph to send to a virtual friend in the future. The task had the objective of encouraging participants to use simple present sentences, so that they would be presented in the corresponding face-to-face class. This task reinforced the idea that participants could explore language creatively knowing that the researcher-teacher would provide correction and feedback in class. This way, it can be observed in the analysis of their paragraphs which shows that they were worried about the originality of their texts and used the translation tools efficiently to carry out this task as can be seen in the following excerpts: (<participant C> *I also really want to learn to speak English.*; < participant D> *I currently live in the city of Vila Velha. The reason for this allocation is due to my military career*; < participant E> *I have many curiosities about foreign languages. I would like to make friends with a pen pal to learn more about...*; <participant F> *...wish to meet new people.*). In this sense, one can perceive the positive impact of tasks with online tools on the participants' performance, in lexical terms (< participant D> *currently*; *due*; *curiosities*; < participant E> *foreign, make friends*),



grammatical terms (< participant G> *I'm in the Navy*; < participant H> *I would like to make...I'm curious about...*; < participant E> *I have many curiosities...*), L2 discursive terms (< participant H> *...make new friends.*; < participant D> *...is due to my military career*), and also in the development of digital literacy since participants used the internet tools well.

The analysis of the data suggests that participants in this study see the hybrid approach used as being relevant and useful. The use of online tasks to develop participants' L2 skills and digital literacy proved to be positive and overall relevant in the flipped classroom approach. The participants in the study were able to use the internet tools to develop autonomy, thus, minimizing their out-of-class preparation effort and obstacles and maximizing the contact with the target language and authentic materials. Also, the analysis of the online tasks administered in the study in the flipped classroom approach can be said to have helped participants to access relevant online contents in L2 both in the class and out of the class, in a more autonomous search for information and education.

## 7. CONCLUSION

The analysis of data in the study reported here showed that the use of pedagogical tasks with online tools was important to develop learners' autonomy, L2 skills and digital literacy, in an inverted class approach. The analysis of participants' reports suggests that hybrid approaches, such as the inverted classroom, have a positive impact on learners' autonomy and L2 development, corroborating suggestions of Finardi (2012) and Finardi, Prebianca and Schmitt (2015). In the case of Brazil, where the study was conducted, it is important to bear in mind that English has the status of an optional foreign language in basic education (Finardi, 2014). The inclusion of one modern foreign language after 5th grade in the curriculum is mandatory but the choice of which language to teach is made by each school community. Thus, the teaching of English as a foreign language in Brazil is optional. Given the status of English in the globalized world (for example Graddol, 2006; Finardi, Prebianca and Momm, 2013), on the one hand, and its status in Brazil (Finardi, 2014), on the other, it is important to think about internet tools, especially in the form of internet translation tools so as to enable Brazilians to access information in English online in an autonomous way.

The use of internet translation tools can help minimize negative effects associated with the lack of a curricular obligation to learn English as a foreign language in Brazil (for example Porcino & Finardi, 2014) such as the social gap created by the abundant (and often costly) offer of English as a foreign language classes in the private sector. Moreover, given the fact that most Brazilians are online but use the internet mainly to access social networks in Portuguese, perhaps the use of internet translation tools can help Brazilians to actually access relevant contents and information online in English, thus using the internet not only for entertainment but also for information, education and to build social capital (Warschauer, 2003).

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## Chapter #10

### ENGAGING THE HETEROGENOUS URBAN CLASSROOM IN AN INTEGRATED STEM COURSE USING SCIENCE RESEARCH METHODS TO DEVELOP APPS

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#### ABSTRACT

As educators we struggle to motivate students and to provide individual attention. By combining app development with classic research methodology, we were able to engage students in collaborative learning and higher-level research, thereby providing students the benefits of individualized learning and motivation in the classroom setting. Each of the four STEM fields (science, technology, engineering, and math) was highlighted during this full year course. *Science*: Students generated authentic questions and created experiments in which they worked as research teams learning to formulate valid hypotheses. *Technology*: Students were particularly engaged with the online and offline technology aspects of this process, requiring them to play games, and read and write code using NetLogo and Moodle. *Engineering*: The course began with students' hands-on practice in computer hardware design and the creation of electrical schematics leading to their understanding of the value of accurate documentation. *Math*: Students worked to solve classic unsolvable math problems to learn about critical thinking and perseverance in an academic setting. This class was particularly successful in the integration of students with various abilities and interests to work together towards a common goal.

*Keywords*: urban classroom, technology in the classroom, app design, STEM, computer science research.

#### 1. INTRODUCTION

Educators continue to struggle to motivate students and to provide individual attention. With fewer and fewer students pursuing education or careers in STEM fields (science, technology, engineering, and math) it is critical to more fully engage students in the processes of science as soon as possible. Most commonly in the science classroom, inquiry often resembles “cookbook science.” In this practice, the teacher or textbook provides the questions that students are to investigate with predefined tools. Additionally, the teacher knows the answer to the inquiry process and students often feel disengaged from the actual practice of science and scientific thinking (Berland et al, 2015; Chinn & Malhotra, 2002).

In response to this problem, the National Research Council, in collaboration with stakeholders (science teachers, local superintendents, etc.) around the United States, generated the Next Generation Science Standards, or NGSS (Schweingruber, Keller, & Quinn, 2012). The overall conjecture in the NGSS is that learning science content alone is insufficient to learning how to “do science.” Science content is intertwined with science practices and critical thinking skills. Therefore the goal of every science classroom should

be to give students an opportunity to engage in authentic science where students, along with some teacher guidance, generate the questions, develop a research strategy, enact a research methodology, collaborate and review with peers, and generate reasoned answers to their questions. The construction and implementation of the course described in this chapter seeks to give students in an urban classroom an opportunity to “do science” rather than merely be “taught science.”

### **1.1. Nature of the Collaboration**

The project discussed in this chapter is a collaboration between a New York City Department of Education (NYCDOE) public high school teacher and a doctoral student at The Graduate Center of the City University of New York (CUNY). The collaboration was made possible by the CUNY Science Now GK-12 Fellows Program, NSF Graduate Fellows in K-12 Education Program (GK-12). The main goal of the GK-12 program was to train doctoral students to become better communicators of their own scientific knowledge and research by engaging them in a curriculum development process in collaboration with high school teachers to create hands-on research experiences for high school students. The resulting curriculum, known as “Authentic Research Modules in Science” (ARMS), offer high school students the opportunity to participate in authentic research experiences. The ARMS become a permanent resource for participating high schools and NYCDOE teachers. (for more on the GK-12 program, and to view the ARMS visit: <http://www.cunygk12.net>)

By working together to produce and teach the ARMS, the fellow and teacher gain valuable expertise and experience, which in turn directly benefits the students:

- Fellows deepen their understanding of pedagogy and instructional design
- Teachers deepen their scientific knowledge and ability to direct student research
- Students gain practice of authentic research and deepen their understanding of concepts in biology, mathematics, and earth and environmental sciences.

The ARM developed for this project sought to teach high school students research skills by introducing them to the process of developing software for a mobile device (APP). Research Skills is not on its face an engaging subject, we sought a way to entice students to actively participate. We chose APP development as the motivation since smart phones and their APPS have become so prevalent in everyday life, and the software design paradigm could easily be used to engage students with a variety of interests. In other words, not all students had to aspire to be Bill Nye the Science Guy. Indeed, there was ample room for students who prefer more traditionally artistic subjects. It was our goal to teach traditional research skills while introducing high school students to the computer science area of Software Development. Although not all our initial goals were met, many of the benchmarks we look for in a successful curriculum module were. The resulting ARM, and the results from the first implementation are the subject of this chapter.

### **1.2. Theoretical Foundation**

As pointed out by the NGSS, students must engage in science practices that are similar if not identical to the practices of scientists in order to have a full appreciation for science. When examining some of the aspects of what it means to be a scientist, other researchers concur, (i.e. Duschl & Osborne, 2002; Berland et al., 2015). Scientists do things such as generate models, design experiments, evaluate evidence, analyze data, and engage in peer review. However, in the science classroom, students memorize information about the models teachers say are created by scientists, read conclusions made by scientists,

and the teacher is the sole arbiter of understanding. This gives students little opportunity to generate their own meaning of the natural world or other phenomenon they observe around them. It also separates them and their lived experience from the world of science.

Students in schools with limited resources are left even further behind in their exposure to science because they do not have appropriate science apparatus, textbooks, multi-media, and science teachers with deep content knowledge. To make up this deficit, it is important that in addition to authentic science research, scaffolds must be developed and implemented into the course so that students can utilize their cognitive abilities in a subject for which they have limited exposure (Cuevas, Fiore, & Oser, 2002; Reiser, 2004). Also as a way to develop deep, critical thinking in science, researchers have recommended using open-ended or ill structured problems (i.e. Angeli & Valanides, 2009; Chinn & Malhotra, 2002). What separates this course from other problem-based learning interventions is that it is our goal to engage in multiple science practices across all four STEM domains by using cognitive and metacognitive scaffolds. These scaffolds will be detailed in the sections on Design.

## **2. BACKGROUND OF THE EDUCATIONAL SETTING**

The course, Science Research Methods (*SRM*) was developed specifically to be taught as a full year course for 3<sup>rd</sup> year high school students, ages between 16 and 17 years old to enhance their college applications. Located in the center of New York City, the school occupied the two top floors of a commercial building. Many of the facilities were new (i.e. a media center with 30 new iMac computers); however, the school had no real dining facilities, or gymnasium.

Of the 14 students enrolled in the course, 10 of them were also enrolled in the school's Advanced Placement United States History and Advanced Placement Biology course, both being offered at this school for the first time. Within the context of the school, these students were considered "high achievers." However, on national tests, like the PSAT, these students were in the lower third of all college-bound students. Additionally, one student who has been diagnosed as relatively, high functioning on the autistic scale was also enrolled in the class.

With only 432 students in all four grades, this was considered a small school, with approximately one teacher per subject per grade. Two Assistant Principals taught two classes each. Diversity of the school is listed as 97% minority with 45% African American, 52% Hispanic, and 3% White. 23% of the students had Individual Education Plans and were receiving special education support either in the regular classroom, in out of class support, or in restricted classrooms. Approximately 78% receive free lunch. The Parent Coordinator, a staff position, at the school reported many students are likely eligible for free lunch but do not report it because their parents are unable to complete the requisite forms due to literacy issues or fears about their immigrant status.

During the fall semester, the school was notified that it was to be closed along with 24 others. A major public, political, unsuccessful campaign to stop the closing ensued which involved many students, staff, and administrators' efforts and emotional resources.

### **3. INTEGRATED STEM DESIGN ELEMENTS USING STANDARD SCIENCE RESEARCH METHODOLOGY**

Two books provided a framework for practice, *STEM Student Research Handbook* (Harland, 2011) and *Teaching Inquiry-Based Chemistry: Creating Student-Led Scientific Communities* (Gallagher-Bolos & Smithenry, 2004). The first book is a guide for teachers who are preparing students who wish to perform their own research projects, often with the goal of entering science fairs or other research competitions. Other than content specific teaching units, the chapters of this book provided a general outline for the course. Just as this book begins with generating preliminary research ideas and science ethics, so we began our course. Whereas the first book emphasizes how the individual is to perform research, the second book begins with the idea that research happens in teams. This book aided the classroom teacher in adapting elements of the *Student Research Handbook* to suit the structure of the class where students would be working in research teams rather than alone.

Integrating the four STEM fields suited the disciplinary backgrounds of both of the two instructors, the fellow with a background in computer science and the classroom teacher with a background in science. Additionally, the development of apps for mobile devices requires content from all four domains. Each domain was integrated into the teaching units as were the scaffolds and open-ended problems.

The classroom teacher and fellow developed the teaching units over the summer prior to the course implementation. During these meetings the two instructors discussed the STEM content and creative ways to teach them. The classroom teacher was still responsible for all assessments that would determine the students' grades. However, because the course did not have a culminating, standardized test, we had a lot of latitude regarding how to assess student learning. We wanted to verify that students were engaged in authentic science as outlined in the two guiding handbooks and that the students were also functioning like a scientific community.

#### **3.1. Science Design Elements**

To begin with a common language and vocabulary about science, each teaching unit utilized the CREATE method of examining primary literature in science (Hoskins, Lopatto, & Stevens, 2011; Hoskins, Stevens, & Nehm, 2007). Hoskins et al. developed the create method to scaffold science content for upper level undergraduates with limited science background. Students received portions of primary science literature related to their classroom content and either generated concept maps or cartoons about the science methods and data discussed. During the first unit on science ethics, students were asked to make concept maps about the issues outlined in their e-text on ethics. However, it was more helpful for students after they watched a documentary film on the infamous Stanford prison and Stanley Milgram's obedience experiments (Gibney, 2006). Students were asked to first generate a concept map about the methodology used in the two experiments on human subjects. Then the class engaged in conversation about the ethical concepts discussed in the e-text. Students were better able to create more complex concept maps about ethical treatment of human subjects. By generating concept maps and discourse both in class and online, students were able to co-construct knowledge science topics.

So that the students could become familiar with computer architecture, part of our science curriculum covered electrical circuits. However, many of the students had either no experience with or limited memory of lessons about electricity. Therefore, we had the students build their own circuits with batteries, light bulbs, and aluminum foil. They were required to create both parallel and series circuits and draw schematics of each. Students also generated concept maps about their observations about heat, resistance, voltage, current, and their relationship to one another. Through peer review of the small group created concept maps, online discourse, and a lot of blown out light bulbs, students recreated a general idea of Ohm's Law.

Up until this point, the classroom teacher assigned the tasks. However, once we started research on the mobile apps, it was most important that the research questions and designs come from the students directly. Research teams were created through an algorithm exercise discussed in the Mathematics Design section below. The teams set to work on the apps they were to create, developed surveys to perform market research about their designs, redesigned their surveys based on new iterations of their research questions, and changed the designs of the apps to accommodate the research. At all points, students engaged in peer review through online conversations as well as in formal and informal presentations to the other research groups. Designs for three distinct apps were developed from this process by the end of the academic year.

### **3.2. Technology/Engineering Design Elements**

Too often technology is an afterthought in the classroom. Technology is often seen as a tool to be used to enhance or simplify traditional activities, and not as something to be explored and used to do what could not be done with traditional methods. We see technology used to simulate a frog dissection, or to collect data on student achievement using programs that mimic otherwise manual activities. However, if we approach the use of technology from the perspective of what can it enable us do that cannot be done using traditional methods, then we enter into a new type of learning environment. Our goal was to go beyond the use of computers as data collection machines. We wanted the use of technology to enhance the exploratory aspects of the course, and engage students in learning about the technology itself.

Students are generally familiar with different forms of technology; smart phones, gaming devices, and computers, to name a few. For many, the familiarity stops at the cursory level of user. How a computer works is a mystery, as is what it looks like inside. It seemed to us that if we wanted students to be able to engage in APP development and understand the hardware limitations of interface design, students would need to also understand the engineering aspects of computers. We set up an interactive hands-on computer museum, modeled after interactive hands-on science museums like The New York Hall of Science (<http://nysci.org/about-main/>) and Liberty Science Center (<http://lsc.org>). For each example of hardware we had, we also had the manual and repair manual (when available). The students had special tools to open the hardware and examine inner workings, see the circuit boards, and learn how to read the associated schematic. By learning and understanding about the component pieces, students would better understand how to design APPs.

We introduced online tools to help students document their work, have discussions outside of class, and to learn about programming. Integral to the design of the course was the use of a Moodle site and NetLogo. The Moodle site was used to give students access to both pre and post activity documentation and discussion forums. We regularly posted photos of student activities and guest speakers.



An interesting anecdote, as part of the ethics component, students discussed the idea of proprietary vs. open source software. Initially most, if not all students fell on the side of proprietary software. One of the guest speakers brought in a 3D printer built from plans from an open source project and explained to students how the community contributes to making the product better by discussing and posting their enhancements and solutions to others documented issues. In fact, the speaker had contributed a solution that became part of the published schematics. Students, reengaged in the proprietary vs. open source discussion; many, changing their initial stance.

We used Moodle as the forum to extend and document some of our in-class discussions. For example, as part of engaging students in the necessary thinking and practices for the software design process, we started with an in-class simulation of the Logo turtle. Students enacted being the turtle, and moved according to the instructions given by the other students. This then extended to the students working in NetLogo to construct a program to draw a scene of house with a tree under a sun. The interactive nature of NetLogo made it possible for students to test and change their programs as they created them. We used a Moodle forum as an out-of-class discussion area, and as an area for students to interact with the fellow. The final projects were posted in a Moodle forum, which allowed students to share their work with each other.

To make the APP development process an authentic experience, we adapted some of the ideas from the CREATE methodology to form software companies. Initially, students conducted interviews and market research to pitch their APP idea; the top 5 and their creator were selected as the five companies. Students then applied for jobs at the companies of their choosing, and were selected on the basis of job applications. Similarly, companies presented their ideas to focus groups and reworked their product based on the feedback. Although none of the companies reached their goal of bringing their APP to market, it was less important for students to complete the APP as it was for students to participate in the experience, and gain mastery with the ideas of problem solving and creative solutions.

### **3.3. Mathematics Design Elements**

The mathematics for classic science research methods requires both standard statistical analysis and basic logic. Students were already being exposed to statistics in their regularly assigned mathematics course. The classroom teacher informally met with that math instructor to confirm topics already covered and worked together to reinforce them. However, since the class focused on mobile app design, learning to work with algorithms was also important. Their first exposure to algorithms was the “Stable Marriage Problem,” which states that given a set number of men and the same set number of women and each of them have ranked who of the opposite sex they would like to marry, marry the men and women together such that there are no two people who would rather be married to someone else (Gale & Shapley, 1962). Despite the hetero-normative assumptions, all students played along in small groups and developed strategies to generate stable marriages. It was also explained to students, that these are the sorts of algorithms utilized by colleges when setting up roommates from the incoming freshman class.

Rather than give students a textbook to read, students performed “act outs” of two problems that demonstrate algorithms, “Prisoner’s Dilemma” and “Dining Philosophers”. The “Prisoner’s Dilemma” is a canonical demonstration of game theory whereby it is possible for two supposedly rational people to not cooperate if they believe it is not in their self interest. The teacher prepped two students to play the “prisoners” and two others to play the police officers. The remaining class members were outsiders watching the

negotiations. Afterwards, the whole class discussed strategies that may be employed to gain the advantage. In the “Dining Philosophers” problem, five philosophers must figure out how to eat bowls of spaghetti while only in possession of one chopstick. (In the original problem the eating utensil is a fork.) The object of the task is for students to figure out how to share the chopsticks in such a way so that no one “starves” assuming there is no shortage of spaghetti or amount a philosopher can eat. Students spontaneously hypothesized that the algorithms would be different if there were more, fewer, and even numbers of philosophers sitting at the tables. The class engaged in these iterations as the teacher kept serving up bowls of spaghetti.

Between acting out the two open-ended problems, students were introduced to programming techniques through their use of NetLogo (Wilensky, 1999), an open source graphic user tool. As an open source tool, programmers also created games and simulations and shared both the programs and the program codes on the site. After acting out their algorithms, as in “Prisoner’s Dilemma” and “Dining Philosophers,” students then were able to test their theoretical work with a computer simulation (Poulter, 2003; and Wilensky, 2003, respectively) and see the code that made the simulation possible. This also gave them the opportunity to copy bits of code created by other programmers to build their own. Only a few students gained any sort of true programming proficiency and most students found programming tedious. However, their ability to define and create algorithms developed further.

The final algorithm project returned to the Stable Marriage problem. Students were to create research teams based on algorithms they created. The teacher decided how many students would be in each research team based on their initial app designs. Students decided what the jobs titles would be, then generated job descriptions and interview questions for each job. Students also completed a preference sheet for the jobs and teams they preferred to work on. The teacher created interview sheets based on the student generated descriptions and a schedule for all students to interview for the jobs they wanted on all teams. According to the schedule, students were both interviewers and candidates. The next day the teacher presented the interview sheets without identifying information and asked the students to create algorithms to create the most number of happy employees and research teams as possible, just like in the stable marriage problem. There was a whole class discussion regarding the recommended algorithms, and the teacher revealed the research teams and job assignments per the chosen algorithm. Student then evaluated the algorithm chosen as well as the alternatives proposed both online and in a reflective essay.

#### **4. SECOND ITERATION AT ANOTHER HIGH SCHOOL**

The course was repeated the following year, at another New York City high school, with some differences and modifications. The first difference was the type of school and the population of students. The school is one of New York City’s nine specialized high schools. The school has a 96% attendance rate and a 96% graduation rate. 99% of the graduates attend college. The classroom teacher participating in the project had more Instructional Computer Experience, thus students were accustomed to using Moodle and other online collaborative environments. Computer Science is a standard part of their school curriculum; therefore most students had experience and knowledge of NetLogo. Another difference was that the timeline was shortened, thus we focused on the APP development portion of the original course. We modified the original course to engage students in research centered on the four jobs related to APP development: marketing, user interface, user manual, and programing (coding).

Similar to the original design of the course, students worked in groups and chose different aspects of the app to work on. Given the shortened timeline, the groups were chosen by the classroom teacher and students were limited to solving a physics problem. The market research piece was then adjusted to be research of online physics tools, simulations, and demos. Students were encouraged to select an area that was not represented by other online tools, and the classroom teacher guided them to tackle a problem that was perceived as achievable. That is, the design of a simulation that the classroom teacher felt the students could complete. This was generally a successful strategy, since student groups chose their topic.

In one case however, the group could not reach a consensus. Even when guided as to which problem to “choose”, the students were not motivated to complete their project. The teaching fellow took an active role with this group, engaging them to participate in an authentic problem solving experience. Rather than do something they weren’t interested in, the students and the fellow engaged in a discussion about what was truly interesting to them. Students were encouraged to go beyond any physics problem they knew the answer to, and encouraged to use the opportunity to explore a solution to a physics problem they did not know the answer to. The theory was to use the process of designing an algorithm to help students learn more about the problem. This proved to motivate students and push them beyond their initial in-class participation.

Students at this high school had experience and knowledge of the online tools used, such as Moodle, were adept at internet research, and had all taken a year of NetLogo as part of their Computer Science course. Given this, we felt confident that the shortened time line and necessary modifications to the original course would still be a valuable experience to the students. Indeed, students were comfortable working independently and in an out of the class setting. It was interesting to observe that they were less comfortable when participating in peer review and group discussion. The in-class group presentations did not stand out and lacked interaction between the students; rather this interaction was observed when the fellow engaged the group individually, then the group engaged in meaningful discourse.

Although the end result of this iteration of the course was that the highly achieving students at this high school were able to complete their APP in the shortened time, their engagement in the authentic research experience was not apparently superior. When engaged by the fellow, the students were more likely to exhibit creative thought and problem solving skills. It was surprising that the students at this specialized high school required quite a bit of scaffolding to engage in communication with their peers and in collaborative environments.

## **5. DISCUSSION**

Before giving an overall discussion of the course, we want to discuss the significant impact this course had on one special needs student, we will refer to as Jack in this. Jack, an 18-year-old African American male, was enrolled in both this Science Research Methods course and Earth Science with the same classroom teacher because the teacher had a relationship and experience working with the special needs support staff. Normally, Jack was highly medicated to maintain frequent outbursts as well as irrational behaviors and verbal rants. While this behavior was mildly evident in the Earth Science class of 35 general education students, Jack never outwardly appeared to lose behavioral control.

His personal paraprofessional was with him during Earth Science but not always in SRM. At times in SRM, Jack needed to be reminded to write notes or be physically guided if the classroom activity required students to move around the room. When there was a lot of physical movement in the class, Jack was clearly confused. During group activities, his classmates would guide and remind him rather than the teacher. Jack's special instructional team informed the classroom teacher that his major academic goal was to write a full paragraph by the end of the year. As the semester went on, Jack became more socially integrated. He could not fully engage at the same level of complex discourse as the other students, however he participated and actively struggled to be understood by his classmates without having an emotional outburst.

Another reason Jack was placed in the class was because over the summer he received and was obsessed with his iPad. Much of his time was spent using his iPad for playing games, it also served as good motivation for him to write on his own. At the beginning of the school year, he was still only writing a few sentences at a time. When he was assigned the job of Game Designer in his group, he called himself the Inventor with great pride. He would explain the game that he wanted to develop at every class meeting. When told that the beginning of any good game begins with writing the instruction manual, Jack took the task seriously. He drew diagrams and sketches of screen shots he wanted to create and wrote explicit instructions for all of the buttons he thought end users should have. With very little guidance and encouragement, Jack turned his ideas into 5 pages of text and 2 complete screen shot diagrams. The other students in his group decided to adopt Jack's game for the one they were developing. By the end of the school year, Jack had 10 pages of documentation and 4 complete sketches of his design. The other students in the class recognized the game as being similar to another popular game. However, they all agreed that it was different enough and compelling enough to be worth developing.

The ability to engage in self directed research is essential to any authentic research experience. Participating in the unknown and trusting that one's skill set is enough to solve a problem is not familiar to most high school students. The SRM was developed to give students the experience they needed to successfully participate in authentic research. Indeed, throughout the course, students complained that they were unsure of what was really happening in the class and that they did not know what topics were being covered. However, both science and math educators in the school were able to look at the student work and identify both the learning goals and their location in the curriculum. When writing the final evaluative essays for the class, a few of the students were able to definitively state that the class taught them to not only think differently but to think better. Students expressed an awareness of being uncomfortable with the idea of open-ended situations that do not get resolved in the classroom.

Armed with the concepts of scientific methods, science and engineering skills, students engaged in the design of mobile APPS, created and used algorithms, worked collaboratively, and engaged in regular peer review, with little to no teacher direction. They used statistical analysis to answer research questions, evaluate their data, and made iterations to research and product design based on the data. We consider these tasks to be part of authentic science inquiry.

We have seen that it is possible and highly beneficial to provide higher order thinking opportunities to students who have few opportunities to do so in the classic, underachieving urban classroom. Often students with low skills, who otherwise have the cognitive ability

and personal motivation to go on to college, are not afforded opportunities to become college ready. In fact, students in this environment often mistakenly believe that they are ready since they are considered the high achievers in these overall academically and socio-economically poor environments. However with high expectations, the appropriate tools and scaffolding, students can build on their limited skills and gain insights into actual undergraduate level academic experiences before they attend a university.

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## Chapter #11

### MOBILE LEARNING IN HONG KONG TEACHER EDUCATION

#### Pilot implementation and evaluation

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#### ABSTRACT

To align with the international trend on using information and communications technology in education, the Hong Kong government has recently announced a policy to broadly implement e-learning in schools through a more pervasive use of mobile devices (such as smartphones and tablets) and electronic textbooks to support classroom teaching and students' self-regulated learning. However, many local schools and their teachers are not yet ready and confident enough (in terms of their teaching methods, strategies, and approaches) to adopt mobile devices in their classroom activities. The present chapter reports a few case studies showing how a team of teacher educators initiated a pioneer e-learning project to support the education sector, by offering relevant training to pre-service student-teachers and in-service teachers. The team designed, developed, and applied a number of innovative mobile learning activities in five different classes of undergraduate teacher education courses. A total of 364 undergraduate students completed a survey collecting information on their prior experiences, attitudes, and views on mobile learning, in order to evaluate their learning effectiveness in technology-enhanced lessons. To illustrate the educational implications of the present study, selected qualitative and quantitative findings will be presented together with some examples on the implementation of innovative mobile learning activities in some classes of teacher education courses.

*Keywords:* mobile learning, e-learning, teacher education, higher education, Hong Kong.

#### 1. INTRODUCTION AND LITERATURE REVIEW

The use of mobile technology to enhance students' learning (also known as technology-enhanced learning or e-learning) is drawing increasing attention and interest in recent educational research (Attewell & Savill-Smith, 2004; Berge, Muilenburg, & Crompton, 2013; Kukulska-Hulme & Traxler, 2005; Peng, Su, Chou, & Tsai, 2009; Wang, Wu, & Wang, 2009), due to the widespread usage of different mobile devices, such as smartphones and tablet computers, in many teenagers' daily lives for communication, web surfing, social networking, video/photo-taking, and entertainment (e.g. playing electronic or online games, listening to music and songs, and watching TV, videos, or movies). Many researchers anticipate that there will be extensive adoption of mobile learning, not only in open and distance education, but also in formal classroom education and informal out-of-school learning (Brown & Mbatia, 2015; Sharples, 2007).

The term mobile learning (or m-learning) has been coined to describe any learning taking place with learners using mobile computational devices, including mobile phones, smartphones, tablet computers, laptop PCs, Personal Data Assistants (PDAs), pocket PCs, etc. (Peng, Su, Chou, & Tsai, 2009; Quinn, 2000). The key feature of this type of learning is being mobile, but a more educationally-relevant definition has been put forward by Laouris and Eteokleous (2005). Furthermore, Traxler (2005) advocated that the definition

of mobile learning: “Should address also the growing number of experiments with dedicated mobile devices, such as game consoles and iPods, and it should encompass both mainstream industrial technologies and one-off experimental technologies.” The advantages of mobile learning are well-known not only because this type of learning enables self-regulated and collaborative learning activities between learners at anytime and anywhere (Attewell & Savill-Smith, 2004), but because it facilitates paradigm shifts in education, such as spatial shift (from campus-based to home-based learning), curricular shift (from national/fixed curricula to personal curricula), and shift in teacher’s role (from knowledge-provider to facilitator of learning) (Ally, Grimus, & Ebner, 2014; Alrasheedi, Capretz, & Raza, 2015; Desai, Hart, & Richards, 2008).

In 2014, the Hong Kong government announced a policy (with the release of a new policy document for consultation on the fourth strategy on information technology in education) to broadly implement e-learning in schools through a more pervasive use of mobile devices and electronic textbooks to support classroom teaching and students’ self-regulated learning. However, many local schools and their teachers are not yet ready and confident enough (in terms of teaching methods, strategies, and approaches) to adopt mobile devices in classroom activities. From a review of literature on mobile learning, it emerges that past teaching methods and educational research (Brown & Mbatia, 2015; Grant et al., 2015; Seppala & Alamaki, 2003; Tessier, 2014) have focused on the elementary use of mobile devices for communication and reading purposes (discussion, sharing of photos or other materials, short-message service, substitution for textbook, etc.), while there were very few examples of innovative or advanced applications, such as the development of an augmented reality-based mobile learning system for scientific inquiry activities (Chiang, Yang, & Hwang, 2014).

On the other hand, the implementation of mobile learning is in fact coupled with many challenges and barriers, such as fragmentation of learning time, high cost of mobile devices and connectivity service, and the abuse of the devices (causing disturbance of lessons) for personal calls and other non-educational purposes (Denk, Weber, & Belfin, 2007), which need to be identified for further research and development, before the potentials of mobile learning can be fully utilized for educational purposes. Using Google Scholar for a search of academic journals up to August 2014, Baran (2014) identified 329 articles on mobile learning and teacher education. He carried out a detailed analysis of 37 selected reliable articles and found that (a) teacher educators were the subject of only four studies, (b) six papers were directly related to science education and (c) design-based research was used in four papers only. The technology used in all those studies was limited to well-known mobile devices, such as mobile phones, tablets, smartphones, laptops, iPods, iPads, PDAs, and handheld PCs, but did not involve micro-controllers, such as *Arduino* (<http://arduino.cc>) for conducting on-site or remote-controlled experiments. Furthermore, there was not much prior in-depth research done on teachers’ views, perceptions, and attitudes towards mobile learning. In a limited study on pre-service teachers’ perceptions of the use of mobile phones and laptops in education, Nihat Sad and Goktas (2014) administered a survey to 1087 participants and revealed that mobile phones were perceived to have weaker potential than laptops as mobile learning tools. To bridge the aforementioned educational gap, from September 2014, in the largest teacher education institution in Hong Kong, a group of science teacher educators started to incorporate in some teacher training programmes an array of different teaching and learning activities, which were designed for the use of innovative mobile learning activities. Four instances of these new approaches are reported below, together with the evaluation of perceived



learning effectiveness from the point of view of the students and these students' prior experiences, attitudes, and views on mobile learning.

## 2. METHODOLOGY

For present case study purposes, more demanding mobile learning or e-learning activities were newly developed and separately adopted in five undergraduate courses (each for a 3-hour lesson): A, B, C, D and E, by three lecturing staff X, Y and Z with expertise in Chemistry, Physics, and Physics, respectively (see Table 1). The course A was taught by staff X and was aimed at developing student-teachers' teaching methods or pedagogies in which participants were first assigned to play some applications on simulation experiments in typical school science topics, e.g. photosynthesis in biology and water rocket in physics (force and motion). Free mobile apps used as scientific tools, such as Smart Tool, were introduced to design inquiry experiments. Later, the students were taught how to develop apps by themselves using an online app-building tool called *App Inventor 2*, provided by the Massachusetts Institute of Technology (MIT, <http://ai2.appinventor.mit.edu/>). The objective of the tool was to equip participants with the capability to develop apps (or to modify open-source apps) for some simple simulation experiments or activities for their future pupils at school. During the lesson, students whose major was neither ICT nor computer science, and who, therefore, had never written any codes for computer programming before, learnt how to create an interactive BMI app with the App Inventor 2, which is user-friendly and contains built-in blocks, instead of abstract programming languages. Though this was the first time they used the MIT *App Inventor 2*, most students could create their first mobile app successfully. As far as we know, this kind of approach, which requires the students to develop their own apps, is rarely found in any teacher education programmes or courses which are not directly related to computer science or ICT. This is because most teacher educators are themselves unable to develop apps, unless they are ICT experts. On the contrary, staff X had received an hour of formal training on app development just before the lesson.

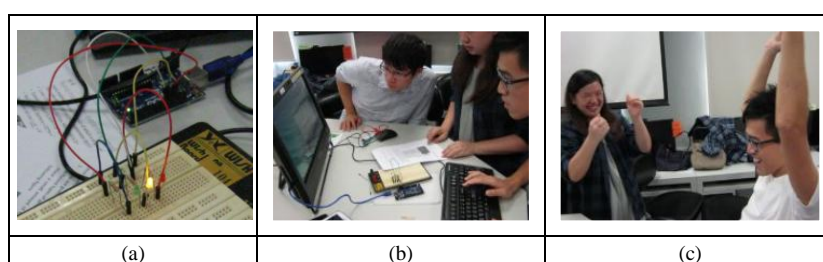
*Table 1. Undergraduate courses, lecturing staff, and distribution of students participating in the trial lessons.*

Course Code	Nature of undergraduate course	Lecturing staff (expertise)	No. of students	No. of questionnaires returned
A	teaching methods or pedagogies	X (Chemistry)	72	60
B	science and technology, and their link with society	Y (Physics)	98	80
C			80	55
D	a general-education course on daily-life applications of chemistry	X (Chemistry)	54	39
E	scientific and socioeconomic aspects of information	Z (Physics)	60	35

Courses B and C were related to subject knowledge in science and technology, and their link with society, as taught by staff Y, and there were two separate classes of students who mostly had no senior secondary school background knowledge in science. The aim of the newly incorporated lesson was to facilitate the students' in-depth understanding of the mechanism and principles underlying computer-automated systems, as well as the link between hardware and software. During the lesson, students were organized in groups of three to four members and asked to build a simple automated traffic light system. A manual was provided to them as a guide on how to wire simple circuits consisting of basic

electronic components including LEDs and resistors, and on how to code simple computer programmes for *Arduino* micro-controllers to control the time in which the colored LEDs were switched on and off. A proper development of hardware and software, i.e. a correct circuit with an appropriate computer program, would result in a system simulating automated traffic lights, as used in daily life. For many of the student-teachers, the lesson was their first experience in computer programming and, yet, most groups were successful in building the traffic light simulator in a 3-hour lesson, following the manual (Figure 1).

*Figure 1. Photos of students' performance using the Arduino platform to develop an automated traffic light system: (a) wiring the electronic circuit, (b) coding to programme Arduino for conducting scientific investigation and (c) enjoyment on successful completion of the system.*



In addition to building the automated traffic light systems in one lesson, students were given online quizzes in the other lessons of course B and C. The goal of the quiz was to consolidate the students' knowledge, after a discussion on specific topics of science and technology. Each quiz consisted of 5 to 6 multiple-choice questions and was administered to students via Moodle during class, after the discussion of each specific topic. Students logged in to Moodle via their own mobile devices to access the quiz, they were allowed to refer to their notes and discuss with their classmates to find the correct answers to the questions. After a set period of time, the lecturer closed the quiz and the results were computed by Moodle. Students immediately obtained their own quiz scores, as well as performance statistics for the whole class. For more difficult quiz questions, they had a discussion with the lecturer.

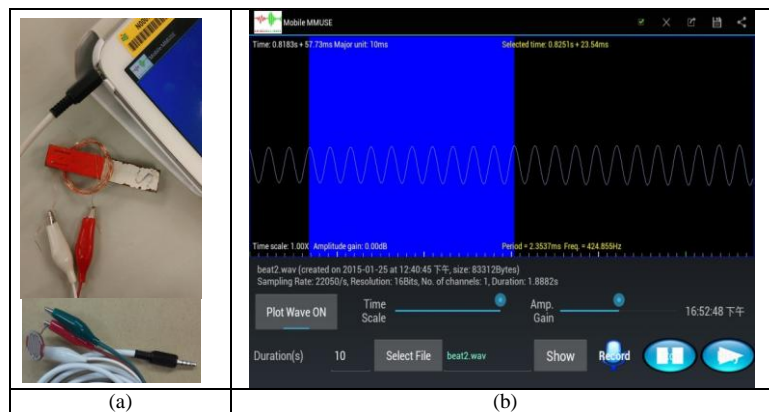
Course D was a general education course taught by staff X and was related to daily-life applications of chemistry, such as wine brewing. The alcoholic contents of homemade wine after fermentation could be determined by the traditional titration method. However, the alcoholic changes during fermentation were not known. The aims of this newly designed mobile learning activity were to (i) find out the alcoholic content in homemade wine using the *Arduino* alcohol gas sensor and (ii) develop a remote experiment using *Arduino* sensors to monitor the fermentation process of wine brewing, so that students could compare the rate of fermentation in different conditions. During the lesson, students calibrated the alcohol sensor using standard alcohol solutions (from 0%-20%, see Figure 2(a)). Later, they prepared wine samples in different conditions, in which the independent variables were: quantity of grapes, mass of yeast, and mass of sugar added. The dependent variables were alcoholic content, pH, and temperature change. A remote-controlled experiment using a newly developed mobile logger (see Figure 2(b)) was set up in the laboratory, in which the data were measured, and recorded automatically and continuously for two weeks. Students could access the data through their own mobile devices at any time and from any place, and the lecturer discussed the experimental results with the students after two weeks.

Course E was taught by staff Z and dealt with the scientific and socioeconomic aspects of information. Most of the students lacked science-education training in their senior secondary schools. One of the authors of this chapter, Y. Y. Yeung, has developed an app called mobile MMUSE (MultiMedia Utility for Science Education), which enables an Android-based mobile device to record, display, and analyse sound, as well as light, and electrical signals with the use of a modified audio cable (connected to the microphone input of the mobile device) plus a light-dependent resistor, or a copper coil (see Figure 3). There are some experimental worksheets designed for guiding students on how to use this app in a tablet or smartphone to (a) collect, (b) visualize (the waveform and amplitude) and (c) measure the duration, period, or frequency of different sound sources (including tuning forks, musical instruments, or animal/insect voices), of light signals (from infrared remote control or fiber-optic communication), and of electrical signals generated by an electrical generator or by a copper coil when a bar magnet moves across, or passes through, it.

Figure 2. (a) Setup for calibration of alcohol gas sensor and (b) setup for online monitoring of the fermentation process in wine brewing.



Figure 3. (a) Connection of a copper coil (upper photo), or a light-dependent resistor (lower photo), to the microphone input of a tablet via a modified audio cable and (b) screen capture of the signal displayed in the app called mobile MMUSE.



After the lesson, a self-developed and validated questionnaire was administered to all the class participants (364 in total), on a voluntary basis. Apart from requesting some background information, the questionnaire (see Tables 1 and 2) consisted of four parts, namely (1) ten questions on the respondents' prior learning experience with mobile devices, (2) seven questions on the respondents' attitudes and views on mobile learning, (3) seven questions on the evaluation of the respondents' e-learning experience in the lesson, and (4) four open-ended questions to collect the respondents' opinions and feedback on the issues

of using mobile devices for e-learning, the reasons why they thought some activities were more interesting, suggestions for improvement, and other comments.

### 3. Results and Discussion

The survey was administered to students in five courses and 269 questionnaires were returned, with an overall return rate of around 74% (see Table 1). The mean score and standard deviation (SD) of all items in each section is provided in Table 2, while the qualitative data collected from the open-ended questions are summarized in Table 3. While the overall mean of the students' prior learning experience with mobile devices is fairly high ( $2.9 \pm 0.8$  in a 4-point Likert scale), there are distinctions on the type of experiences. They had much more experience (with mean being 3.31 to 3.38) on searching web information, using a dictionary, encyclopedia or translator, and tools, such as calculator, map, or other educational apps; but less experience (with mean being 2.48 to 2.58) on learning new science concepts through simulation or virtual experiments, or conducting scientific investigations or experiments using the built-in sensor of mobile devices.

The respondents generally (less than 10% of them responded with disagreement or strong disagreement) held very positive attitudes and favorable views on different aspects of mobile learning (with overall mean of  $3.6 \pm 0.9$  in a 5-point Likert scale), except the campus support of their e-learning (mean of  $3.16 \pm 1.0$ ), which was substantially lower. Regarding the evaluation of the students' e-learning experience in the lessons concerned, the respondents provided a fairly high mean score of  $3.5 \pm 0.7$  (in a 5-point Likert scale and in fact less than 8% of them responded with disagreement or strong disagreement), and responded very similarly across the seven questions (with mean being 3.43 to 3.59) on the attitude-related aspects of learning (interest, stimulation, and motivation to learn), their ability to carry out the activities, their preference for more e-learning activities in other courses, and adoption of e-learning approach in their future teaching in schools. Table 3 summarizes the key feedback provided by the respondents, as collected from the four open-ended questions, on the main reasons for interest, the problems encountered in different types of e-learning activities, and the suggestions for improvement. This information will form a very important reference for future large-scale implementation of mobile learning in this or other teacher education institutions.

Table 2. Consolidated results of the Likert items in the questionnaire survey.

Part	Content/Aspect	No. of questions and Scale	Distribution of responses	Overall Mean (SD)	Cronbach's Reliability $\alpha$
1	Prior learning experience with mobile devices	10 questions with 4-point Likert scale	Rarely =1: 5.8% 2: 20.0% 3: 48.8% Frequently =4: 25.4%	2.9(0.8)	0.84
2	Attitudes and views on mobile learning	7 questions with 5-point Likert scale: Strongly disagree (SD), Disagree (D), Neutral (N), Agree (A) and Strong agree (SA)	SD=1: 2.1% D=2: 7.1% N=3: 31.3% A=4: 47.7% SA=5: 11.7%	3.6(0.9)	0.82
3	Evaluation of e-learning experience in the lesson	7 questions with 5-point Likert scale: Strongly disagree (SD), Disagree (D), Neutral (N), Agree (A) and Strong agree (SA)	SD=1: 1.4% D=2: 6.4% N=3: 37.2% A=4: 50.1% SA=5: 4.9%	3.5(0.7)	0.90

Table 3. Consolidated results of the open-ended questions in the survey.

Question Aspect	Category	Opinions or feedback
Reasons for most interesting activities	Programming	Excited with first-time experience in programming. Useful aid for teaching purpose.
	Online quiz	Interaction with teachers and classmates. Can realize the extent of understanding immediately.
	Remote experiment	Can access the process everywhere. Amazing to build such an equipment. The result was interesting.
	Playing simulation apps	Can link up the scientific principle with technological product. Simulation was well illustrated. Step-by-step demonstration.
Problems on e-learning	Instruction	Limited time. Students cannot follow the pace. Limited teaching aids/equipment ( e.g. tablets). Not every student can participate. Learning objectives unclear to students.
	Programming	Not experienced users. Unable to connect the Arduino board with the computer.
	Online quiz	Connection to Moodle is difficult sometimes. Mobile devices ran out of power.
	Remote experiment	Require both mathematics and science knowledge.
Improvement or solution to problems	Hardware	Unfamiliar with the tablet Android-based operating system and interface. Malfunctioning of the circuit board and of the electronic components.
	Instruction	Give enough time for students to try. Ask helpers/teaching assistants to provide support and follow the progress of each group of students. Provide more equipment. Make students responsible for specific tasks. Clearly state the learning objective before starting the activities.
	Programming	Provide relevant background materials to students for self-learning prior to the lesson. Provide a clear list of troubleshooting for the problems which may occur in connecting the Arduino board with the computer.
	Online quiz	Tablets provided in-class to students who have problems with connection to Moodle or their own devices.
	Hardware	Adapt the teaching materials or apps to mobile devices of other brands.

Although various difficulties were encountered during the activities, many students enjoyed the lesson. For the activities developed in course A, students were excited because it was their first-time experience in creating apps. Unfortunately, students did not have enough time to further develop their own apps. From their responses in open-ended questionnaire, they enjoyed the MIT app inventor activity, while they found it difficult to imagine adopting it in their future teaching. This might be due to the fact that most of them were not familiar with computer programming. They preferred using scientific simulations or free apps they might develop in their future teaching career, because of ease of handling and infusion of different scientific inquiry processes, such as manipulating variables. For instance, although students in courses B and C had to learn from scratch basic computer

programming skills during the construction of traffic light systems, they collaborated to tackle the difficulties encountered. After completing the task, many groups took pictures of their completed traffic light systems to celebrate their accomplishment. Most importantly, through implementing the activities, they developed a better understanding of information technology, as well as its value in teaching and learning. For the remote experiment in course D, for all students this was the first time they performed this kind of experiment and they were happy to use new technology. In the open-ended questions, most of them revealed that it was not very difficult to perform the experiments and they could monitor the process and compare the graphs. Students in Course E considered the activities much more interesting (because of the unexpected findings) than the traditional experiments and they felt it was easier to understand the underlying scientific concepts and principles. Some became very excited in using a mobile device to measure human reaction-time during a game between classmates. However, they also remarked that there was not enough time for so many mobile learning activities.

#### 4. CONCLUSIONS

An array of mobile learning activities was implemented in five teacher-education courses by three different teacher educators. The activities were: (a) app development by students, (b) wiring circuits and programming of a traffic light system based on the *Arduino* micro-controller, (c) *Arduino*-based remote-controlled experiment on wine fermentation and (d) low-cost experiments based on the newly developed MMUSE app. These approaches are innovative in that, as far as we know, no similar activities have ever been adopted in training pre-service or in-service teachers who are not majoring in either computer science or ICT.

The use of *Arduino* and the development of computer apps are probably quite common in many other courses or programmes of engineering or computer science, but the underlying educational context is very different from that of student-teachers who lack the basic engineering or programming training prior to the lesson. It should also be noticed that the teaching staff were not trained engineers nor computer programmers in their own academic disciplines and so they needed courage and confidence to implement those innovative teaching and learning activities in their classes, given the high risk of failure. As reported in the case study above, the educational outcomes of the mobile eLearning activities are qualitatively correlated with the ultimate aim of providing some innovative and hands-on mobile learning experiences (especially the newly-developed experiments for scientific investigation) to student-teachers, so that they will be able to develop different ways of using mobile devices in their future classroom teaching and learning activities. The case studies reported some innovative approaches which were in stark contrast with the elementary, or layman, use of mobile technology in teacher education, as recorded in the literature (Seppala & Alamaki, 2003; Montrieux, Vanderlinde, Schellens, & De Marez, 2015).

As shown in Table 2 (with high Cronbach's Reliability  $\alpha > 0.8$  for the quantitative findings), students had a fairly good prior level of experience and had positive attitudes and views on mobile learning, even though most of them did not have any academic background in information technology or in computer science. The results were strikingly different from those obtained by Nihat Sad and Goktas (2014) whose findings implied: "An urgent need to grow awareness and further positive attitudes among" student-teachers towards mobile learning. The questionnaire used here also collected students' personal information, revealing that nearly all of them possessed a smartphone and nearly a half of

them had a tablet. Combining this information with the fact that there is 100% WiFi coverage within the campus, it could be concluded that it is highly feasible to have a widespread adoption of mobile learning in teacher training programmes. These findings will be compared to those of research involving other university students enrolled in other types of undergraduate programmes (Park, Nam, & Cha, 2012) and will undergo further analysis to uncover the underlying factors (Wang, Wu, & Wang, 2009; Abu-Al-Aish, & Love, 2013). Besides, they could be used to redefine or revise the current research priorities in mobile learning as advocated by Yu-Chang, Yu-Hui, and Snelson (2014).

However, the findings from the students' evaluation of a 3-hour e-learning experience should be viewed as tentative, because students normally need to be exposed to new teaching activities for a few lessons before they can reliably assess the learning effectiveness of these activities. Nevertheless, the students' identification of learning problems and their feedback are useful for future refinement and improvement of the mobile learning activities and teaching approaches, and for integration with remote-controlled experiments (Tho & Yeung, 2015) and community-based science learning (Tho, Chan, & Yeung, 2015). In fact, students have shown a greater level of engagement and collaboration in their learning process, as well as of joy and happiness for the successful completion of their tasks. The educational implications of these findings are that they should be viewed as positive and favorable evidence for the widespread incorporation of innovative mobile learning activities in various teacher education programmes. Subsequently, when the student-teachers graduate to become regular teachers in school, they will have acquired the sort of confidence and competence in the effective integration of mobile learning so as to improve access to education of a mobile world (Ally, Grimus, & Ebner, 2014). Mobile devices will then become a good learning companion of young people, instead of being merely a handy tool for entertainment or social networking, as they are nowadays.

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## Chapter #12

### GAMIFICATION AND TECHNOLOGICAL LITERACY Educating electricity users

**Aphrodite Ktena**

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#### ABSTRACT

The staggering technological advances of the last decades and rapid changes in the engineered world surrounding us have led to the emergence of technological illiteracy as a major social challenge threatening to create outcasts. Informal education, a path typically chosen by those who feel marginalized by the formal school system, may be more appealing to children and adults alike since it takes away the pressure of school performance and the stigma of failure. The challenge in creating content for informal learning lies in engaging and retaining the learners in an active mode, in making them truly interested in their learning process and achievements. Gamification technology has been proposed for developing engaging informal education programs targeting technological literacy. A novel methodology for developing gamified applications is proposed which is based on a well established behavioral model. It uses the cognitive model to develop the individual's knowledge base and skills and gamification mechanics for emotional engagement and triggering. This methodology has been used to develop a pilot application targeting electricity users which aspires to educate them in electricity saving, consumption, production and markets in line with the emerging smart grid paradigm.

*Keywords:* electricity, smart grids, behavioral modification, technological literacy, SMARTEGE.

#### 1. INTRODUCTION

Technological illiteracy is a state of cognitive disequilibrium experienced by an individual where his or her knowledge and skills are not sufficient or necessary to account for and interact with the world he or she lives in. At a social level, it blocks potential for further progress, raises barriers, leads to social exclusion and is ultimately counterproductive.

Technology goes hand in hand with the history of mankind and the evolution of human species as it spans all activities and objects developed by mankind. The dazzling pace of the scientific and technological progress, particularly in the second half of the 20th century, has left educational systems trailing behind gasping for breath in their effort to catch up, and a large part of the population lost in an ocean of awe and ignorant bliss. More often than not, the former give up the unfair struggle and focus in providing solid, conventional tools that will hopefully enable the future citizens to learn, find out for themselves and catch up on their own. More often than not, the latter are disenchanting by the educational content which seems to reflect another era than the one they are living in and end up brushing aside the tools offered to them, opting for the easier path of mass information rather than that of education.

In this landscape, informal learning methods may be a valuable companion, alongside formal and non-formal education material and structures, in the struggle against technological illiteracy and social exclusion. Because, *“if we all occupy different positions in a vast, all-inclusive circle, rather than occupying different levels in different pyramids which are themselves at different levels, then it is impossible to fall from a height and more difficult for movement to be experienced as mortal threat”* (Wilshire, 1990, p.267).

Gamification is a promising informal learning methodology. Loosely defined as a practice of using gaming technology and mechanics in non-gaming applications, it has already found its way in digital applications and marketing. According the Gartner Hype Cycle, gamification has moved from being at the end of ‘innovation’ triggering period (2012) to the maximum point on the peak of ‘inflated expectations’ (2013) to approaching fast the ‘trough of disillusionment’ (2014) and moving towards the ‘plateau productivity’. According to the 2015 chart, the hype is over and gamification is omitted from the chart being considered as a mature rather than an emerging technology in digital marketing.

However, the role of gamification in education is still an open-ended question (Dicheva, Dichev, Agre, & Angelova, 2015). Even though applications have already been developed for both formal education in traditional classroom environment as complementary learning tools or in e-learning and distance learning platforms (Domínguez, et al., 2013; Lee & Hammer, 2011) as well as informal education and behavior intervention or modification (Carr, Taylor, Hunt, & Mejia, 2014; Mohr, Schueller, Montague, Burns & Rashidi, 2014), published results are still inconclusive. It is not clear yet what the appropriate methodology is for gamifying educational content or what type of courses or learning it is more appropriate for.

In this chapter, we aspire to offer a roadmap for developing educational applications for informal learning based on Fogg’s Behavioral Model (Fogg, 2009), a model developed for persuasive design targeting behavioral modification. The methodology proposed uses the cognitive approach (Bloom & Krathwohl, 1956) for capacity building and the flow model (Csikszentmihalyi, 2000) for user engagement through game mechanics. This method has been applied to design an online application for smart phones and tablets targeting the technological literacy and behavioral modification of electricity users in line with the paradigm shift towards smart grids and demand side management (Constantos et al., 2014).

## **2. BACKGROUND**

### **2.1. Technological literacy and informal learning**

According to Piaget’s cognitive child development theory, when a child’s knowledge base can no longer account for the world around it, it enters a state of cognitive disequilibrium and is no longer able to assimilate and process the new knowledge and skills required. This leads to a frustrated state which is believed to drive the learning process towards a new equilibrium point. Though Piaget’s theory is concerned with children developing into rational individuals, and not with learning processes, it may be extended to the cognitive development in adults in the sense that Kant defines enlightenment as “man's emergence from his self-imposed nonage”: when an individual is aware of the lack of knowledge on a certain problem, enters a state of disequilibrium (Kavathatzopoulos, 2001), as in the case of technological illiteracy.

People need a minimum level of relevant knowledge in order not be shunned and benefit from a novel or updated technology or system. Technological illiteracy is a self-sustained condition where lack of understanding and hands-on experience will make a technologically illiterate person less likely to learn through experience and develop intuition and judgment for technological applications (Pearson & Young, 2002).

Technological literacy is a basic transversal skill (Pearson & Young, 2002; ITEA, 2007) that goes way beyond the use of computers or web searches. It is about knowledge and skills as well as ways of thinking and acting that allow people to participate in the world around them in an intelligent and thoughtful manner. A technologically literate person: realizes the pervasiveness of technology; is familiar with the basic concepts important to technology; knows about the engineering design process; understands that there are trade-offs, capabilities and limitations involved in any system; understands there are risks, costs and benefits in the use of any technology; recognizes the dialectic relationship between technology and society; is capable of improving his or her life by solving simple problems and participates actively in decision making processes concerning technological solutions (Pearson & Young, 2002). When a society enjoys a higher level of technological literacy, its members are more immune to opinion forming and manipulation and more likely to apply filters and good judgment in the adoption or use of some technology thus enhancing its positive aspects while blunting the negative ones.

In the quest towards a new equilibrium state, the technologically challenged individual will either attempt to construct the new knowledge or seek it out where it exists. He or she will turn towards educational structures and resources or search for knowledge and/or information through informal channels.

Informal learning is nowadays viewed as a third learning path, the other two being formal and non-formal educational programmes or curricula. It may be defined as the learning taking place, in the absence or in spite of authorized instructors, outside curricula and educational institutions. Informal learning can be (Schugurensky, 2000):

- a) self-directed when purposefully undertaken by an individual or a group and uses knowledge and information resources found in an another person or repository, e.g. Internet, in a self-assisted manner; it is intentional and conscious
- b) incidental when unintentional but conscious
- c) tacit when unintentional and unconscious.

Informal learning, like formal and non-formal education, may build on existing components of our knowledge base (additive) or configure it anew by transforming its base units (transformative).

The value of informal learning in technological literacy is discussed in (Pearson & Young, 2002) while standards for technological literacy are presented in (Standards for Technological Literacy, 2007).

## **2.2. Informal learning and gamification**

According to a survey of the American Society for Training and Development on informal learning (ASTD, 2008) typical practices employed by companies for personnel training include: emails for sharing knowledge (68%), offering employees reading material on an intranet (52%), “fingertip” knowledge (52%), “self-learning” facilities where employees can access learning modules at their own pace (32%), instant messaging (32%), online social networking (31%), peer-to-peer coaching (30%), voluntary informal mentoring (28%), communities of practice (20%), informal networks (20%), online discussion groups (14%), wikis, blogs or other employee-generated content (12%). Such practices are all compatible with gamification design methodologies and mechanics.

In adult learning, motivation may stem from a variety of reasons and engagement must be linked to immediate, tangible results. Gamified applications do not rely on the user's desire for learning and investigation but are relevant to the user's everyday life, experience, and culture through the game narrative, strategy, and clear and precise goal. Gamification learning is a non-linear process like online and self-learning and the mechanics used to increase motivation, engagement and interaction among learners appeal to the cognitive, emotional and social areas of players in a mixed and interleaved way: e.g. when a badge or an award obtained for mastering a given course content and attaining expected learning outcomes is communicated to all other players, it appeals to all three areas.

Similar to a course, a gamified educational application offers levels allowing incremental progress and the design of own learning path and curve through typical gaming practices such as tasks and missions. Assessment is immediate, incremental, progressive as well as fun through game mechanics such as notifications, points, leaderboards, badges, and awards. Social interaction can be as simple as the use of a leaderboard or social media for invitations and messages or scale up to users forming communities and competing in teams. In any case, the social dimension allows the users to tell their own story, motivates them to create an identity through the application thus further engaging them in the process.

### **3. DESIGN METHODOLOGY**

Our approach is based on Fogg's Behavioral Model - FBM (Fogg, 2009) developed for persuasive design targeting behavioral modification. FBM postulates that individuals are convinced to change their behavior on an issue, when three conditions are satisfied: sufficient motivation, adequate ability and timely triggering to implement behavioral change (Fig.1). Motivation, M, and ability, A, can be visualized as two axes defining a plane of possible behavior states,  $B(M,A)$  reflecting the various levels of motivation and ability among people. Individual behaviors,  $B_i(A_i, M_i)$  occupy various positions on the plane and follow different trajectories to the target. Assuming that behavioral change is incremental, each trajectory is the result of discrete, smaller rather than larger, steps towards the target. To move from, say  $B_1$  to  $B_2$ , triggering must be applied at the right timing. This is when the individual is able and motivated enough to attain  $B_2(A_2, M_2)$ , i.e. the individual's motivation and ability are higher than  $A_2$  and  $M_2$ , respectively.

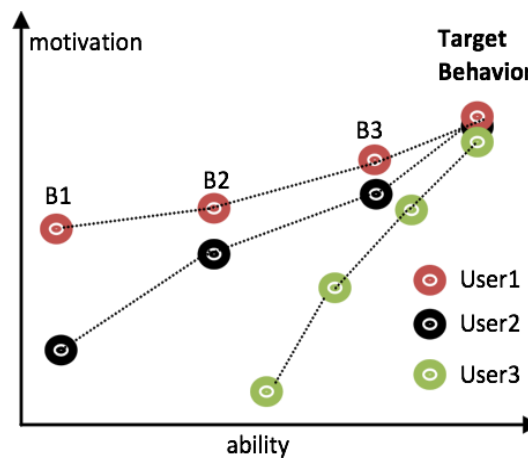
In the context of learning environments, the target is a learning outcome of a course. Learners, who are not equally motivated or able at the beginning of the course, are allowed and encouraged to follow personalized trajectories towards attaining the predefined goals. They are allowed to do so by the availability of educational content supporting various trajectories and are encouraged by appropriate and timely triggering.

#### **3.1. Persuasive technology and learning environments**

According to FBM, the ability of an individual to implement change is determined by the simplicity of the steps required to accomplish a task. It is a function of six variables which can be thought of as finite resources: *money, time, physical effort, mental effort, social deviance and non-routine*. Each one is associated with a cost whose value is different for each individual. The ability function can be modeled as a cost function whose value is determined by the variable with the highest cost at any given time: e.g., if change in a given direction by an individual requires investment in both physical effort and money but the individual is in a dire financial situation, the height of the barrier preventing the individual

from changing is determined by the lack of money. If the cost function  $C$  of change is given by  $C = \max\{\text{money cost}, \text{physical effort cost}\}$ , to facilitate change,  $C$  must be reduced either by decreasing the required investment in money or by increasing the ability of the individual to invest the required amount. In other words, to facilitate change, the height of the barrier as perceived by the individual must be decreased. This can be accomplished either by decreasing the barrier height in absolute terms or by raising the individual's level.

Figure 1. FBM's plane of behavior states and trajectories towards the target behavior (left). The 3D technological literacy space (Pearson & Young, 2002) (right).



In the context of learning environments, the ability is determined mainly by the mental effort required to accomplish a task. For the learner to take steps towards achieving a given learning outcome, it is necessary to mainly increase his/her capacity through education. In this process, it is important to remember that the cost function associated with each step depends on all six variables. Decreasing the mental effort required to attain the next level in the learning process, should not have a cost in time, money, physical effort, social deviance and non-routine higher the cost savings achieved via capacity building.

In (Pearson & Young, 2002), technological literacy is conceptualized as a three-dimensional space defined by axes, x: ways of thinking and acting, y: knowledge, z: capabilities (Fig. 1). A technologically literate person moves on a trajectory towards higher values of all three variables. In terms of the FBM model, the horizontal 'ability' axis corresponds to the y-z 'literacy plane' defined by capabilities and knowledge. Movement along the 'ways of thinking and acting' axis of technological literacy corresponds to the behavior modification trajectory of FBM after motivation and triggering is introduced to engage the user in the process. The latter is accomplished through game mechanics along the lines of the 'flow' model (Csikszentmihalyi, 2000).

The motivation of an individual to learn and/or implement change is increased leveraging three basic emotional dipoles: a) the pleasure/pain motivator which has an immediate effect on the learner, e.g., high/low grade, answer/not answer a question b) anticipated hope/fear which has a long-term effect, e.g., move towards/away from mastering a skill or conquering a learning outcome c) social acceptance/rejection, e.g., high/low ranking in class, popularity among a group with a common target outcome.

Depending on the ability and motivation of an individual appropriate triggering must be applied choosing from: a) sparks, messages for unmotivated individuals b) facilitators, activities designed for individuals of low ability c) signals offering guidance and advice to individuals of sufficient motivation and ability (Fogg, 2009).

User1 in Figure 1 is highly motivated but is lacking ability. User1 will benefit from facilitators and content guiding him/her through the learning process, making sure he/she is not disenchanted or discouraged in the process by appropriate notifications and encouraging sparks. User2 has low ability as well as motivation. In this case, all types of triggering should be applied to guide User2 towards the target. User3 has high ability but very low motivation. Though there is still educational content to be covered, he/she must be first engaged in the process using all three emotional dipoles.

The application must offer all these options to the users and guide them towards the appropriate direction where, in turn, they will be able to choose features they feel more comfortable with. Gamification processes and technologies are used to do that.

### **3.2. Gamified cognitive learning**

The application learning content is developed following the cognitive approach and Bloom's taxonomy (Bloom & Krathwohl, 1956) in agreement with the six levels of the learning pyramid: know, understand, apply, analyze, evaluate, create. These levels are used to determine the learning outcomes, develop learning material and design the game levels.

The more types of material are offered, the more flexibility is given to the user to draw own learning path: notes, reading material from external sources, useful links, short videos, sounds or other audio material, figures, assignments, quizzes, tests, are all found in a library organized according to Bloom's taxonomy. User generated content may also be allowed which will be moderated by the application administrator and subject to game mechanics: a user uploading learning content will earn points in the game according to the quality, relevance and level of the content, the usefulness of the content to fellow students, etc.

To decide on the choice and use of game mechanics the motivation matrix of the application is constructed (Constantos et. al., 2015) where the following phases must be identified: a) acquisition, during which users are first attracted and engaged in the learning process; the phase's duration, content and mechanics depend on the type of learning b) education which spans an educational application from beginning to end c) attraction, during which personalized features are introduced; based on the ICT tools available, data-mining techniques may be used for more accurate learner-user profiling d) involvement which starts later in the game as capacity increases and the user feels more confident to advance at higher levels and tackle harder tasks e) motivation which spans the application from beginning to end, using all types of FBM motivational dipoles in conjunction with triggering f) conversion is an important phase in applications targeting behavioral modification where the user attains target behavior; the content in this phase is clearly target oriented addressing well educated and well motivated users; in other educational applications, this phase refers mainly to the final level of the cognitive pyramid g) conservation is also a phase of applications targeting behavioral modification; in educational applications, the engagement stops when all learning outcomes have been achieved and this phase is not required and i) excitement aiming to make users return to the game by renewing the content; this phase may not be required in educational applications.

The game mechanics used must serve the defined learning outcomes and motivation phases. Once the narrative and goal of the ‘game’ is determined, its levels must be defined in a clear and transparent manner. These must be of increasing difficulty and compatible with the learning material organized according to Bloom’s taxonomy. Sparks, facilitators and signals are developed for each level. The counters of the game are decided next and points are assigned to each user action in a way that serves the learning outcomes and the desired goal while maintaining the user in the ‘flow’ zone. Tasks and missions appealing to the cognitive, emotional and social area are designed as well as badges and leaderboards to reward the users and enhance competition among them.

#### **4. ELECTRICITY GRID AND USERS**

Over the last two decades we are witnessing an accelerating paradigm shift in electricity grids and markets. The power grid is required to abandon the traditional supply side management in favor of the demand side management of a ‘smart’ grid. The shift is triggered by the pressure for energy saving and low carbon emissions on the one hand and electricity market deregulation on the other. It is enabled by technologies such as renewable energy sources (RES) and distributed micro-generation, wireless networks, telemetering and telecontrol. The smart grid allows two-way communication in real time between the provider and the user or the producer and the system operator generating data to be used for the optimum operation of the system. The emerging smart electricity markets are expected to provide the necessary feedback mechanisms (Neuhoff, 2011).

The user of the smart grid is therefore an active agent interacting in real time with the grid and the markets rather than a passive consumer receiving and paying the electricity bill on a regular basis. In this new techno-economical reality, the majority of electricity users, are technologically challenged if not totally illiterate. A recent survey has shown (Constantos et al., 2014) that electricity users lack fundamental knowledge and skills: they cannot read their electricity bill, they do not know what a kWh stands for, they are not aware of their energy profile and needs, nor can they estimate their consumption never mind making informed decisions on RES installations towards net zero energy building (nZEBs) which are one of the EU 20-20-20 targets.

Their inability to function in the emerging paradigm hinders the uptake of technologies and policies that will facilitate the transition to the demand side management, or even adopting new habits in light of the much advertised energy savings. Due to marketing, they respond positively to buzz words such as RES, photovoltaic's, smart meters, etc, but are not aware how these technologies may affect their lives, the limitations and trade-offs involved or their value for money.

In light of the above, we have developed (SMARTEGE) a gamified online application for smart phones and tablets targeting the technological literacy of electricity users using the methodology described in the previous section. For example, let us assume that we want to train users to purchase online and in advance the electricity (kWh) they will need for the next day, week or month. To accomplish that, they must:

- be able to do so, i.e. to know where the relevant application is, how to use it, the basics about electricity generation, consumption, saving and billing, the energy profiles of their appliances over a period of time, how to compute the electrical energy necessary for the time period of their choice, etc.

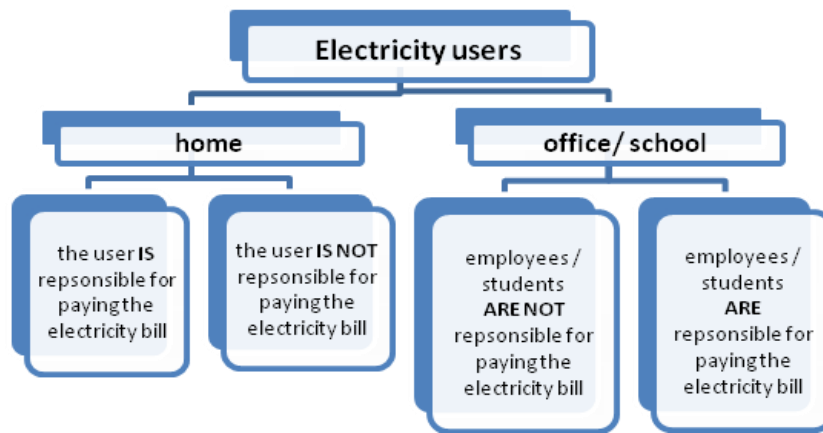


- be motivated enough to engage in the process because of saving money while increasing comfort levels; better income and energy management; benefits from the electricity provider; avoiding running out of credit and risking a black out; being part of a wider online community exchanging info and tips.

- be triggered at the right timing by messages reminding them that credit is running low or appliances are left on standby mode; notifications about competitive kWh pricing, tips on navigating and using the application; warnings about excessive electricity consumption of appliances etc.

SMARTEGE’s learning content takes into account the following user types (Fig. 2): users paying for electricity use, such as parents or office managers, and users not responsible for paying the bill, such as kids, students or employees.

Figure 2. Electricity user types.



The expected learning outcomes for the SMARTEGE user, as a consumer, are to: know the basic notions and definitions of electrical energy; understand the relationships between the electrical energy quantities; apply this knowledge to a building’s energy management; analyze the energy profile of a building; evaluate the energy performance of a building; create energy efficient scenario for energy management.

The expected learning outcomes for the SMARTEGE user, as an electricity producer and market agent, are to: know the basic notions and definitions of electrical energy production and market; understand the relationships between the electrical energy production and consumption quantities; apply this knowledge to the management of small RES installations and electricity trading; analyze the techno-economical profile of a RES installation; evaluate the performance of a RES installation; create energy efficient scenario for RES management. The educational content in the form of tips, definitions, explanations, questions and reading material is developed according to these objectives.

The application presents a 3D virtual environment that emulates the basic daily functions and actions of an electricity user in a house and an office building, in real or accelerated time. Using gamification mechanics, such as badges, leaderboards, levels etc the user is gradually trained to understand the energy profile of appliances and equipment operating in the virtual building with respect to the set points defined by the user, to evaluate the effect of his/her actions and habits on it, to analyze the costs and benefits

associated with energy upgrading or saving tactics. At a higher level, the user is allowed to virtually produce electricity in order to attain the ultimate nZEB goal. The user's ability is improving through knowledge content offered in various forms, such as tips, information, reading material, quizzes, exercises, and is guided through the process with appropriate triggering while being motivated by counters, reputation points, leaderboards, badges. All types of motivators are used while special emphasis is given in the social dimension: the user is interacting with other users and is allowed to exchange information or messages through social media. At advanced levels, with the purchase of appropriate hardware, the user can emulate, monitor and control the electricity use and production of a real building.

The pilot version currently being tested has four levels. The first level is a 'Tutorial', at the acquisition phase, which offers a virtual 'tour' of the application and introduces most of the game elements that will be encountered in the game. The user is asked to answer a set of quizzes to accumulate points. If users fail, they are prompted to read appropriate educational material available in the 'library' and take the test again.

The second level is the 'Flat' which unlocks once the tutorial is completed successfully. The user is invited to select from the application's "inventory" typical home electrical and electronic appliances and position them in the virtual flat he/she is going to manage. With the help of appropriate triggering and educational material, such as tips, recommendations, explanations and definitions, the user is led to schedule the operation of the selected appliances to optimize the electricity consumption as well as the comfort level in the Flat. The user may increase the energy class of all buildings under his/her control by replacing existing appliances and devices with others of higher energy class. This is accomplished by spending 'Wallet points' accumulated through the successful completion of tasks and missions appropriate for each level.

The next level is the 'Office' which unlocks after the user has managed to accumulate a certain number of points at previous levels. To reach the ultimate goal of net zero energy consumption buildings (nZEB), electricity microgeneration is enabled from this level on. The user first learns to optimize the electricity use and consumption of all his/her buildings, residential or professional, and then is allowed to use 'Wallet points' for the installation of electricity generation components. The concept of electricity production is a very important one in the game, since it allows the user to think of electricity as a resource and not simply as a costly comfort enabler. The user is also granted access to new educational material concerning electricity generation and storage devices, such as photovoltaics, wind turbines and batteries, as well as the relevant legal framework.

'My Home' is the last level where the user can a) simulate the electricity use of an actual installation, e.g. his/her house b) with the acquisition of appropriate hardware, monitor the electricity use of the actual installation and have full control of it, setting operating points and allowing remote on/off of appliances. At this last level, the user is given the opportunity to relate what he/she has learned to the real world.

"Wallet points" are earned when tasks and missions are accomplished, such as answering a set of questions, reading material, creating new content, inviting a friend, commenting on another user's actions etc. They are spent when higher energy class devices are acquired and installed and are lost when resources are managed poorly.

The idea of trade-offs involved in the use of various technologies underlies all actions in the game as it is important that the users learn to apply judgment and not simply follow trends or shy away from innovation.

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The increase or decrease of “Wallet points” activates the pleasure/pain dipole as the user is pleased to see his/her wallet points grow through successful missions or timely moves but experiences pain and frustration when points are lost; the user is then triggered to gather more wallet points by participating in new missions. The SMARTEGE leaderboard shows the user’s ranking which depends on points earned through user actions related to the optimum management of resources and electricity profile changes. Users are also awarded badges upon certain achievements.

In SMARTEGE all three FBM stimuli are used: a) Risk messages, warnings, award announcements are used as sparks; for example, a warning message is issued when the facility operated by the user has very high consumption at an unlikely time of day b) Facilitators are usually in the form of advice; for example, a message prompting the user to answer a quiz for point collection to be redeemed in appliance upgrading improving his/her consumption profile c) Signals are simple reminders or advice; for example, a message notifying the user to purchase a second PV panel.

Social acceptance / rejection is a powerful dipole in SMARTEGE linked to the use of social media. The user is given the opportunity to shape his/her profile / position in the ‘market’, to compare positions and actions with others, to view user profiles, rankings and achievements. Furthermore, the user can invite friends, form an identity and achieve a certain status in the SMARTEGE world.

## **5. FUTURE RESEARCH DIRECTIONS**

In the future, the social dimension of the game will be upgraded to allow users to form alliances and compete by selling and buying electricity thus creating a virtual market regulated by the administrator. The application’s environment will be enriched with more building types with different energy profiles. The application will be tailored to specific learner’s needs, e.g. school building managers, public building users, etc. Based on the test phase results, anticipated early in 2016, future versions will also collect data and information for accurate user profiling in order to personalize the application’s content and thus enhance the behavior modification aspect of the application.

## **6. CONCLUSION**

Well established models used in digital marketing and gaming are proposed to be used for the development of gamified applications for informal learning targeting technological literacy. Here they are applied to develop a mobile/tablet application for literacy in electrical engineering technology. When developing applications for adult learners one must keep in mind that their motivation stems for a variety of reasons and their engagement is linked to immediate, tangible results. Such an application must (Carr et al., 2014): a) offer feedback in a form similar to the student assessment while not snubbing the gaming practices: immediate, incremental, progressive and fun b) have a clear aim and not rely simply on the user’s desire for learning and investigation c) pertain to the user’s everyday life, experience, and culture d) offer levels in a form similar to creating a course while using gaming practices to engage the user, such as tasks and missions e) allow for design of own learning path and curve f) allow for social interaction.

So far the benefits and mechanics of gamification have been presented as a novel education tool with applications in informal learning towards technological literacy. As mentioned earlier, every technology has its limitations, trade-offs and risks. In this case, when designing such an educational application we should ask ourselves why is

gamification shaped in this particular way, which interests it serves, what are its long-term effects on mass education, should learning material be a product or part of the edutainment business. Finally, the ubiquitous nature of such applications encourages the spread of mistakes and erroneous information so careful control over content is needed.

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## Chapter #13

### SPEECH AND LANGUAGE SOFTWARE IN THE INTERVENTION OF ORAL MOTOR FUNCTIONS IN AUTISM SPECTRUM DISORDERS

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#### ABSTRACT

**Aim and objectives:** The research focused on the analysis of speech (oral) motor abilities of children with autism spectrum disorder (ASD) using the special speech and language therapy (SLT) software. The relations to dyspraxia, as well as the early educational correlations with the development of speech, and early speech vocalization including complex motor difficulties, are mentioned. The grounds stemmed from our wider focus on the assessment of pragmatic language level, since the ability of facial expression gestures represents one of the most important pragmatic, nonverbal communication activities. **Methodology:** We mapped the oral motor abilities of children with ASD in the initial and final stages of the examination, applying the software programme FONO 2, a multimedia programme intended for individuals with impaired communication ability. We used the observational numerical scale evaluation followed by comparison of the inter-stage differences within longitudinal observation. **Conclusions:** The results show that it is possible to achieve positive outcomes by applying a systematic SLT approach based on using the SLT software in the intervention focused on the development of the oral-motor activities in children with ASD. We put forward a discussion on the possible exploitation of the results for assessment in the sphere SLT intervention.

*Keywords:* autism spectrum disorder, oral motor praxis, speech and language therapy, assessment, technology, pragmatic communication.

#### 1. INTRODUCTION

For diagnostic as well as therapeutic activities, modern speech and language therapy (SLT) use not only a variety of equipment but also technology comprising specifically designed software applications. The latter enables strengthening or even direct compensation of limited or deformed information coming from sensory-perceptual system, which, otherwise, results in insufficient feedback about an activity conducted by the person (Vitásková, 2013). Better feedback from the performed motor activities, including oral motor activities, is then ensured, above all, by means of visualization (or visual biofeedback). The substance of this influence is a reciprocal connection between the skills to recognize (gnosis) and the skills to carry out purposeful movements (praxis) or, at qualitative level, between perception and motor activity. Among the motor activities we can include those associated with speech production, non-verbal communication and co-verbal behavior. The non-verbal component of communication that is, for the most part, formed by facial expressions, gesticulation and prosody, is the very basis of pragmatic value of communication, i.e. for functional use of speech in every-day social contact. It forms the so-called communication competence that crucially determines understanding the contents of information conveyed by the surroundings of the speaker because it can complement, alter or even negate the formal component of the message (Vitásková & Říhová, 2013).

In addition and in relation to the education process, it is necessary to highlight that, according to Samfira, and Fărăgău-Dragos (2014), the majority of school communication is conducted by means of non-verbal communication. Therefore we assume that it is necessary to regard the possible deviations, which can be primarily caused also by the differences in oral motor activities, as significant (with secondary consequences observed e.g. in facial expressions). They can cause false understanding of the communication behavior of a pupil whose form of spoken utterance can differ significantly from his/her communication intention or intended contents of the verbal utterance (see Vitásková & Lechta, 2014). This can, however, be caused by the inability, or limited ability, to produce or adequately flexibly and functionally adapt the pragmatic components of communication, based on disordered oral motor movements.

## **2. BACKGROUND**

Oral motor skills and, consequently acquired and mastered motor skills, are the predictors of speech ontogenesis (individual development of speech) and, naturally, determine the development and quality of communication skills. Oral motor movements are enabled by the neuromuscular set up of the oral-facial system. They can be defined as motor gestures executed by one's jaw, lips and tongue. Autism spectrum disorders, within the context of oral motor movements, comprise many inhibiting factors, such as more frequent comorbidity with dyspraxia or apraxia, which represent reduced or totally absent skills to produce targeted, learned and accurate movements, which can be connected both with non-disturbed and, on the contrary, with a priori definitive gnosis (recognition) (Belmonte et al., 2013; Dewey, Cantell, Crawford, 2007; Mitchell et al., 2006; Winder, Wozniak, Parladé, & Iverson, 2013; Warreyn, & Roeyers, 2014.). Miller, Chukoskie, Zinni, Townsend, & Trauner (2014) suggest that the etiological ground of dyspraxia in ASD children relate to control and integration activities of the brain responsible for praxis executed by cerebellar and cortical mechanisms. The substance of the disturbance is also problematic imitation of movements or their performance based on exposed verbal instructions. According to Biscaldi et al. (2014) the imitation deficits are cognitively based, and the most disturbed activities in ASD are significant in timed motor performance and the quality of the movement. As autism spectrum disorders are, a priori, disorders of communication, we consider a speech and language therapist (SLT) as a key member of an interdisciplinary or transdisciplinary team interested in the diagnosis and complex intervention of persons with ASD (more, e.g. Vitásková & Říhová, 2012; 2014). The objective of this chapter is to draw attention to the possibilities of application of a special speech-therapeutic software program utilized originally for different types of diagnoses associated with communication disorders, in speech-therapeutic diagnosis determination and in the intervention of individuals with autism spectrum disorder.

## **3. OBJECTIVES, RESEARCH DESIGN AND METHODOLOGY**

The principal objective of the research investigation was to analyze the oral motor skills in selected persons with autism spectrum disorder, divided into the following two partial goals:

- To assess oral motor skills in children with ASD in the initial and final phases of the investigation by means of the software programme FONO 2, unit Warm-up, and by the created evaluation numerical scale.
- To compare the differences in the results between the initial phase of the oral motor

activities in children with ASD and the respective final conditions.

The principal, as well as the partial objectives, were shaped as three major research questions:

- What is the condition of the oral motor skills in children with ASD in the initial phase of the investigation?
- What is the condition of the oral motor skills in children with ASD in the final phase of the investigation?
- Are there differences in the oral motor skills evaluation in the initial and final phases of the investigation?

The fundamental research tool was the speech-therapeutic multimedia programme software FONO 2, which was originally designed for the diagnosis and therapy of people with disturbed communication skills. It comprises 5 basic types of exercises – sections Warm-up, Associations, Phonemic hearing, Reading and repeating dactyl signs (Čo je Fono, 2014). For the purposes of this part of the research we focused on oral motor skills in the monitored people with ASD, we selected a team called Warm-up with 37 activities. For the research activities, we selected 13 tasks and adjusted the recommended utilization of the programme. Our selection included the following isolated and sequential oral motor, or oral-facial, activities: 1. Smile but do not show your teeth. 2. Smile and show your teeth. 3. Pout your lips. 4. Bite your lower lip. 5. Bite your upper lip. 6. Open and close your mouth. 7. Move your jaw left and right. 8. Chomp. 9. Whistle. 10. Try to imitate chewing. 11. Blow into your cheeks and do puuuu... 12. Stick out your tongue between upper and lower teeth, keep it straight and stretch at the tip. 13. Touch the middle of your upper lip with your tongue. The personal motor activity of a person is accompanied and supported by the programme by presenting a visual model (a face performing the required movement appears on the screen), which provides the person with ASD visual facilitation of the movement imitation. The sample oral motor gesture is accompanied with verbal instruction (recorded human voice specifying the movement) and the final option, very important in our opinion, comprising visual feedback in the form of the performed motor activity of the person visually compared with the example demonstration (on the right part of the screen). It is also possible to record the movement for more detailed analysis. The main method applied was longitudinal extrospective monitoring conducted in the period of 4 months. The monitored areas were determined and the evaluation items, accompanied by graphical visualization produced by the applied software, were conceived. The evaluation scale was divided into three main areas shown in Table 1.

*Table 1. Evaluation scale for assessment of oral motor movements within the programme “Warm-up” for persons with ASD.*

Initiation of the activity	Assistance	Accuracy of performance of the given exercise
0 – does not initiate the activity	0 – requires full assistance in performing the activity	0 – performs the exercise completely wrong
1 – initiates the activity following our assistance	1 – requires partial assistance in performing the activity	1 – performs the exercise wrongly but after our correction, he/she is able to perform the exercise correctly, at least partially
2 – initiates the activity after verbal request	2 – does not require any assistance in performing the activity	2 – performs the exercise wrongly but after our correction, he/she is able to perform the exercise completely and correctly
3 – initiates the activity himself/herself		3 – performs the exercise completely and correctly



In the successive steps, we conducted evaluation of the initial and final phases of the SLT, using the above-mentioned software in three persons with ASD at infant or adolescent age. The SLT had to be, in order to maintain the principles of beneficence (see Vitásková, 2013), interlinked also with further complex development of the persons with ASD.

#### 4. RESULTS

For the purpose of this chapter, we present an example of the changing oral motor conditions in a girl M. and a boy P. Within the time span of 4 months, 11 speech therapies were conducted applying the above-stated unit “Warm-up” of the FONO 2 program. Other areas of focus of the SLT included gross and fine motor skills, comprehension, active and passive vocabulary and the practice of social situations comprising non-verbal communication. The visualization of the oral motor movements were accompanied by an analysis and ended with comparing the monitored areas within the given time span. We observed whether there are, in the monitored activities and within the given time span, positive or negative changes or stagnation. We also focused on tasks that showed significant positive changes as well as on tasks that were more demanding and challenging.

The comparison of M. is described in Table 2. At the time of investigation, M. was 6 years old, diagnosed with atypical autism with mild intellectual disability (according to ICD 10., WHO).

*Table 2. Evaluated areas of the monitored activities and corresponding numeric scales with results in girl M.*

	Activity	Initiation	Assistance	Accuracy		Activity	Assistance	Accuracy	Initiation
	Initial evaluation	1	2	1		2	Final evaluation	1	2
2		2	1	2	2	2		2	3
3		1	1	1	3	2		1	2
4		2	1	2	4	2		2	2
5		2	1	2	5	3		2	3
6		2	2	1	6	3		1	2
7		0	0	1	7	1		0	2
8		3	2	2	8	3		2	2
9		0	0	0	9	1		1	1
10		2	2	2	10	3		2	2
11		0	0	1	11	1		0	1
12		0	0	0	12	0		0	0
13		0	0	0	13	1		1	1
Stagnation						N= 16 (41.03 %) [I=4, D=6, S=6]			
Positive change					Σ	N= 21 (53.85 %) [I=8, D=6, S=7]			
Negative change						N= 2 (5.13 %) [I=1, D=1, S=0]			

From the results presented in Table 2, it follows that positive changes occurred in 21 monitored activities within 13 given tasks. The working majority of tasks (53.58 %) showed a positive change in the field of initialization (N=8), assistance (N=6) as well as accuracy of the performed motor task (N=7). In all instances, this was a shift upwards by one evaluating scale – e.g. in activities No. 3 “Pout your lips”, activity No. 5 “Bite your upper lip” and activity No. 10 “Try to imitate chewing”. Further, also in the field of assistance with the given activity in activity No. 1 “Smile but do not show your teeth”, activity No. 4 “Bite your lower lip” and activity No. 9 “Whistle”. Positive changes were

also apparent in the accuracy of performing individual activities, e.g. task No. 2 “Smile and show your teeth”, No. 6 “Open and close your mouth” and task No. 13 “Touch the middle of your upper lip with your tongue”. Less frequent in the evaluation result, implying stagnation of the skills, with 41.03 % (N=16) included activities such as initiating activities No. 2, 4 and 12, assistance in activities No. 3, 7 and 8, and performance accuracy in activities No. 1, 8 and 10; we did not record in the final evaluation any positive changes when compared with the initiation phase of the evaluation. Negative changes acquired the lowest percentage 5.13 % (N=2) in terms of quality of evaluated activities, which was recorded in two instances - activity No. 1 “Smile but do not show your teeth” in its initialization and activity No. 6 “Open and close your mouth” in its assistance (2→1).

The second person who underwent the analysis of oral motor skills is a boy P. At the time of the research examination, he was 6 years old and diagnosed with atypical autism with attention disorder and hyperactivity (according to ICF 10., WHO). As is obvious from Table 3, all evaluating scale values are present for P. – value No. 0 up to value No. 3. The lowest evaluating category (value 0), which represents severe difficulties in initialization and execution of a given activity and which, at the same time, requires a higher rate of support, occurs 12 times. In combination with other evaluating values (prevalingly with value 1), value 0 is present, e.g., in activity No. 1 “Smile but do not show your teeth”, activity No. 3 “Pout your lips”, activity No. 4 “Bite your lower lip”, as well as in activity No. 7 “Move your jaw left and right”, activity No. 9 “Whistle”, activity No. 11 “Blow your cheeks and blow out with “phuuuu” and activity No. 12 “Stick out your tongue between the lower and upper teeth, hold it straight and stretch the tip of the tongue“. Value No. 0 is detected both in the category of initialization, and support and accuracy of execution of the given activity. The highest frequency is with value No. 1, which also represents problems in initialization (initialization only after our support), partial facilitation with execution of the activity and the ability of partial execution which is, however, preceded by significant correction. This evaluating value occurs fifteen times, most often (twice) in activity No. 2 “Smile and show your teeth”, activity No. 5 “Bite your upper lip” activity No. 7 “Move your jaw left and right” and activity No. 13 “Touch the middle of the upper lip with your tongue”.

Table 3. Comparison of the observed oral motor activities in person P.

	Initial evaluation					Final evaluation			
	Activity	Initiation	Support	Accuracy		Activity	Initiation	Support	Accuracy
	1	0	0	2		1	1	1	2
	2	1	1	2		2	1	2	3
	3	0	1	2		3	0	1	3
	4	0	0	1		4	1	2	1
	5	1	2	1		5	1	2	2
	6	3	2	1		6	2	2	3
	7	1	0	1		7	1	1	2
	8	3	2	3		8	3	1	2
	9	1	0	0		9	2	1	2
	10	2	1	2		10	2	2	3
	11	0	0	1		11	1	0	1
	12	0	0	1		12	0	0	1
	13	1	1	2		13	0	1	2
	Stagnation					N= 18 (46.15 %) [I=7, D=6, S=5]			
	Positive outcome				Σ	N= 17 (43.59 %) [I=4, D=6, S=7]			
	Negative outcome					N= 4 (10.26 %) [I=2, D=1, S=1]			

The representation is 17 areas (43.59 %) in the stage of initialization (N=4), support (N=6) as well as accuracy of the execution of the given activity (N=7). Positive changes refer, in three instances, to increase by two evaluating scales; in other instances by one evaluating scale. Significant changes, as stated right now, are practically touching the activities No. 4 “Bite your lower lip” (support 0→2), activity No. 6 “Open and close your mouth” (accuracy 1→3) and activity No. 9 “Whistle” (accuracy 0→2). We can, therefore, state that we have recorded the most positive changes in these activities during the speech-therapeutic intervention.

As it is evident from Table 3, even the category of negative balance is not missing in P. – i.e. regression in the final evaluation compared with the initial evaluation. Such results were recorded in 10.26 % (N=4) and present in all three monitored areas – initialization (N=2), support (N=1) and accuracy in the execution (N=1). This relates to activity No. 6 “Open and close your mouth” (initialization 3→2), activity No. 13 “Touch the middle of the upper lip with your tongue” (initialization 1→0), activity No. 8 “Click one’s tongues” (support 2→1) and also activity No. 8 “Click one’s tongue” (accuracy 3→2). It is then obvious that activity No. 8 showed negative decrease in two partial activities.

## 5. FUTURE RESEARCH DIRECTIONS

The research investigation is, naturally, also limited and influenced by factors determining the course of the investigation. These are, above all, momentary physical and mental conditions of the child, and the impact of external environment (such as noise, heat or, on the contrary, cold). With respect to the importance placed on the diagnosis and significant deficiencies not only in communication skills, the 4-month duration of the research investigation cannot be considered as sufficient for obtaining key results and, above all, to speak about the authenticity of the positive results. Despite the mentioned circumstances and limitations, we attempted to create suitable conditions for materializing the given investigation.

Further monitoring shall be oriented on the application of the acquired findings on oro-facial sensitivity on the one hand and in the diagnosis of pragmatic aspects in communication in relation to facial expressions on the other. We believe that one of the neglected areas that should be involved in the diagnosis of pragmatic communication skills of persons with ASD is the area of oral motor skill. The influence of oral motor skills in children with ASD on the quality of their production and perception of pragmatic representatives of communication should be examined from a specific SLT point of view, which is able to synthesize both contextual as well as the formal aspects of speech (compare Vitásková & Říhová, 2012). The resulting findings will serve SLT diagnosis and intervention in persons with ASD more effectively and also may increase the quality of the education process that is, for the most part, conducted, evaluated and controlled by means of communication processes.

## 6. CONCLUSION AND DISCUSSION

From the comparative results above it can be inferred that the conducted intervention targeted at the development of oral motor activities resulted in positive outcomes, which is especially reflected in the prevalence of positive results (53.85 %) over the negative (5.13 %) in M. This finding is in relative compliance with the Biscaldi et al. (2014) results confirming improvement of some of the motor, including facial (oral) motor, performance in ASD.

The presented results must be perceived as very encouraging, especially concerning activities involving sequence of movements. This is plausible especially in terms of the activities “Smile but do not show your teeth” and “Touch the middle of your upper lip with your tongue”. The execution of such activities, in their entirety, is rather difficult and in persons with ASD this aspect should even be more pronounced as they have difficulties with serializing and sequencing. The value representing stagnation of the child’s skills (41.03 %) also showed significant frequency, which indicates that the results are not fully positive in such a relatively short span.

In the second comparison, in case of P, we can state that a dominant position in the evaluation was occupied by stagnation of the evaluated categories. On the other hand, this category is quantitatively close to the second category representing positive balance. The difference is only 2.56 %, which can be perceived as almost irrelevant. We also recorded negative balance, which is represented by 10.26 % and this also cannot be taken as insignificant. It is, however, necessary to take into account the possible factors (immediate physical or mental conditions of the child, the environment, etc.) affecting the entire examination that can, to a certain extent, influence the evaluation.

In conclusion, we can state that according to the oral motor skills analysis carried out on a person with ASD by means of the speech-therapeutic software program FONO 2, its partial section Warm-up and our own evaluating scale, it is obvious to state the possibility of, through systematic SLT intervention focused on the development of mobility in the oral facial area, achieving positive results. It is, logically, not possible to generalize these results. That is why it would be suitable to carry out further, more detailed and longitudinal investigation in this field.

The results constitute partial results of the specific research *Research in the Sphere of Communication Specifics in Selected Groups of Individuals with Communication Ability and Deficiencies or Disorders* (IGA\_PdF\_2014016), *Pragmatic language level in individuals with autism spectrum disorders*, supported by the Czech Science Fund of the Czech Republic (GA14-31457S), and *Research on selected communication disorders and deviations focusing on the specifics of speech therapy and hearing impairment assessment and intervention* (IGA\_PdF\_2015\_024).

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## Chapter #14

### TIME AND INNOVATION AT SCHOOL

#### The efficacy of Space Learning method in classroom

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#### ABSTRACT

The concept of *teaching competence* challenges today pedagogical research in the effort of finding new ways to organize the curriculum and to design learning activities in classrooms. EDOC@WORK3.0 project deals with the need to rethink the dimensions that characterize an educational practice, with specific regard to the dimension of “time”, so as to adapt it in order to favor a differentiation in disciplinary teaching. This project supported teachers in acquiring competencies in new methodologies related to *time scheduling* and accompanied them in its design and application in their classroom. In this chapter we will present the didactic methodology known as *Spaced Learning*, inside the theoretical framework of adaptive teaching and allocated time. We will describe the results of the experimentation conducted by the teachers who attended the PON EDOC@WORK3.0 project and the training experience made in such an innovative educational method.

*Keywords:* teaching competence, spaced learning, allocated time, time scheduling, adaptive instruction, teaching practice, innovation, school, neuroscience.

#### 1. INTRODUCTION

The concept of competence teaching challenges today pedagogical research in the effort of finding new ways to organize school curriculum and to design learning activities in classrooms. The idea of an innovative didactic rethinking the time dimension that characterize an educational practice and to adapt the *learning time* and *allocated time*<sup>1</sup> (Glaser,1977; Anderson, 1980) in order to favor a differentiation in disciplinary teaching, is gaining field (Boccanfuso, Walker, Princiotta, Knewstubb, & Moore, 2012; Farbman, 2012; Ylimaki & Brunderman, 2014).

In the framework of EDOC@WORK3.0<sup>2</sup> Project (Research & Competitiveness National Operative Programme 2007-2013: Smart Cities and Communities and Social Innovation) INDIRE - the Italian National Institute for Educational Research and Innovation<sup>3</sup> - is committed to accelerate the conditions enabling didactic innovation in Apulia region. Through the monitoring and observation of the experimentation of education projects in the recent years, the institute got in touch with a number of didactic innovation examples thus detecting those that could foster a meaningful change in the school didactic and organizational praxis towards a systemic innovation horizon.

The Italian national movement of *Avanguardie Educative*<sup>4</sup> (literally, educational vanguards) allowed to set up a map of the most mature methodologies that already provided

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<sup>1</sup>Allocated time is time during which students have an opportunity to learn some subject matter.

<sup>2</sup>Official home: <http://www.edocwork.it/>

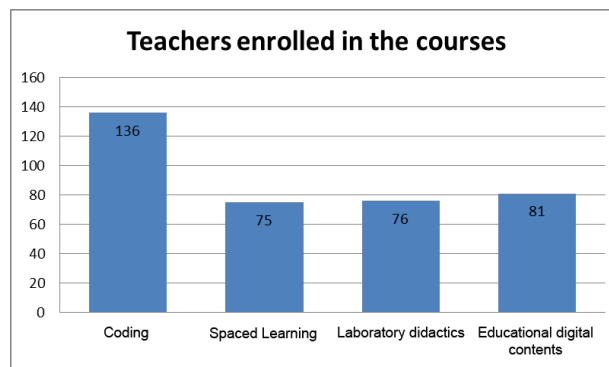
<sup>3</sup>INDIRE is a public research institute whose main mission is to sustain the evolution of the Italian educational system through technology-enhanced teachers training, system actions for improvement and innovation: <http://www.indire.it/>

<sup>4</sup><http://avanguardieeducative.indire.it/>

evidences as for the positive trends in increasing learning outcomes and reducing early school leaving in Italian schools. As a consequence the institute set up a specific training action on four didactic methods and set up their experimentation so as to investigate the condition under which innovation and effectiveness occur and can be widespread in the whole region of Apulia. The envisaged teachers training path was delivered in a blended mode (40 hours among hands on labs and online autonomous learning, peer discussion and project work production). 21 educational classes have been activated on the themes of *Coding*, *Spaced Learning*, *Laboratory didactics* and *Educational digital contents*.

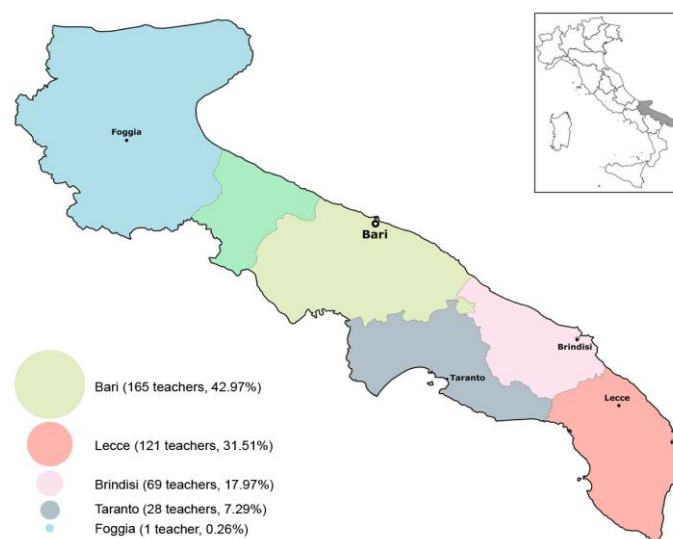
As shown in figure 1, the teachers enrolled in the course were about 400 split in four groups according to the innovative methodology they chose: 136 in Coding, 75 in Spaced Learning, 76 in Laboratory didactics, and 81 in Educational digital contents.

Figure 1. Teachers enrolled in the 4 courses offered by Docenti InFormAzione.



These teachers have been distributed according to the Apulia provinces as illustrated in Figure 2: 42.97% coming from the province of Bari (156 teachers), 31.51% from Lecce (121 teachers), 17.97% from Brindisi (69 teachers), 7.29% from Taranto (28 teachers), and 0.26% from Foggia (1 teacher).

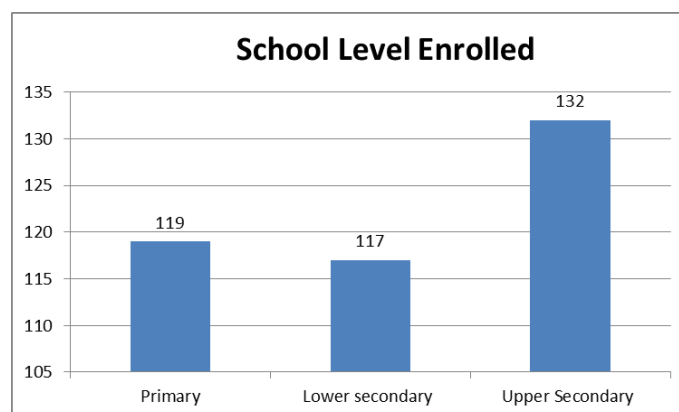
Figure 2. Number of teachers enrolled in the training classes by geographical area.





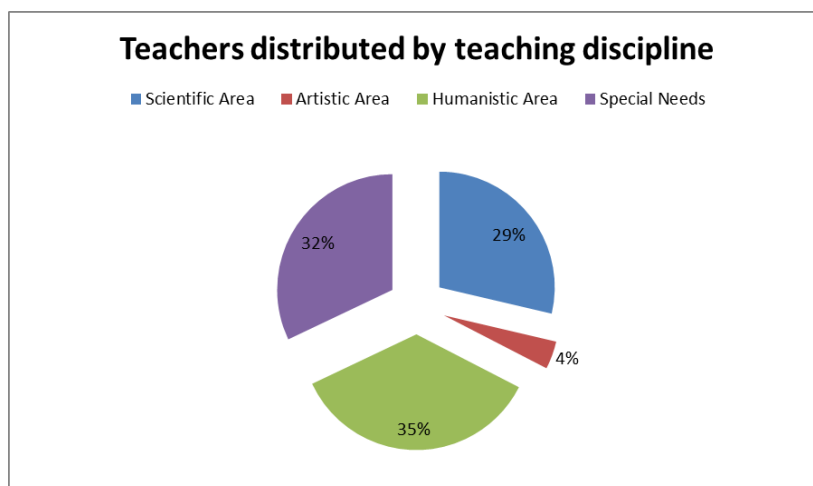
As shown in Figure 3, 119 teachers work in primary schools, 117 in lower secondary schools, and 132 in upper secondary schools.

Figure 3. Teachers enrolled in *Docenti InFormazione* according to school level: primary, lower secondary, upper secondary.



The training path conducted on the four methods thus involved 368 teachers from Apulia experimenting innovation in their respective teaching field: 35% humanities, 29% scientific, 4% arts, whereas a significant number of teachers (32%) were Special Need teachers. The implemented courses have been designed to be strongly focused on practice so as to sustain teachers in the development of professional skills also using technologies. The courses also aimed to stimulate teacher reflection on how to consolidate the new methodologies in their classroom improving their practice every day.

Figure 4. Teachers distributed by teaching discipline.



Being specifically focused on the dimension of “time”, Spaced Learning proved to be a suitable methodology to increase students’ involvement, attention and long-term memorization. *Pedagogical patterns* that refer to *time-based innovative models* and practices to be experimented in the context of teaching are therefore identified and formalized. In this chapter we first present the didactic model and the research in support of the didactic impact and then the results in terms of learning outcomes of a sample group of students coming from the experimentation classes in Apulia.

## 2. BACKGROUND

Time is a critical dimension of the curriculum and of learning (Duncheon & Tierney, 2013). The construct of time influences student learning inside and outside school and consequently pervades the educational discourse. In a recent report (Baker, Fabrega, Galindo, & Mishook, 2004) the authors examine the influence of time on learning outcomes worldwide. What they consider fundamental is not the linear relationship between time spent on lessons and learning outcomes, but rather the need to understand how time dimension – from an adaptive point of view and in the direction of personalizing the educational offer – can drive a review of curriculum, educational schedule and teachers’ action.

Time dimension is one of the elements that can trigger the process of schools’ adaptability among learners and guarantee opportunities for their individual success and development (Millot & Lane, 2002). The distinguishing feature is precisely based on teacher’s ability to meet the specific individuality of each student. This ability is commonly referred to as *teaching adaptively* (Corno, 2008). We therefore need “to capture the adaptive strategies” to foster the manipulation of all elements able to drive practices of “adaptive teaching”. As a concept, adaptive education can be actually defined as the use of alternative formal-or-non-formal educational strategies in the framework of a curriculum, that are able to meet students’ needs (Mangione, 2013) The ability of adapting didactic conditions and situations is a required condition to build an effective learning environment, as stated also by Wang (1992) who suggests that “creating effective, practical school learning environments that are responsive to the diverse needs of students has been a continuing challenge in school reform efforts” (p. 1).

The connections between learning and time management are one of the most studied topics in psychology of education (Fredrick & Walberg, 1980). Several researches adopted the concept of time as the fundamental dimension to the learning process, linking particular time allocations with achievement variations (Duncheon & Tierney, 2013) and demonstrating a strong and positive influence of time on learning and *effective teaching* (Wang, 1984). According to Walberg, Niemiec, & Frederick (1994), “along with effective teaching productive time engenders learning”. These authors also suggest that “time should be a central concept in curriculum theory and practice” (p. 86).

The theme of “time optimization” compared to interruptions that can be functional or not to long-term memory, as well as “time customization” for carrying out complex tasks and for the study of particular disciplines, have been the subjects of numerous studies and investigations (Duncheon & Tierney, 2013).

Particularly, Leonard's works on "instructional time" (Leonard, 1999), the one by Lasley on "time on task" (Lasley & Walker, 1986), and the one that start to questioning about the influence of individual dimension on the relationship between *time spent on learning* (TSL) and *time needed for learning* (TNL) and on the impact of this relationship on students' achievement<sup>5</sup> (Gettinger, 1984), have fostered a theory of time as a predictive factor of "educational productivity". These studies are the basis of modern theories that revalue time as an element for learning activities in the classroom.

Reflections on the efficient utilization of time in education and on time scheduling in the curriculum (Patall, Cooper, & Allen, 2010; Brucato & Gainey, 2014) on one side, and the attention to micro-management of time in experiences in order to support memorization (Kelley & Watson, 2013) or on learning interruptions through the "erosion teaching time" (Leonard, 2009) on the other, bring us to ask about new educational models planned and managed on the base of a different utilization of time and space in teaching and learning activities.

In the context of the project EDOC@Work3.0, *Spaced Learning* method has been selected among many subjects for a widespread training in Apulia region. A blended approach has been employed to make teachers understand the method and its application in the classroom, albeit in a limited and experimental form.

We will point out how this process, ranging from training to experimentation, is the basis for identifying the conditions that allow us to bring innovation in the classroom and contribute to its management and customization with respect to the context.

### 3. SPACED LEARNING: THE METHOD

Spaced Learning is a particular approach, investigated in neuroscience (Fields, 2005), *characterized by a specific definition of the lesson timing*, (Fields, 2005), aimed at fostering the memory encoding by using its typical time pattern. *How can the genes of a single neuron know how to reinforce a synaptic path?*" Fields discovered that the creation process of long-term memory had "time" as key factor: the repletion of three stimulation, spaced by 10 minutes without stimulation, triggers a reaction that reinforces the permanent synaptic path (Barratt & Kelley, 2008). Brain cells are illuminated and linked depending on how they are stimulated: 10-minutes interval between stimulations leads to the long-term memory building (Kramár et al., 2012). As Kandel et al. (2014) and others have pointed out, human memory involves different mechanisms that encode, consolidate, reactivate and update explicit memory. Spaced Learning is an encoding technique for students.

Spaced Learning envisages structured repetition of contents separated by small intervals; this method supports storing learned information into the long-term memory (Cain & Willey, 1939). Kelley (2008), experimenting the method throughout one entire year during physics and biology teaching, demonstrated an increased effectiveness of this method as it regards the speed of learning, with respect to traditional teaching techniques.

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<sup>5</sup>TNL refers to the number of learning trials, or exposures to a passage, needed to obtain 100% accuracy on a criterion test covering the passage content; TSL refers to the number of self-determined trials spent on an alternate task form.

A Spaced Learning lesson consists of three “inputs” of short duration (15-20 minutes), concerning the subject of the learning process and spaced by 10-minutes breaks. During the breaks students attain at simple activities, such as dribbling a basketball or playing with modeling clay, that should be unrelated to the content of the lesson. This aims to minimize the danger of disrupting the pathways being formed to record the information in the two inputs that are followed by breaks.

*The first input* given by the teachers provides the information that the students are required to learn during the lesson. Here it is important to provide the essential information with the technical language characterizing the topic. The duration of the input is not predetermined: 10-15 in order to keep students’ attention. In this session the neuronal path start to create memory. This first moment is followed by a 10 minutes interval that must have nothing to do with the lesson’s content. During this and the successive interruption it is important to avoid stimulating memories paths that are being formed so that they can find their consolidation in the rest<sup>6</sup>. Henceforth the activity must have nothing to do with what students are learning so as to increase the possibility that the neural path “rest “and form stronger connections.

Kelley envisages activities of equilibrium, movement, coordination to be developed in collaboration. Since student’s school identity is strongly influenced by the cultural implicit shared by the related cultural context, we found that Italian students succeed in relaxing during individual activities and not in the group activities. Indeed in the latter case students tend to continue talking about the topics presented during the lecture during the input moments thus invalidating the method since they do not allow to the neural path to strengthen through resting. Asking to students what they want to do the day before the lecture can allow teachers to better organize the relax moments.

*During the second input* the teacher revisits the content of the first session recalling the key topics and changing the way to present its content (for instance using different examples and changing the interactivity modes). The same neural paths will thus be stimulated, strengthening their importance to the brain. Different key examples could be used or some key information could purposely be neglected to observe what students remember from the first input. It is important to specifically remove the information that students are required to know, since their attention should focus on this information only when they are required to recall it.

In the second interval the same principles of the first one are applied, providing a relax time of about 10 minutes. In this interval the activity can be a variation of the former one; again, the importance is that it is not related to the lesson’s content.

*During the third input* the teacher stays on the first session’s content, and proposes student-centred activities: students are required to demonstrate what they acquired about the content shared during the first input, applying their knowledge to exercises or problems. In this phase the teacher will monitor the students just to verify their actual comprehension of the content. The choice of the test used to check students’ learning is up to the teachers. Given the limited time at our disposal in the experimentation phase, we decided to

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<sup>6</sup>The lead neuroscientist recommended the two 10-minutes spaces were distractor activities, ideally physical activities to minimize possible interference in the synaptic tagging and capture processes putatively occurring (Fields, 2005).

administer a multiple choice questionnaire allowing partially-automated result processing. The use of student-centered authentic tests would have provided a more complete assessment method in case of a greater availability of time, since the student has to face situations/problems showing what he/she learned, minimizing the risk of mere content memorization.

As for the Spaced Learning technique, currently few research results are known. In recent scientific works (see Carpenter, Cepeda, Rohrer, Kang, & Pashler, 2012), students adopting only Spaced Learning produced remarkable results (see Kelley & Whatson, 2013). Three types of structured tests have been conducted for the study of this method in biology in UK: 1) a study with students aged 13-15 randomly divided into an experimental and a control group; 2) a study with students aged 14-15 homogeneously divided into groups by ability, randomly assigned to a control and an experimental group; 3) a study with students aged 14-15 to whom teachers administered Physics lessons with “traditional” rehearsal and final test and Biology lessons with spaced learning rehearsal and final test (Kelley & Whatson, 2013).

Nationally standardized results of the high-stakes test for all groups in the study were analyzed by the CEM Center, comparing individuals’ predicted and achieved scores through linear regressions, and these data were used as the basis of results analysis. Both in case 1) and 2) one hour of instruction through Spaced Learning had an impact significantly greater than many hours of teaching. Experimental groups’ scores were based on 60 minutes of instruction, and control groups’ scores on teaching over four months with 23 hours of direct instruction. In case 3) the regression analysis of experimental group’s scores in Physics and Biology organized by ability level produced a similar significance value.

Results show that long-term memory related to a whole school year can be rapidly reconstructed through Spaced Learning and that students seem to easily get used to the method. Even if there are substantial proofs that a number of communication systems in humans and in other species operate quickly, with exchanges occurring in milliseconds, this cannot explain the impact of Spaced Learning on the high speed of learning proven by test results. Evidences suggests that Spaced Learning is more efficient than traditional teaching. These results have evident parallels in Neuroscience, that show rapid memory storage in humans and indicate that time manipulation is a key variable for learning. Kelley’s study is limited to Biology and Physics, and it does not directly explore the use of Spaced Learning in different subject matters and with students aged other than 13-15. The results of this study should be explored in different contexts with subjects of different age and other tests should be used to assess the learning outcomes.

Indeed, the use of authentic tasks and the TIC integration can ease the design and development of learning situation and they could function as an “antidote” to reduce this method to a mere memorization technique.

The model requires a micro-design effort that can be a detractor to its implementation. However, this limit is partly overcome by the awareness that teachers manifested, about the capacity that the method has to act on students’ curiosity, motivation, interest, concentration and memorization (Xue et al., 2011; Carpenter et al., 2012). To present, remembering and understanding information are respectively the keywords associated to the three inputs of Spaced Learning patterns.

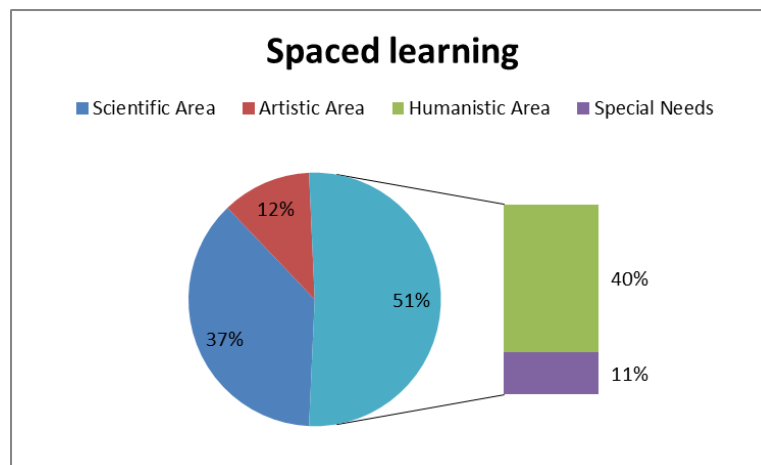
The teachers who are currently attending the training project are using this methodology to accelerate the mastering of advanced topics with their best students, or rapidly create long term memory for students who are inattentive. This methodology can be combined with other less common forms of learning, based on the investigation and retention of concepts (such as *Enquiry-based Learning* or *Flipped Learning*) (Deignan, 2009; Lewis & Kelly, 2014).

#### 4. “DOCENTINFORMAZIONE”: THE EXPERIENCE

The teachers’ training activity on Spaced Learning method was one of the training initiatives offered to primary, lower and upper secondary school teachers within the wider program “Docenti InFormAzione” (lit. *TeachersInTraining*) in Apulia region.

Overall 26 classes of Math and Science teachers, 8 classes of Art teachers, 28 classes of Humanities teachers followed the Spaced Learning course; 8 experimentation have been conducted for Special Educational Needs (SEN) teachers, confirming the value of this method in inclusion and personalization (see Figure 6).

Figure 5. Disciplines involved in Spaced Learning experience.



The educational mode is based on laboratory didactics, centered on learning by doing and aimed to support the modeling process and practices useful to experiment such a method with the students in the classroom.

The course was conducted by an expert teacher, selected from a school leading the *Avanguardie Educative* movement, capable to adapt the methodology to the didactic contexts described by the teachers attending the course allowing wide margins of flexibility in the implementation of the solutions in class.

The training experience aimed at increasing teachers’ competencies in the Spaced Learning method implementation in a context of collaborative reflection and reciprocal enrichment. During the first face-to-face meeting, the expert teacher described the added value of Spaced Learning and illustrated a “pedagogical template”, namely an organizational pattern to guide the design of a Spaced Learning lesson plan in primary and

secondary school. Then teachers were grouped by discipline and school level, and they negotiated the topic on which to create the class (see Figure 6). Cooperative learning dynamics have been supported by the expert teacher since this phase. In the second meeting, a first input of the Spaced Learning was provided. During the first 15 minutes the expert teacher introduced simplified guidelines and provided key points. Each teacher, within his/her group, was assigned the task to realize a multimedia presentation highlighting the main content of the topic to be dealt through the definition of keywords, relying on the possibility to use an interactive whiteboard or projector in the classroom.

*Figure 6. Captures of teacher training activities.*



During the third meeting the teachers, individually but within their scaffolding group<sup>7</sup>, were required to realize a second input for the Spaced Learning. The review of the topics of the first session was carried out through interactive contents and ideas, in a group activity setting. The expert indicated a series of multimedia tools (such as Educanon, Teachem or Knowmia, specific environments which let him build and share interactive video lessons), guiding the learners-teachers in the development of skills allowing a dialogued lecture.

During the fourth meeting, the expert showed how to build a virtual classroom. This is a fundamental activity, since documents, products and interactive-test sharing in the cloud is a specific need of the collaborative activity among teachers aimed at designing tools to assess students' learning.

The training experience raised interest and enthusiasm from involved teachers, who experienced it as an opportunity to renew their didactics. The novel aspect is a flexible model that allows each student to lead his/her learning process, to become more autonomous and responsible, as well as interested in studying.

Teachers have been engaged in social discussions and collaborative reflections on the link to *Flipped Classroom* and *Block scheduling* method which, together with the *Spaced Learning*, feed the galleries of the ideas of the cultural movement *Avanguardia Educative* originated by INDIRE to promote school's change through a new time conceptualization.

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<sup>7</sup>We define as "scaffolding group" a set of teachers who teach the same subject in the same school level and help each other in bringing this innovation to their classes.

## 5. EFFICACY OF THE METHODOLOGY: OBSERVATIONS IN CLASSROOM AND EVALUATION OF LEARNING RESULTS

In order to analyze the modality of introduction of innovative practices in the context of traditional didactic situations, the research group privileged the adoption of an empirical interpretative research approach defined in the methodological literature (Semeraro, 2014).

This research type is grounded on the constructivist ontological approach: the theoretical framework in this case does not advance by hypothesis; instead explorative aims are pursued.

The same phenomenon is studied in specific cases (selected by spontaneous acceptance and not by selection of the best situations or projects) from multiple independent perspectives, using multiple approaches and techniques in a sort of *triangulation* (Cook & Reichardt, 1979) among class observations, interviews, reflections on learning objectives.

### 5.1. The observation of Spaced Learning in Apulia classroom

A specific “observation grid” has been designed for recording the class activity and the related logbook.

As for the type of student participation, there are interesting elements that show how time management and technology integrated in the instructional design favored a student active and collaborative role. In particular, it is clear from the interviews the surprise effect resulting from the introduction of pauses deliberately devoid of references to the topic under study. With regard to the question related to time management, a student says: *“I was very impressed when the teacher gave us the 10-minute break, when she said ‘Do whatever you want’ and especially struck me when she said ‘Do something that is not connected to the lessons’. The breaks have certainly undermined the traditional classroom teaching, favoring students concentration.”* In this regard, a second student said: *“At the beginning the teacher explained for about half an hour and then we were left free for few minutes and then during the lesson she asked us some questions on the subject. The novelty was the break. We liked this novelty. I had the impression of being more concentrated”*. What changed is not the amount of hours devoted to curricular matters, but the way to review the unit of time specified in a form suitable to support long-term memory development, without the cognitive load that the timing of traditional lectures generates. To this end, another student said: *“The distribution of time between the activities carried out by the teacher and those that we carry out remains the same, maybe we learn more because lesson breaks allow us not to get tired towards the end [...] With this new method the mind is even more refreshed... ”*.

The lesson break encouraged the construction of moments of exchange and dialogue – *“In the pauses the communication exchanges between us students increased”* – although a difference in the articulation of space in the classroom setting was not registered: *“No, there was no change. We’re always in that position in the classroom, we have traditional desks.”*

During the first break, the boys of the class, organized in a circle, each with his own tablet or iPad, engaged in recreational activities based on video games. Girls spent time listening music via mobile devices, watching video clips on YouTube or reading e-books. None of the students exchanged information about the content of the lesson in progress (figure. 7).



Figure 7. Break in the Spaced Learning.



During the assessment students, with the permission of the teacher, used search engines to disambiguate some functional concepts to carry out the test. Themes have been the subject of sharing across the classroom using the interactive whiteboard. Finally, students used online repository environments or specific applications (e.g., Dropbox) to share the final exam file with the teacher. Time management also influenced the way and the effectiveness of the assessment, as highlighted by the students themselves: *“The new articulation of time changed the way we face the test because we checked if we had understood the lesson, while usually the teacher explained first and questioned us after [...] I experienced this change as a pleasant thing, because we had time to relax after the explanation and also to reflect on what we had done [...] better understanding concepts.”*

The teaching practice thus influenced and supported the effectiveness of the method. Mobility granted by supplied device enabled a better supervision of the class action and a responsive scaffolding to specific requests of students, including in-depth clarification towards less performing and introverted students. The teacher showed a particular ability in the management of the technological equipment, articulating her action between a general and a more dedicated and customized level. She used the peer learning method through dialogue and discussion, thus keeping the levels of motivation and sharing high.

Technology has been fully integrated in the design and teaching practice and in the lesson timing. The ability to use mobile devices and the whiteboard encouraged participation and accelerated learning to the extent that students were able to associate teacher’s explanation to concrete images, videos and content from the web and also dedicate more time to the exercises. In this regard, a student says: *“A very important thing was the use of the iPad as a tool of self-regulation by which it was possible to manage the exercising timing of each student with the general timing of the whole class”*.

The dialogued lesson modes were often interspersed by critical questions posed by the teacher that appeared superimposed on the students’ tablets, to encourage participation and peer support.

In this model the different articulation of time seems to have really disrupted the lectures and facilitated the concentration of the students as well as the moments of exchange and dialogue. On the other hand, a real integration of technologies in designing the lesson enabled the activation of collaborative knowledge building modes.

It is to be noted, however, that sometimes, even in the presence of a small and limited change of school time, the actors refer of a perceived benefit at a level of understanding and participation which does not have a real and symmetrical repercussion on the learning processes. Moreover, if the benefit is episodic, because it is linked to a “temporary experiment” that does not have a continuity in time and does not bind to a real implementation process of innovation, it is inevitable not to find benefits that invest the more purely cognitive processes involved in learning.

## 5.2. The learning results

The elements observed in Apulia classroom allow us to position ourselves critically with respect to what emerged from the data collected in the sample of 8 classes in which learning assessment tests were administered.

*Do students involved in innovative educational models based on the new articulation of time envisaged in Spaced learning reach higher learning outcomes than those experimenting traditional teaching models?*

The methodology envisaged that the assessment tests were designed by the teachers at their discretion so as to appraise the fallout of the educational models on four cognitive aspects of learning, declined in indicators freely adapted from Bloom's cognitive taxonomy<sup>8</sup> and Dublin descriptors.<sup>9</sup>

The choice of assessing knowledge/skills instead of competencies was dictated by the very short duration of the experimentation that could not allow the development of skills in relation to the innovative models applied.

Each teacher was required to assess his/her students tests, giving each student a score between 1 and 10 for each of the indicators. The analysis of student achievement is quantified on the basis of the following six groups of profit:

- Level 1: 1 to 3 (completely insufficient)
- Level 2: 4 (insufficient)
- Level 3: 5 (mediocre)
- Level 4: 6 (sufficient)
- Level 5: 7 to 8 (satisfactory)
- Level 6: 9 to 10 (excellent)

Once the student results were collected, based on assessment tests made ad hoc by the teachers themselves, we grouped the scores on scales of performance. The objective was to assess the repercussion that innovation brought in the classroom, resulting from the testing of innovative educational model, on the processes of learning declined in knowledge, understanding, contextualization and evaluation.

Table 1 shows the assessment results for each indicator registered by 8 experimental classes.

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<sup>8</sup>Bloom's taxonomy is one of the ways to formalize the phases of acquisition and familiarization with sets of information or theories. It is a distinct taxonomy of educational objectives distinguished by *cognitive* (from which our *indicators*), *affective* and *psychomotor areas*.

<sup>9</sup>The “Dublin descriptors” are built on the following elements: knowledge and understanding (knowledge and understanding), application of knowledge and understanding (applying knowledge and understanding), ability to draw conclusions (making judgments), communication skills (communication skills), Learning skills (learning skills).

Table 1. Assessment results for all indicators.

School	Knowing facts and phenomena					Understanding processes and concepts					Using learned knowledge and procedures					Expressing a judgment on the basis of a criterion or standard				
	1-5	6	7-8	9-10	Total	1-5	6	7-8	9-10	Total	1-5	6	7-8	9-10	Total	1-5	6	7-8	9-10	Total
1	14	3	11	3	31	4	12	12	3	31	14	3	11	3	31	8	9	14	0	31
2	0	1	21	7	29	0	0	22	7	29	0	0	4	25	29	0	2	2	25	29
3	0	4	9	2	15	0	0	15	0	15	0	0	3	12	15	0	3	12	0	15
4	12	3	10	3	28	4	11	11	3	29	12	3	10	3	28	6	9	13	0	28
5	0	9	14	1	24	0	9	14	1	24	0	9	14	1	24	0	10	13	0	23
6	11	9	8	0	28	11	9	8	0	28	15	9	4	0	28	28	0	0	0	28
7	12	9	7	0	28	12	8	8	0	28	14	9	5	0	28	26	0	0	0	26
8	11	9	8	0	28	11	9	8	0	28	15	9	4	0	28	28	0	0	0	28
Total	60	47	88	16	211	42	58	98	14	212	70	42	55	44	211	96	33	54	25	208
Total (%)	28,4%	22,3%	41,7%	7,6%	100%	19,8%	27,4%	46,2%	6,6%	100%	33,2%	19,9%	26,1%	20,9%	100%	46,2%	15,9%	26,0%	12,0%	100%

As shown in Figure 8, concerning the area *Knowing facts and phenomena* 22.3% of alumni scored 6, whereas 41.7% got a score between 7 and 8; 7.6% had an optimal result, since they got a score between 9 and 10; the remaining 28.4% did not reach sufficiency.

Figure 8. Results for the indicator *Knowing facts and phenomena*.

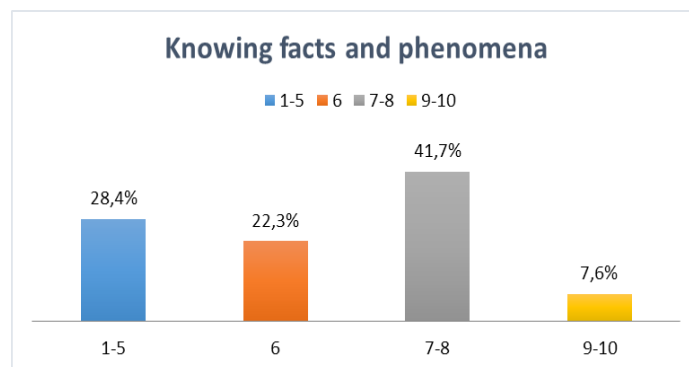
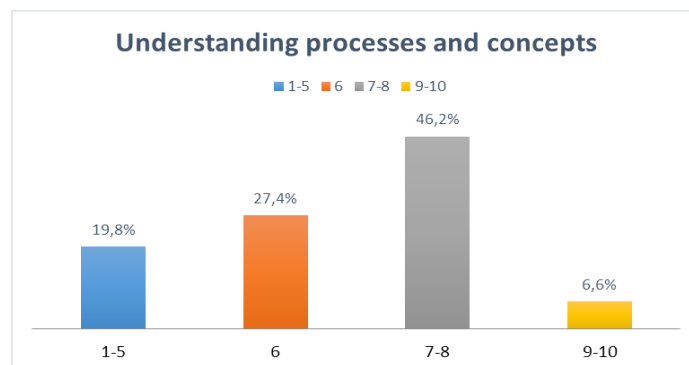


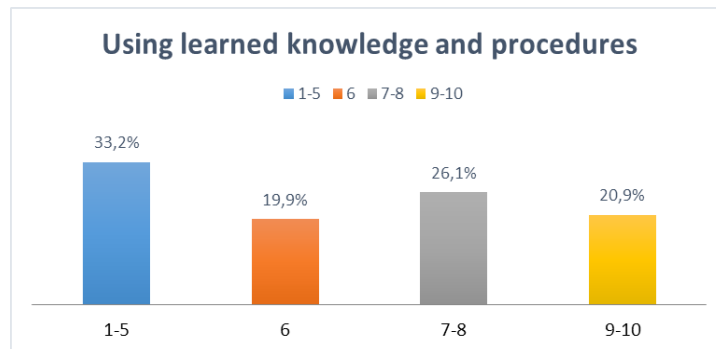
Figure 9 shows that in the area *Understanding processes and concepts* 27.4% of students scored 6, 46.2% reached a score between 7 and 8, while 6.6% obtained 9-10; 19.8% did not reach the sufficiency level.

Figure 9. Results for the indicator *Understanding processes and concepts*.



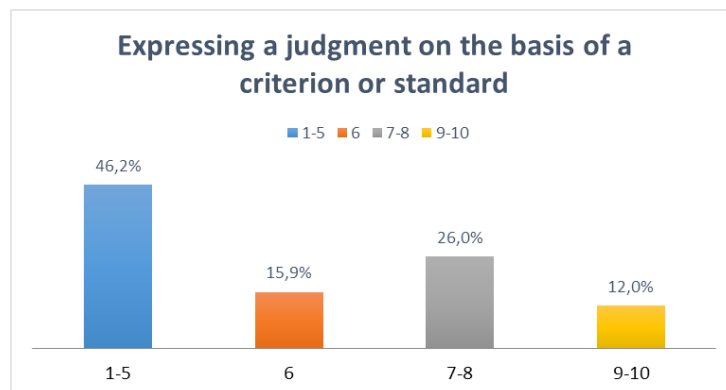
In the area *Using learned knowledge and procedures* (see Figure 10), the majority of the students obtained the sufficiency: 19.9% scored 6, 26.1% obtained between 7 and 8, while 20.9% reached the optimal score between 9 and 10; the remaining 33.2% obtained a score between 1 and 5.

Figure 10. Result for the indicator *Using learned knowledge and procedures*.



In the area *Expressing a judgment on the basis of a criterion or standard*, the majority of the students did not obtain the sufficiency: in fact 46.2% of students got a score between 1 and 5, 15.9% reached 6, 26.0% had a score between 7 and 8, while the remaining 12.0% reached the optimal result of 9-10 (Figure 11).

Figure 11. Results for the indicator *Expressing a judgment on the basis of a criterion or standard*.



Synthetically, success levels *deeply insufficient*, *insufficient* and *mediocre*, all aggregated in the 1-5 category, have been slightly predominant in the indicator *Expressing a judgment on the basis of a criterion or standard*; these data express that the didactic methodology had a scarce repercussion on the formulation of judgments in relationship to internal and external evidence criteria. This is likely to be attributed to the short time of the experimental phase. A satisfactory level was attained both in *Knowing facts and phenomena* and in *Understanding processes and concepts* areas; this finding shows that teachers probably used assessment tests such as authentic tests, allowing to assess such dimensions, thus avoiding the risk to incur in a mere mnemonic technique.

The excellence level had its major occurrence across the 4 areas in *Using learned knowledge and procedures*. In this sense, the method seems to have the ability to let students link previous knowledge to current learning and apply it to new contexts.

## 6. CONCLUSIONS

Comparing the international research results described above with the previous analysis developed on the design grids produced by teachers, a first picture of the method's strength and weakness can also be traced: this method is difficult to implement and its use is discouraged to introduce a new topic and in absence of technical assets, such as the interactive multimedia whiteboard.

Spaced Learning is interesting for its potential to help students in preparing exams. Besides, it is extremely useful to overcome learning gaps, related not only to information memorization but also to the comprehension and contextualization of those rules and procedures typical of a discipline.

Some weak points of the method, highlighted by the Italian teachers involved in this program, are: the risk of chaos during the pauses in crowded classes, the need to properly identify age-tailored distraction activities, the limited time for students to ask questions, the need of a significant amount of time for class preparation and technical assets setup, the identification of ad hoc spaces and dedicated materials.

Due to the shortness of the experimentation and the fact that the observation was conducted only once (specifically during a lesson in Spaced Learning mode in an Apulia school), the results obtained are more satisfactory, but more research actions would be required to validate the method's effectiveness. Moreover, this teaching technique requires the mastery of the method by teachers, whereas in Italy Spaced Learning is still at an early stage of adoption.

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<sup>1</sup>Giuseppina Rita Mangione coordinated the INDIRE experimentation of innovative models in Apulia. In this work she wrote the introduction (Section 1) and the background about adaptive instruction and time in education (Section 1). She defined the experimental research plan (Section 5), described classroom observations (Section 5.1) and analyzed the data about learning results (Section 5.2). Maeca Garzia described the novel didactic model called Spaced Learning and prepared the quantitative analysis about learning results (Section 5.2). Maria Chiara Pettenati is research director and scientific coordinator of the EDOC@Work3.0 project and of apulian teachers training. She treated the description of training (Section 4) and the conclusions of this chapter (Section 6).

## Chapter #15

### ELECTIVITY AND EDUCATION: AN EMOTIONAL WAY TO LEARN SIGNIFICANTLY

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#### ABSTRACT

Many contemporary scholars talk about emotion, learning and education. This chapter tries to understand if it is possible to learn through emotional observation and if learning can become significant and effective. In our daily lives, there are many experiences that challenge us emotionally. Being aware of our own emotions and our own ability to solve difficulties, helps both adults and children in a growth phase and in school-age. Authors ranging from Montessori to Piaget, Maturana, Varela to Putnam, from Hillman to Dennett and Damasio, to Karmiloff-Smith, reflect on this topic. This chapter aims to study the phenomenology of the development and of educational experiences. We tried to find the emotional dynamics of adolescents. The analysis of neuro-cognitive and learning processes, which will be called elective, allows a recognition of those dynamics, related to the various self areas, which need strengthening and enhancement and which may become an educational and transformational choice for future generations.

*Keywords:* electivity, immersion, degrees-gradients, phenomenology, learning, relationships.

#### 1. INTRODUCTION

Learning, especially of an induced type, is usually forgotten and is often reason domain when we talk about cognition. How to make learning not only knowledge but also a deliberate choice is the goal of this study. This notion is connected to empathy (Boella, 2006), through which you can improve what Vygotsky would call ‘zone of proximal development (Vygotskij, 1966). Learning is elective (Visconti, 2011) because it is not linked to knowledge but to what is internalized, emotional-somatic markers – (Damasio, 1995, 2000) in an ontological perspective and of humanizing/education. The concept of education goes over the prescriptive aspect of development, growth to become a category of meaning, as hermeneutics of life (Demetrio, 1997) and as resulting in neurological and transformative human factors. This position follows the theory expressed by Karmiloff-Smith on "representational redescription" (Karmiloff-Smith, 1995), which will be discussed later and that will validate the hypothesis presented.

##### 1.1. Elective learning and motivation

In his work “De Atractionibus Electivis” Torbern Bergman, the Swedish chemist, states that in the relationship between individual subjects something occurs that is quite similar to the particular phenomenon existing in nature, whereby two united elements split to form two more couples driven by other two, due to mutual attraction, starting a not precisely identified synthesis and rejection process.

Wolfgang Goethe was particularly fascinated by this research, as he was interested in different disciplines, and above all in natural sciences, he went into detail of Bergman’s theory, whose law “atractio electiva duplex” in Latin, hints just at that unknown



phenomenon whereby two naturally coupled elements split in order to re-build more couples because of “special affinity”. It is still unknown and almost impossible to explain why some elements attract each other and others reject each other in an absolutely natural and physiological way. Actually, the attraction and rejection phenomena that occur in nature likewise can be seen in other conditions regarding man and these are as articulated and interconnected in its internal and external dynamics.

So, why should we rule out that such reaction could also happen in the manifold and multi-sided learning process and relevant acquisition (when one wants to express an ampler view in line with the object of this research) with its latent, hidden dynamics, that is somehow unknown to pure scientific rationality?

“Elective affinities”, that is how Wolfgang Goethe called them when he wrote one of the greatest masterpieces of the XIX century international literature taken by great love for the study of natural sciences; that is a masterpiece mediated, though, by the genial mind of a matchless writer and teller of stories that belong to man’s fleeting existence (Goethe, 1999).

His existence is composed by specific chemical components, by endocrine and endogenous factors, by pulsions and instincts, but also by the soul’s codes (Hillman, 1997, 2004) that are the real inner incontrollable, non-manageable drives that reason cannot explain, but they are actually the real stimulus that leads us to those involving passions that motivate our existence and take part in our lives with the right determination to improve, which gives meaning to the “living the world” and gives the right force to that impulse that leads from man’s world to the world beyond (Cambi, 2006).

### **1.1.1. Representation of the self and education: mental processes, corporeality and emotions**

The electivity, therefore, through the higher mental processes, becomes a preferential channel to reach the inner part and to learn elements that become education and ethical style. Human mind considered supernatural entity, a superior mind as it was "God's mind" in Spinoza, creates higher functions of our brain at different levels: from reason, to memory, to intuition, to will, to feeling and emotion. It is no longer conceived as an endogenous uniprocessor (Piaget, 1983), although it preserves the ability of adaptive-instrumental and constructive re-appropriation of the environment through the experience as an organized action in the process of knowledge through the thoughtful (Dewey, 1961), of that body and mind that Merleau-Ponty would call psychic body (Merleau-Ponty, 1965). Already Fodor (1983), in his volume "Modular mind" argues that the mind is characterized by modules with specific functions and each module processes the data differently, however, the areas are poorly connected. Only a few more years later A. Karmiloff-Smith (1995), states that the mind is strongly specialized and modules are less rigid and isolated as considered by Fodor (Fodor, 1983). Mental processes, therefore, are characterized by modularization that Karmiloff-Smith considers inherent in linguistic processes (Basile, 2001) and hermeneutic interpretation. According to the latest research there is a theory that arises between cognitive psychology (mind as manipulation of symbols occurring in a system similar to the computers) of a modular innatist type; and, connectionism (the mind as a result of the many physical and chemical interactions that occur on a network of neurons) of an anti-innatist and anti-modularist type. It is defined as evolutionary connectionism (mind as a result of the many physical and chemical interactions that occur on a network of neurons in the intersection between evolution and learning), very close to the positions of Karmiloff-Smith who believes that only modules exist at birth and grow throughout life and are in small part encoded in the genome as a

result of complex interactions between genetic information, development and significative experience. The theory of connectivism has a conception which is less easily adapted to evolution and it is more interested in the complex interaction between genetically inherited information and information gained through experience. "This form of pan-adaptivism is not shared by all cognitivists. Noam Chomsky, for example, considers the mind as a manipulation of symbols and considers that there is a specific mental module for the language or for syntax, but does not believe that language emerged in humans due to specific evolutionary pressures (Fodor, 1983). Even evolutionary biologists like Stephen J. Gould (1941-2002) have repeatedly argued that what is inherited genetically is not necessarily the result of selective pressures and not necessarily adaptive. It can be the result of random factors, or it may be neutral from the point of view of adaptive and is connected to another adaptive element, or may be evolved carrying out a function and later reused for a new function (Calabretta, 2002, pp.52-53).

Education is to be considered as the overall interpretation of linguistic and social representations with emotions, relationships, cognition and conveying of meaning and significance (Bateson, 1977). The electivity is compared to these two different categories: development category and soul category.

The idea of electivity is closely linked to the whole phenomenology of human development that is strongly connected to an "emotional brain" (LeDoux, 2003) and "emotional intelligence" (Goleman, 2001).

This study wants to observe and improve all those dynamics that represent the man conceived between body and mind (Erikson, 1950; 1984), in his various vital spheres with degree-gradients of the self.

Learning processes (elective) are originated from a choice (Dennett,1993), sometimes unconscious (Bateson,1977), and internalized according to the general state of satisfaction and health (Damasio, 1995, 2000). Pedagogically this appears very meaningful because it acts on the enhancement of each of them. The action of valorisation and strengthening of different areas is established on the basis of observation made through the recognition of the degree of satisfaction and the gradient of improvement. The tables relating to the degree-self gradients, as will be shown later, aim to highlight the overall status of a person in a given context and to implement improvement measures promoting, facilitating and empowering processes that emerge in times of fragility (in the table below about the degrees-gradients of the self).

## **2. BACKGROUND**

From the research carried out among two hundred teachers of early childhood, primary and secondary schools who used the tables of degree-gradients of the self what emerged was that the state (emotional, relational, cognitive, affective) experienced by each student heavily influenced the motivation, commitment and general involvement in the processes in which it is required to participate. The grid gradually realized through opinions and emotional states of students, concerned the different spheres of the phenomenology of the self. This grid is divided in degree-gradients and refers to moods, mood, gratification and the idea of security/insecurity/dissatisfaction of everyone. Wants, needs and expectations represented by teachers have also been considered. The feedback in rewarding behaviors and attitudes of confidence, attribution of meaning aimed at strengthening, aroused, in most cases, greater orientation to the task to be performed, emotional and effective management and operational balance.

It is from this basis that the structure of degrees-gradients can be used as a tool of dynamic observation that does not immediately reach the submerged part.

Starting from the concept of gradient as vector magnitude, we want to use the concept of degree-gradient to create a possible tool for the depth observation of some dynamics that underlie the phenomenology of the self.

In psychology, the term gradient is used in reference to the change of motivation to approach or to move away from a purpose, which is related to the distance of the subject from this, and we speak respectively of gradient approach and removal.

### **3. SELF PHENOMENOLOGY AND DEGREES-GRADIENTS. A METHOD TO IMPROVE RESOURCES**

Grades-gradients are trying to find (in the situation and in its potential) the degree of emotional satisfaction/dissatisfaction (emotional gradient); one related to motivation (motivation gradient), the relational one, related to perception/self-perception, acceptance and self-acceptance, to the representation and self-representation, to self-esteem; and that expressed by the character and personality (gradient of potentials and resources), in an attempt to observe the growing subject:

- degree of emotion and affection (Defense/inhibition, closing/aggressiveness, euphoria/dysphoria): feels loved/you don't feel loved; has demonstrations of care/didn't care demonstrations; you feel cared for/don't feel cared for; feels listened to/don't feel listened to and needs in its requirements; feels accepted/not accepted feels in his hardships and difficulties; feels defended/does not feel defended; view independence-autonomy/independence-autonomy doesn't show; view security/safety doesn't show.

For the emotional-affective gradient it is necessary to improve the sense of safety in an attempt to promote an adequate reply to the capacity of processing the fear of separation, abandonment and loss (Bowlby, 1980, Ainsworth, 2006). It is crucial to convey a healthy sense of belonging that is reassuring throughout the individuals' development and accompany them during learning experiences (Attili, 2001), training and socialization:

- degree of relation (Rogers, 2007; Lèvinas, 2006) reached with respect to the self-esteem, the self-perception and self-concept: you like-you don't like; others likes/dislikes towards others; feel self-confident/not feel self-confident (Bandura, 1977); to feel accepted/not accepted; to feel welcome/not welcome; to play in group/don't play in group; to believe to be able to share experiences/to feel unable to share experiences.

As what concerns the relational gradient and self-confidence, it is necessary to improve the level of self-esteem, acceptance, approval, and involvement of sociability, trying to promote an adequate concept of himself and of the concept that other people have of that himself and to eliminate the feeling of rejection, isolation, exclusion;

- degree of motivation (Maslow, 1982) which highlights: he has got expectations upon himself/has not got expectations on himself; he believes he can do tasks well/badly; he feels able/does not feel capable; he feels valued/he does not feel valued.

For the motivational gradient, it is necessary to get levels for the improvement of success, sense of self-perception of competence, self-recognition and performance recognition, to allow a proper motivational condition and a good disposition to do so that he can eliminate the feeling of failure and frustration;

- degree of potential compared to temperament and to the character and personality: he appears introverted or extroverted, i.e., he shows passivity or sociability, over-cautious

or expansion, or control, calm or impulsiveness, anxiety or sobriety, stress or restlessness or aggression.

For potential and resources gradient, it is necessary to the overall improvement of the sense of inhibition-closure, prohibition, regulation, self-regulation, self-control and self management and emotional body (Lanciano, Zammuner, & Trivisani, 2010; Lazarus, 1991), in an attempt to foster a general and adequate expression condition of individual resources although specifically considering temperament and character in order to build a balanced personality and a solid identity. Some of the prevalent emotions (fear, surprise, sadness, disgust, anger, happiness), can be contemporary and transversal recurrent, but according to the degree of processing of each area you can consider how to plan an educational project.

Obviously the observation, so structured, is not intended, nor as a sort of diagnosis, nor such a classification, but it is instead aimed at strengthening itself through the educational awareness and a style, a humus, or climate, or an encouraging educational atmosphere.

#### **4. FUTURE RESEARCH DIRECTIONS**

According to the investigation shortly described above you can imagine new research horizons and set goals for improving methodologically the phenomenon study in children, designing interventions on psychological, pedagogical, as well as educational life learning. Some of the prevailing emotions (fear, surprise, sadness, disgust, anger, happiness), can be recurrent, contemporary and transversal, but according to the degree of processing of each area you can consider the level of educational project. Obviously the observation, so structured, is not a sort of diagnosis, or a classification, but it is aimed at strengthening of phenomenological self through the educational action and awareness and employment of a style, a humus, a climate or educational atmosphere encouraging (Franta & Colasanti, 1998), ahead of a schedule-educational-didactic design.

The reading of various styles: motivational, emotional, relational, personality, corresponding to the analysis just presented, is linked to ecosystem complex phenomena that occur in a non-rigid and non-static way and can be derived from a series of indicators in scanning of degrees and get through the use of some tables, which can highlight an affirmative or negative gradient for each item-stimulus compared to general condition and specificity to area of interest. The degree-gradient (affirmative or negative) can be adjusted at different times and in different ways: by accepting the empathetic listening, at gaming experiences, dramatization, storytelling, in working groups and, more specifically, in the dynamics within the class, in order to enhance individual learning resources, and related capacity/ability that lead to it, is realized with the activation of endogenous structures, prefabricated and experiential practices acquisitional crossing pattern of experiences and representations of each. Such interaction determines forms of representational redescription and operating systems and rebalancing of values. The contemporary educational system experiencing an excessive instructive-transmissive and notional load, neglects key aspects of the students: their creative ability, their intense emotional baggage and their self-esteem. The idea presented in this chapter focuses on the recovery of pedagogical style that approaches closer to the experiences of children, adolescents and youth that always show the need to be heard and cared for empathically.

## 5. CONCLUSION

The intersection between issues relating to the individual development in educational and training processes, determines the nature of an approach aimed at the enhancement of the representations Attitudes, behaviors, lifestyles and expressions of personality take shape through processing mode of educational and training processes in elective acquisition terms, breaking down the psycho-social dynamics and joining them analytically and normatively. Translate meaningful educational experiences in internalization of value elements gives education the substantial potential of transmission. The resulting combinations between levels of gratification/commodities and grades gradient compensation of each area can be considered the 'cornerstone' of an educational process, and also means necessary to listen child and adolescent in cognitive and learning processes. To observe, supervise, be responsibly and self-critically is the pedagogical way to hone those skills that the Moscato defines "key competencies", in a pedagogical perspective that goes beyond" mechanistic and deterministic conceptions, didactic-training visions, behaviorist, and pedagogical conceptions" (Moscato, 2007, 2008).

Skills, even if considered both sociological, behaviorist and cognitive-analytical, do not respond adequately to the total baggage of those that can be universally defined the human skills.

Bellingreri (2005) also talks about empathic skills. It is in this perspective that empathy becomes an important pedagogical category. If there is not such pedagogical 'humus', it is impossible any form of educational purpose.

The whole pedagogical and choreographic scenario is intended as exposition, proposal and project that catches the educational moods.

In the phenomenology of the self can be identified:

- an emotional self corresponding to the sphere of affectivity and the balance between attachment and separation;
- a relational-representative self related to the self-confidence and self-perceived image;
- a motivational self based on the intensity of interest and inclination to participate;
- a potential self due to temperament and character in progressive perspective of personality development.

The affective degrees-gradients are emotional and attachment conditions linked to the adults; the motivational degree-gradient matches the interest and motivation to cultivate passion, asking with curiosity, planning initiatives and projects; the relational and representative degree-gradient is a personal perception of self, of judgment and self-acceptance linked to the element of sociability; the character and personality degrees-gradients are the individual resources, the outcome of previous experiences.

The elective invests the whole human territory throughout the life involving every part and all that belongs to it. It occurs in the expression of the immanent life which, in turn, relies on the sense of values offered by pedagogical action (Acone, 2004).

## 6. RESULTS

Note: for emotional-affective gradient it is necessary to improve the sense of security so that to encourage an appropriate affection and remove the feeling of separation, abandon and loss.

Table 1. Affective-emotional grade-gradient.

Analysis of the state of satisfaction/dissatisfaction obtained through affective-emotional grade-gradient			
Analysis of the state of satisfaction/dissatisfaction of affective-emotional grade-gradient	GRADIENTS		ENHANCEMENT LEVELS
You feel or don't feel loved	Affirmative	Negative	TO IMPROVE YOUR SENSE OF CARE
You have or don't care demonstrations by loved ones	Affirmative	Negative	
You feel or don't feel dedication	Affirmative	Negative	
You feel or don't feel heard in his needs and requirements	Affirmative	Negative	TO IMPROVE YOUR SENSE OF PROTECTION
You feel welcomed in his needs and difficulties	Affirmative	Negative	
You feel or don't feel defended	Affirmative	Negative	
You show or don't show independence-autonomy	Affirmative	Negative	TO IMPROVE YOUR SENSE OF CONFIDENCE
You show or don't show confidence	Affirmative	Negative	

For the relational and self-confident-gradient it is necessary to improve the sense of self-esteem, acceptance, approval, involvement and sociality to facilitate an appropriate self-concept and the concept that other people have of him and eliminate the feeling of rejection, isolation and marginalization.

Table 2. Relational and self confidence grade-gradient.

Analysis of the state of satisfaction/dissatisfaction obtained through relational and self confidence grade-gradient			
Analysis of the state of satisfaction/dissatisfaction of relational and self confidence grade-gradient	GRADIENT		ENHANCEMENT LEVELS
You like/don't like	Affirmative	Negative	TO IMPROVE YOUR SENSE OF SELF-REFLECTION
You like/dislike	Affirmative	Negative	
You feel/don't feel involved	Affirmative	Negative	TO IMPROVE YOUR SENSE OF ACCEPTANCE
You feel/don't feel welcomed	Affirmative	Negative	TO IMPROVE YOUR SENSE OF APPROVAL
You feel/don't feel worth	Affirmative	Negative	
You feel/don't feel up to solve problems and difficulties	Affirmative	Negative	
You like to play-work/You don't like to play-work in Group	Affirmative	Negative	TO IMPROVE YOUR SENSE OF INVOLVEMENT-SOCIABILITY
You consider/don't consider to be able to share experiences	Affirmative	Negative	

For motivational gradient it is necessary to improve the sense of success, self-perception of competence, self-recognition and acknowledgment in performance, to promote adequate motivational condition and a good disposition to eliminate failure and frustration.

Table 3. Motivational grade-gradient.

<b>Analysis of the state of satisfaction/dissatisfaction obtained through motivational grade-gradient</b>			
<b>Analysis of the state of satisfaction/dissatisfaction of motivational grade-gradient</b>	<b>GRADIENT</b>		<b>ENHANCEMENT LEVELS</b>
You Have/don't have expectations	Affirmative	Negative	TO IMPROVE YOUR SENSE OF SUCCESS
You believe you can do (do anything) right	Affirmative	Negative	
You feel/don't feel capable	Affirmative	Negative	
You feel/don't feel appraised	Affirmative	Negative	TO IMPROVE YOUR SENSE OF COMPETENCE SELF-PERCEPTION
You feel/don't feel valued	Affirmative	Negative	
It is not hard to show disapproval	Affirmative	Negative	TO IMPROVE YOUR SENSE OF SELF-RECOGNITION AND ACKNOWLEDGMENT IN THE PERFORMANCE
You show /do not show activity	Affirmative	Negative	

For the potential gradient and resources you need to consider the overall improvement of the sense of inhibition-closure, prohibition subduing and adjustment, self-adjusting, self control and emotional management to foster general and adequate conditions of individual expression and channeling resources although specifically in their temperament and character in order to build a balanced personality and a solid identity.

Table 4. Potential-resources grade-gradient.

<b>On the analysis of the state of satisfaction/dissatisfaction obtained through the potential-resources grade-gradient</b>			
<b>ANALYSIS OF THE STATE OF SATISFACTION/DISSATISFACTION OF THE POTENTIALS-RESOURCES DEGREE-GRADIENT</b>	<b>GRADIENT</b>		<b>ENHANCEMENT LEVELS</b>
Show extraversion or introversion	Affirmative	Negative	TO IMPROVE YOUR SENSE OF INHIBITION
Show sociability or liability	Affirmative	Negative	
Show expansion or excessive prudence	Affirmative	Negative	
View vividness or excessive control	Affirmative	Negative	
Show vividness or excessive control	Affirmative	Negative	TO IMPROVE YOUR SENSE OF SELF-ADJUSTMENT
Show calmness or impulsiveness	Affirmative	Negative	
Show production or excessive anxiety thoughtlessness	Affirmative	Negative	
Show sobriety or grumpiness	Affirmative	Negative	
Show serenity or restlessness	Affirmative	Negative	

For the gradient concerning the potential and resources it is necessary to resort to the overall improvement of the sense of inhibition-closing, submission and awe-that of regulation, self-regulation, self-control and body and emotional self-management, in an effort to foster a general and adequate condition of expression and channeling of individual resources although the specifics of his temperament and character in order to build a balanced personality and a strong identity.

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**Section 3**  
**Teaching and Learning**



## Chapter # 16

### PROMOTING MATHEMATICAL MODELLING AS A COMPETENCE: STRATEGIES APPLIED IN PROBLEM SOLVING ACTIVITY

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#### ABSTRACT

Current international documents claim that schools should enhance mathematical modelling competencies in students, as part of an instructional approach that can be considered suitable for the 21st century learners and problem solvers. The objective of this paper is to identify high-school students' initial conceptions and strategies in mathematical modelling that can be taken into consideration when teachers work out educational activities. A clinical interview approach is applied to understand the modelling strategies that are used by nine students during their three problem solving activities proposed in this research. Students showed different approaches in: their use of algebraic symbolism, the justification of their reasoning, representing their ideas mathematically. The findings can help teachers design school activities that are sensitive to the students' initial conceptions, in order to promote their mathematical modelling competencies.

*Keywords:* mathematical modelling, initial conceptions, mental processes, clinical interview approach, mathematics education.

#### 1. INTRODUCTION

One of the crucial points in education is to create learning activities in which students are encouraged to apply their declarative knowledge to solve real problems (Vergnaud, 1981; UNESCO, 2012). This process requires the students to recognize the relationship between the real world and the mathematics world, as well as to understand the role that mathematics plays in offering viable and dynamic models of real-world situations (UNESCO, 2012).

The Recommendation of the European Parliament and of the Council (2006) claims to the development of competence in school education. The competence approach is based on a dynamic model of lifelong learning in which new knowledge and skills necessary for successful adaptation to a changing world are continuously acquired throughout life (OECD, 2006). In our view, mathematical competence consists in the understanding of a problematic situation, according to mathematical language. Therefore, competence is not limited to the memorization of mathematical facts and procedures, but it is the flexible capability of applying the relevant knowledge in real world contexts, in order to make inferences, to solve problems and taking sound decisions. We focus on competences because we are especially interested on the learning of mathematics to become not a "academic knowledge", but a way of thinking of the students, even during their daily lives.

According to De Corte (2007), the acquisition of mathematical competence is possible through a classroom environment in which students have the opportunity to learn mathematics as a dynamic discipline rather than the acquisition of a standard system of procedures that are applied to tasks with an expected solving procedure. Modelling can be considered a dimension of the mathematical competence, since it implies the application of mathematical knowledge in real-world situations.

In this research, we analyse initial concepts of modelling strategies developed by students who participated of the present study.

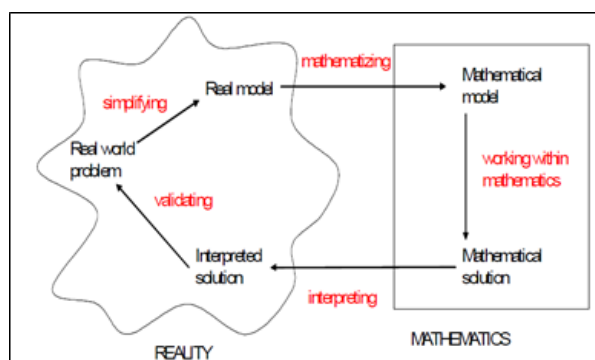
In developing modelling competencies, the students should focus on higher order abilities of translation, interpretation and evaluation of the real life problem in terms of the mathematical model, rather than on algorithmic procedures (Blum, Galbraith, Henn, & Niss, 2007). Furthermore, they must reflect and justify logically the reasoning adopted. Although modelling activities are considered an important educational objective, they are rather rare in mathematics lessons, and there still exists a considerable gap between the ideals of educational debate and the everyday teaching practice (Blum, 2002).

## 2. THEORETICAL BACKGROUND

Analysing the definitions of the mathematical modelling and modelling competence, we can affirm, according to Maaß (2006), that there is a strong connection between them; the Program for International Students Assessment (OECD-PISA, 2006) perceives modelling as having a symbiotic relationship with mathematical competence. We will soon discuss briefly these two definitions.

Modelling is a procedure that places the real world and mathematics in a constant interaction (Blum, 2002). Mathematically, the process of modelling is defined as a procedure to transform real problems in mathematical problems and solve them, interpreting their solutions in the language of the real world.

Figure 1. Modelling process (Ferri, 2006; Maaß, 2006).



In mathematics, modelling consists in creating a symbolic representation of a real world situation, which extracts the relevant dimensions of the situation, connects them in order that transformations in the model simulate potential transformations in the reality. Models are hypothetical artifacts that give the solver a partial but useful tool to support reasoning. Through the cognitive actions of “simplifying, structuring and idealizing” the problem at hand, a real model is obtained. By working within mathematics, a mathematical solution can be found, interpreted, and then validated (Ferri, 2006; Maaß 2006; Blum et al. 2007).

In according to Maaß (2006), modelling problems are authentic, complex and open problems that relate to reality. By their definition, a model must be considered an approximation of reality, since problematic situations are characterized by manifold factors that can hinder and interfere with the idealized approximation. Generally, the construction of the real model is influenced by one's own mathematical knowledge. Modelling activity mobilizes knowledge and competence of the students in solving an everyday life problem, when they assume an active role on the construction of their own knowledge. Such activity requires a constant reflection on the processes involved to solve the problem and stimulate their ability in planning strategies for more complex solutions (Blum et al., 2007).

Maaß (2006) defined modelling competencies as "skills and abilities to perform modelling processes appropriately and are goal-oriented as well as the willingness to put these into action" (p.117). The author presented sub-competencies "based on theoretical considerations Blum and Kaiser specify the term modelling competencies by a detailed listing of sub-competencies" (Maaß, 2006, p. 116) that are described to their understanding of the modelling process:

- Competencies to comprehend real problems and working out a possible model based on reality: construct initial hypothesis in which identify key variables that could potentially influence the problem for then construct relations between them and recognize the relevant information, looking for a simplification of the situation.

- Competencies to set up a mathematical model from the real model: once identified the important variables, mathematize its relevant quantities and their relations, searching for its simplification and reduction where necessary, adopting appropriate mathematical notations.

- Competencies to solve mathematical questions of the mathematical model: to use the mathematical knowledge to adjust the relevant variables and its relations, which is the mathematical model, checking for different forms of the same problem or other ways to solve it.

- Competencies to analyse mathematical results in a real situation: once solved the problem, interpret the numbers within the real contexts, giving real sense to the results; to cast the specific solution into a generalized one; to expose solutions using appropriate mathematical language.

- Competencies to validate the solution: to interact the found solutions into the real work to check the feasibility of the mathematical model, examining it, adjusting it and going through the modelling process whenever the results do not hold; to discuss entire model from scratch.

Blomhøj & Jensen (2007) suggest that competence development as a continuous process. Accordingly, in this research, we are interested in knowing how students have developed their skills in mathematical modelling. The thinking strategies used by students in solving modelling activities are analysed by the theory of conceptual change worked out by DiSessa (1993). In order to explain by which mechanism the students formulate their conceptions, DiSessa (1993) introduces the notion of phenomenological primitive or p-prims. P-prims result from the learner's experience in the world, hence "phenomenological primitives", or "p-prims".

A p-prim is a simple cognitive scheme of qualitative reasoning that helps the student to formulate intuitive or spontaneous conceptions to make sense of a situation (DiSessa, 1988; 1993; Hammer, 1996). In this way, the learner may construct an explanation in response to a single phenomenon, based upon the p-prims that are considered relevant.

According to DiSessa (1993), p-prims are activated when students recognize that sensory data might be interpreted or assimilated within a particular p-prim. In view of existence of primitive ideas, direct experience can play a role in understanding abstract concepts. In our research, the p-prims the students select and apply in mathematical modelling real world situations.

We consider the "p-prims" theory a suitable approach to explain the development of students' competencies, since it can represent the intuitive understanding by a novice who selects only a simplified array of information from a situation, as well as the process of unfolding capability of integrating and selecting aspects of the problem into an expert modelling of the situation. This approach can also make evident the specific obstacles that a student encounters when engaged into real world problems.

### 3. METHOD

The objective of the present study<sup>1</sup> consists in the identification of constraints and opportunities in working out innovative educational activities that can promote modelling as a competence. Specifically, we sought to identify the major obstacles faced by students in the modelling process, trying to identify the basic elements of knowledge or the p-prims (DiSessa, 1988; 1993) of mathematical modelling in real phenomena. The study also analyses the complex shapes of the modelling competence that students have developed until now.

In order to understand the strategies the students apply in modelling, we developed three mathematical activities. The tasks were constructed in such a way that the same sub-competencies were evaluated. A Clinical Interview approach (DiSessa, 2007) was applied in inquiring students' modelling processes during the activities, allowing each interviewee to reveal his/her natural way in solving the problems.

A Clinical Interview methodology concedes that tasks can be designed that provide the researcher an adequate opportunity to make inferences based on the interviews about students' cognitive processes. According to DiSessa (2007) the Clinical Interview allows for interventions where students were encouraged to elaborate on their statements and judgements. In this way, the methodology provides an opportunity to make valid inferences about students' covert intellectual processes and the gathering data provides for a continual interaction between inference and observation. Therefore, the researcher continually analyses conjectures about the students' thinking and intervenes on any occasion that the problem solving activity of the student cannot be adequately explained by the model presented.

The use of interviewing as a successful tool of research must be accompanied by appropriate learning tasks, serving as genuine challenges for students, allowing them to get involved in the interview. The task situations used in the interview are given below:

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<sup>1</sup>This study is part of a Ph.D. research.

*Taxi activity*<sup>2</sup>: the text provides a brief description of a taxi service in function of the cost variation, and presents a table with the tariffs set by the city of Bologna. The problem requires to find the kilometre rate price of a taxi trip and to create a mathematical equation that represents the proposed ride. Students are required to search and analyse information, to apply it on different representations and formulate and justify their assumptions.

*Statue activity*<sup>3</sup>: student are required to use an unconventional unit of measure, in order to estimate the total height of the statue, from an image of a big statue representing a human head and some children playing around it, no additional information provided. Interpreting the situation without the numerical date requires students to search others relevant elements of the problem, to make estimation, to construct new relationships between data, and to make critical assessment of the results.

*Travel activity*<sup>4</sup>: it consists in a written text and a road map. The challenge is to create a journey planning, taking account of the proportions of the distances in the map and justify it. Students are required to select and analyse the relevant information, extracting the unit of the relation cost per kilometer, as a basis to make inferences for different situations.

Nine high school students of different colleges and technical institutes participated in the research. Each student participant was interviewed individually and each interview lasted approximately 60 – 75 min. All interviews were video-recorded and transcribed.

## 4. RESULTS

For the purpose of the present study, we analysed the students' initial conceptions or p-prims, and the unfolding of their complex shapes of the modelling competence. During the analysis, we consider that the results presented by students should not be tagged as true or false, but instead they should be considered as if the applied modelling was pertinent to the given problem.

According to Smith, DiSessa and Roschelle (1993/1994) the students who exhibited p-prims in their working-out activities are called novice modellers, the others are called expert modellers or expert students.

### 4.1. Phenomenological primitives in modelling activities

The phenomenological primitives are the basic elements of knowledge on which more complex mathematical competences are constructed. By analysing the nine students' modelling activities, some persistent phenomenological activities can be highlighted:

*Working out a possible real model*: oversimplification in identifying the variables of the problem; creation of new variables not relevant and inadequate mathematical estimates;

*Working out a mathematical model*: wrong relationships assumed between variables, use of non-mathematical criteria;

*Interpreting mathematical results in a real situation*: interpretation attributed to non-relevant factors; unreliable assumptions and generalizations of inconsistent results in reality.

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<sup>2</sup>Activity built by the authors.

<sup>3</sup>Activity adapted from the site <http://did.ceremat.org/>

<sup>4</sup>Activity built by the authors.



Regarding the specific activities, we highlight the following:

*Taxi activity:* students tend to select factors that are not relevant in the cost of the taxi ride and therefore the related mathematical models are not appropriate.

Figure 2. Fragment resolution present by student MAN in Taxi activity.

I: In your opinion, what are the factors that affect the cost of a taxi ride?  
MAN: [...] *the factors that affect the cost of the ride are the luggage you carry on board, e.g. extra heavy packs, maybe some gifts for relatives when traveling, the distance between the origin place and the arrival place, the taxi ride itself because there can be tricky taxi drivers that make a longer ride and the number of people boarding on car. Because if there are more people, the price is lower because the passengers share the cost, while a person spends more money if he is the only traveller.*

The student refers to a particular situation and assumes a naive point of view of the situation: He does not consider the mathematical situation but only his experience in using a taxi. He relies on three p-prims that are not relevant to the situation, that is: the identity of the taxi driver, the number of people aboard and the gifts.

*Statue activity:* conceptions attributed by students concerns the criteria for mathematical modelling; the selection and estimation of the appropriate unit of measure; its correct application to the object.

Figure 3. Fragment resolution present by student SIM in Statue activity.

SIM: [...] *If it [statue] was large from the head to foot, it would be very large because [the person represented] was one of the most important people in the history of Germany [...] he fought for his ideals.*  
I: But how high would it be, in your opinion?  
SIM: *Even three / four meters.*  
I: How did you figure out that it is approximately 3 or 4 meters high?  
SIM: *No, sorry! Let's say a little more, like five or six meters... Because it would be really important to remind to all people that he was the most important person in Germany [...]*  
I: And, how did you guess these 5 or 6 meters? How would you explain it to your partner?  
SIM: *Because a building from 5 to 6 meters is very high [...] and this would give the image of what this person represented.*

SIM is struggling with a metacognitive problem: 'what are the mathematic relevance criteria?'. His select historically relevant criteria (that is, Adenauer is an important political leader) that cannot be applied to solve the mathematical problem. When asked about the height of the statue, the subject does not construct a unit of measure from the available information (the approximate heights of the children) and refers only casual justifications, such as: *Five or six meters... Because a building from 5 to 6 meters is very high.*

*Travel activity:* Many students have inappropriate modelling of the scale relation and the unit of measure of the map, (the scale of the map is written 1 : 35.000.000 and the text gives the definition of "scale"). Therefore, they are not able to construct a proportionally correct model from the map and therefore they make many mistakes.

Figure 4. Fragment resolution present by student MAR in Travel activity.

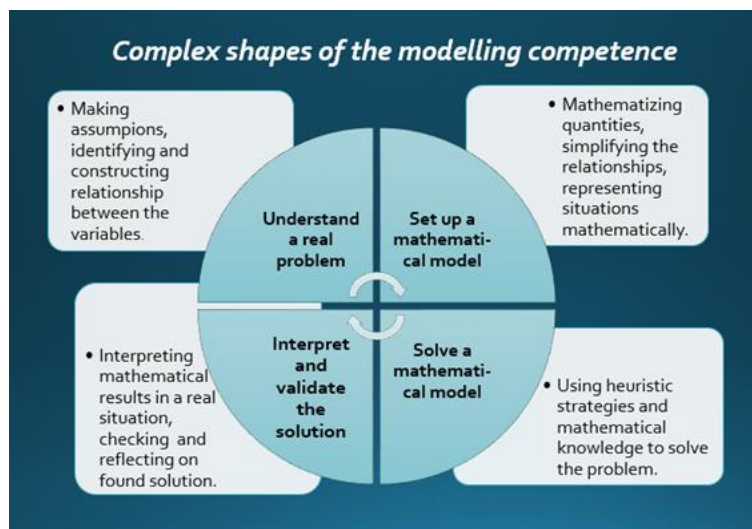
MAR: [...] I wanted to try.... I do not know ... the calculation of how much time you could spend ... I would try to find the time, doing the speed that I invented myself, if you do like 150km / h. [...]  
 MAR: So, more or less one week.  
 I: How did you come to "more or less one week"?  
 MAR: I counted the hours....  
 I: How many they are, according to your calculations?  
 MAR: 8 million.  
 I: How did you get for the amount "hours" to "one week"?  
 MAR: Through the calculator, I counted 24 for 24.... And then... [I took] the one closest to the hours. In effect, it would be 24 for 4 but I think it takes more.

The student tentatively assumes an erroneous average speed, and on this basis she multiplies the speed per hour by the total amount of hours in a week. She multiplies the speed by the total distance, rather than divide it to find the total amount of hours. She assumes a hypothetical average speed, but in her reasoning she considers it as a given and does not revise it in the light of her findings; she puts the numerical data into an incorrect relationship and does not estimate the total amount of hours of driving. As a result she finds a completely unbelievable 'eight million' hours of driving. However, she does reflect on the empirical sense of her findings.

#### 4.2. Complex shapes of the modelling competence

The figure below shows some complex shapes of modelling competence presented by a few students:

Figure 5. Complex shapes of the modelling competence.



An example is the LUC resolution, regarding the Statue activity:

Figure 6. Fragment resolution present by student LUC in Statue activity.

LUC: *If the head of Adenauer is higher by about one and a half children, and the relationship between the head and the body of a person is 1:8 and a child is approximately 1,30 m tall, then:*

$$1:8 = (1,30 + 1,30 \cdot 2) : x$$
$$1:8 = 1,95 : x$$
$$x = \frac{8 \cdot 1,95}{1} = 15,6 \text{ m}$$

Interpreting the conduct performed in Figure 6: The problem presented a photo and the image is the head of a statue and in front of it there are some children. In order to estimate the statue height, the student constructs the following relationship:

Left side of the equation: He puts in proportion the human body with the human head, saying that the measure of head is 1/8 of the body, and he represents it mathematically as 1:8.

Right side of the equation: He puts in proportion the whole body with the statue head, saying that the statue head is high about a child and half. Since, he considers that the child is high about 1.30 meters, then he writes:  $1.30 + 1.30/2$ . He denominates the statue body by x.

He constructs the mathematical model according with the first row of the equation. He solves algebraically the equation and arrives at a valid approximation height.

Expert students present their way of getting to the solution and often clearly exhibit their objectives. They are able to explain the strategic decisions taken and the mental processes used to solve the activities. A limited number of students highlight some possible alternatives that could be more effective to solve the activity.

#### 4.3. General analysis

The interpretation of a real situation remains the main problem for the development of modelling competence. Identifying key variables and constructing a model consistent with the reality are crucial cognitive actions in solving a problem. Some students have selected factors that have no mathematical relation with the problematic situations, such as the solution presented by MAN (Figure 2) regarding the taxi activity. He refers to his own personal experience in taking a taxi: *gifts for relatives, tricky taxi drivers that make a longer ride, the number of people boarding the car to share the cost*. In this case, he refers to a collection of naive abstractions of everyday observed phenomena that do not have a mathematical relevance. Furthermore, he uncritically accepts his experiential p-prims and does not revise his model and does not find the required value: cost per kilometer.

The novice modellers tend to assume mathematical values and do not revise them even in light of absurd results; they are not able to think of numerical values as valid estimations of elements in the real world situations. Making incorrect estimations was the most common mistake made by novices when constructing the mathematical model. When asked if they needed to reconsider the estimations, students relied on their personal experiences to justify their choices. As an example, MAR (Figure 4) made erroneous assumptions throughout her solution procedure and justified it as *I thought about the highway*.

Few students were able to work out a mathematical model from the real situation. As we observed in the Statue problem solved by SIM (Figure 3), the students generally had difficulties in expressing the algebraic equation that represents the real situation. For example, SIM presented a resolution linked to history, without mathematical relevance, stating that *the statue would be really big because it represented one of the most important people in German history*. When the interviewer asked him how high would be the statue, SIM responded *three or four meters*. After having reorganized his response, he introduced a new answer: *5 or 6 meters* and justify it: *Because a 5 to 6 meters building is very high [...] and that would give the right idea of what that person represented*.

In order to create a mathematical model, different competencies of identifying the relevant variables of the problem, of simplifying them if necessary, of choosing an appropriate mathematical notation, of representing the algebraic situation and of formulating and justifying hypothesis are required.

Although all the students have shown arithmetic competence, they express some typical limitations in identifying the vital variables that could possibly describe the real world problem, as the p-prims presented by SIM (Figure 3) and by MAR (Figure 4) make evident. The students were not able to contextualise their intuitions into a mathematical model; they made oversimplification in identifying the variables of the problem, in wrong relationships assumed between variables, in the use of non-mathematical criteria, in interpretations based on irrelevant factors, in inadequate mathematical estimations and in unreliable assumptions and generalizations of inconsistent results in reality.

Expert students successfully interpreted the purpose of the tasks and found a feasible solution, because they related the real world with their mathematical model. A clear example is observed on the Statue problem solved by LUC and reported in Figure 6. Through his explanations, we can understand that he made an appropriate interpretation of the real world and he managed to build the real models in close proximity of reality exhibited. Thereupon, LUC was able to interpret them mathematically, building a model that represents the situation and found valid solutions. It is interesting to look closely the way in which students have mathematized the situation, working out the more efficient one among their own assumptions. It's clear that the "experts" used different kinds of knowledge to correctly apply relevant mathematical principles and definitions. This can be highlighted by comparing SIM's resolution and LUC's resolution in the Statue Activity.

We analysed the students' reasoning in real world problems, asking them to construct approximate, but valid models of concrete situations, in order to conduct inferences. The identification of p-prims enables us to understand the critical points for the development of the modelling competence. The clinical interviews with students provided a sensible context to understand the students' interpretations in terms of p-prims. The exploratory data obtained in the present research do not allow the generalization of the distribution of the p-prims recognized in mathematical modelling, because this inquiry is based on few subjects and is aimed at the detailed description of the phenomenological primitives that are the initial elements of the modelling competence. These mechanisms are simple intuitive abstractions from experience and they are unlikely object of explicit and deliberate considerations by the students.

The study of p-prims can reveal aspects of knowledge not evident through other analytical lenses, yet it demonstrates very practical consequences in atypical mathematics classroom. Engaging students in mathematical discussion has offered us the opportunity to know their p-prims within the modelling process, and therefore we can identify the way they articulate mathematical knowledge during problem solving activities. As the research data have highlighted, it is not enough to have certain skills, in order to solve complex

real-world problems, but it's necessary to realize which are the best strategies to be able to get a satisfactory result. One of the obstacles encountered by the students was the difficulty of identifying the relevant mathematical knowledge to construct a viable model of the situation and to conduct inferences. The students participating in the research showed a comparable initial knowledge of mathematical definitions and arithmetical procedures, and therefore potentially can rely upon similar cognitive resources in their modelling activities. However, some students often failed to understand the relevant elements of knowledge to model each problematic situations.

## **5. FUTURE RESEARCH**

Analysing students' modelling competence is a complex field of inquiry and further examinations are still needed in order to compose the range of the initial elements of reasoning in this knowledge domain. The purpose of this exploratory and qualitative study was the recognition of some modelling competences employed by students during the resolution of real-world problems. This study analysed the student individually, but another interesting investigation would be the analysis of students' discussion about a problem, the counterexamples they can make and their explicit justification of relevance for selected elements of knowledge, in order to achieve a feasible solution and to rework their initial p-prims.

Once analysed, the clinical interviews were reported to a group of high school mathematics teachers. The teachers identified some of the obstacles faced by the students in the modelling process and described some instructional methodologies to overcome the obstacles. The group gave us the opportunity to understand how they manage and discover students' modelling competencies. They also explained how the Italian's Curriculum Framework can help them in the classroom. Teachers' suggested that the introduction of modelling competencies can start from the introduction of new arguments by asking students to apply modelling activities. Students can be encouraged to make conjectures in the mathematical reasoning, and can be given more space to expose their reasoning strategies and to make explicit their assumptions. Teachers also recognised that they can reduce the correction of every lacking points of a presented solution, and focusing instead on the students' reasoning strategies. Furthermore, it is suggested to engage students in presenting arguments and counter-arguments in a cooperative process, in order to make their p-prims explicit, object of critical inspection and recontextualisation into a mathematical perspective, by discarding the experiential intuitions that are irrelevant in scientific reasoning.

## **6. CONCLUSIONS**

Modelling is a sophisticated endeavour for students. It involves the understanding of the real world problem, the framing of the appropriate questions, the making of relevant assumptions to simplify the problem, the formulation of models in mathematical language to obtain an adequate solution. The modelling activities provide opportunities for students to apply their knowledge to solve real-world situations. This study has shown that novice students are capable of completing the modelling activity, albeit at different levels of competence.

The emerging data suggest the importance for teachers to be sensitive in recognizing the students' different conceptions and in identifying their mathematical conceptual primitives. From the constructivist point of view, the presence of phenomenological primitives is considered a fundamental aspect of learning and it requires the implementation of effective teaching strategies to promote the development of mathematical competence, by reframing p-prims into a mathematical perspective.

Investigating further the types of knowledge developed by students and the processes they use to apply them are of fundamental importance on designing new teaching practices.

In conclusion, we consider that teaching to promote students' competencies, as it is established by international documents, is a challenging task for all teachers. By adopting a reflective and flexible attitudes, the teachers can identify the role that the experiential intuitions play in students' understanding of the world-problem situations. It is supposed that a constructive environment, in which students can discuss explicitly on the relevance of their p-prims in modelling the problematic situations can enable them to reframe their reasoning in more adequate mathematical perspectives.

In the school context, we are at the beginning of a long process of changing that requires a profound modification of the daily teaching school: a paradigm shift.

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## Chapter # 17

### **SOCIAL COMPETENCES AND ORGANIZATIONAL DEVICES IN THEIR RELATIONSHIP TO UNIVERSITY STUDENTS RETENTION: A STUDY AT UNCUYO**

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#### **ABSTRACT**

This project –which has been included among the priorities of the University Policies Office – is the extension of a research programme developed by Aparicio (1995-2005). It includes three central projects: 1) An analysis of the factors that impact the university graduates' achievement (two universities, 1980-2014); 2) dropouts within the same period were considered; and 3) students who have been studying longer than expected participated. This project deals with the academic units that show results about retention and performance above the medium rate, including not only basic socio-cultural and psychosocial factors but also aspects related to the psycho sociology of the organizations which have an impact on their organizational quality. The methodology is quantitative and qualitative (semantic associations). A semi structured questionnaire and interviews were applied. It is expected, at a theoretical level, to contribute to the understanding of factors that have a positive impact on the students' achievement as well as on the academic units in which they are inserted. At an applied level, it is expected that this study allows us to know the distinctive profiles and common aspects of these micro institutions so that they are transferred to decision makers and can afterwards lead to programmes for ongoing improvement.

*Keywords:* academic career, university, quality, psychosocial factors, organizational devices.

#### **1. INTRODUCTION**

The basic problem considered here is University Quality, approached not from the system figures viewpoint (graduation rates, dropping out, etc.) but from the human processes underlying them (psychosocial, socio-cultural and organizational). The quality criterion giving insight to these studies is basically cultural relevance. This project continues previous work that implied the development of several complimentary studies and two doctoral theses (Aparicio, 1995, 2005). The current project thus extends such investigations – whose main focus was the analysis of the factors associated to achievement at University and its articulation to the labour market -; all of them conducted within the Consejo Nacional de Investigaciones Científicas y Técnicas (National Scientific and Technical Research Council). In this line, each project contributed with original perspectives from the theoretical and/or methodological viewpoint and enabled to go further into the issue. Regarding its justification at a theoretical level it is essential: a) to know the weight of the factors bearing more impact on achievement in order to develop university programmes leading to strengthen the “missing” competences as well as to include preventive measures; b) to acknowledge the deep factors underlying the



achievement of those students close to graduation; c) from the point of view of the education reform (considered in a broad sense), it is vital to know the organizational devices – distinctive of each academic unit and their impact on the students' achievement within a system whose dropout rates range 70%; d) to urgently know what competences the educational system believes to develop and to contrast them to the ones perceived by the students so as to readjust them. At the applied level, the knowledge of the aspects briefly described above will allow us to implement preventive and corrective measures to avoid individual frustration and to improve institutional quality.

## 2. BACKGROUND

Studies by Cabrera & Nora (1994), Braxton, Johnson and Shaw-Sullivan (1997), offer five broad categories to classify the approaches related to dropout and retention, considering whether the emphasis assigned to the core explanatory variables falls on personal, family, or institutional factors. We can identify five approaches: psychological, sociological, economic, organizational and interactionist, which are supported by empirical research.

As regards the psychological approach, the pioneers Fishbein & Ajzen (1974, 1975) put the emphasis on the role of attitudes, beliefs, and behavioural intentions with respect to achievement. Attneave (1954) includes students' self-perception of university life. Later on, Ethington (1990) add the role of perseverance, previous academic choice and performance as achievement predictive factors, along with self-concept, perception of obstacles during studies, goal relevance, their ambitions and expectations in view of the fulfilment of their objectives (Lévy-Leboyer, 1971). A Spanish view of the importance of these factors is presented by Huertas, Montero, & Alonso Tapia (1997). This widely developed approach has changed since the 90's, when more integrating perspectives started to become more important.

As regards the sociological approach of academic achievement, the French School has made important contributions since the 1970's, especially from cultural reproductivism (Bourdieu & Passeron, 1970) and hyperculturalisms with their wide range of perspectives (Bernstein, 1965; Aparicio, 2005). In the USA, Spady (1970) considers that inclusion, social affiliation, building of tight family bonds (related to the information of our research from the notion of resilience) are essential for achievement factors that are still applicable in research.

The economicist models put the emphasis on the cost-benefit ratio students observe between their investments on education and what they expect to obtain from it within the labour market (Becker, 1964; Mingat & Rasera, 1981, Lévy-Garboua, 1976; 1977; Aparicio, 2007a; 2007b).

Finally, the organizational approaches emphasize the opportunities provided by the institutions in terms of extra-curricular offers, sports, academic support, bibliography resources, laboratories, internships, tutoring, etc. The interesting thing is, in our opinion, that these are more easily controllable factors in the managing areas (intervention level) (Corman, Barr, & Caputo, 1992).

Along this line, different models show the impulse of adaptation to university life and acceptance of the fashion or “identity” each institution presents; the role of engagement and positive interactions among students and with teachers, as well as the role of perspective, which, as stated by Tinto (1975, 1987, 1993)<sup>1</sup>.exhibits an individual side and an academic one. Nevertheless, although Tinto is one of the principal writers about this subject, the studies performed along his model do not show stable results in terms of the influence and the sense of the factors put forward. Otherwise, the concept of academic and social inclusion has been objected by other researchers as inappropriate from the general point of view (Corman, Barr & Caputo, 1992), or as applied to specific groups such as racial or ethnic minorities (Biggs, Torres, & Washington, 1998), or applied to adult students (Spanard, 1990). Whereas Tierney (1992) holds that the model has major limitations; various studies carried out with Caucasians and racial minority show that academic and social inclusion works in the same way in order to account for retention (Cabrera & Nora, 1994). This relationship between socio-academic inclusion and retention has been also observed in studies with representative samples at the national level in the US (Astin, 1993; Leppel, 2002; Tinto, 1998) and in studies on a single institution (Eaton & Bean, 1995; Kelly, 1996). There is also some evidence suggesting that the earlier students start, the better their results are (Gerdes & Mallinckrodt, 1994; Berger & Milem, 1999).

Bean (1980) and Bean and Metzner (1985) adds the persistence factor to Tinto’s model, thus, following Price’s model (1977). Later Pascarella, and Terenzini (1991) suggests, in turn, a model that combines institutional and environmental features, distinguishing five groups: 1) personal features (aptitudes, performance, personality, ambitions, and ethnicity); 2) structural and organizational factors (admission systems, selectivity); 3) environment; 4) interactions within university life; and 5) the quality of students' effort. This last variable, effort, is the core of Pace’s model (1988). On the other hand, Cabrera and Nora (1994) say that continuance at university rests on three mainstays: economic possibilities, perception of benefits, and a suitable academic and social inclusion.

A more recent approach, the psychosocial approach, claims that it is necessary to test the relationship among motivation, social and institutional constructs. This implies considering academic goals, institutional performance, social support, tight bonds (one of the most relevant indicators of resilience), decision-making processes, among others.

We observe that the constructs, despite some differences, describe a series of coincidences, experiences and academic and social forces that could influence on the individuals, globally favoring persistence and completion of studies. In the foregoing methods, the general framework comprising the different components lies in academic and social involvement, i.e., as long as the students feel engaged (Astin 1985) or included within the academic and social systems of their respective institutions (Tinto, 1975, 1987, 1993). Studies carried out in the US also show that the best predictors for graduation are academic training and student’s motivation (Adelman, 2004; Pascarella & Terenzini, 2005).

Compared with the foregoing methods, ours integrate a variety of these factors grouped in the last two approaches: psychological and organizational (see especially Aparicio 2005; 2006a; 2006b; 2008a; 2008b). Some variables used in the afore mentioned models are incorporated and the impact of these variables on the subjective and objective

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<sup>1</sup>Tinto’s theory on student dropout is, probably, the most broadly used theoretical framework in relation to retention at university. Braxton and Hirschy (1999-2004) consider the theory as an “almost paradigmatic dimension”: 775 quotes on the sociologic interactive model. That model is similar to the Astin’s I-E-O Model (1985, 1991)

achievement is analysed based on quantitative methodologies and predictive models (Aparicio, 2005); on the other hand, in the light of qualitative methodologies, we intend to account for the origin of this problem and the significance of dropout in the students' personal-professional experiences.

In this study, we discuss, from a qualitative point of view, the psychosocial aspects of the problem (processes leading to dropout and going against retention), and the institutional aspects, which have been observed in some typical practices identifying each course of study and, in a more global manner, the university. All this has an impact on the perseverance and success in studies and employability<sup>2</sup>. Individuals, institutions and macro-social contexts interweave in this analysis (Aparicio 2008; 2009a; 2009b; 2009c). Here lies the uniqueness of our quantitative/qualitative *sui generis* model.

### **3. OBJECTIVES**

#### **3.1. General Objectives**

To comprehend the deep-seated causes underlying relative achievement present throughout university life from a qualitative perspective.

#### **3.2. Specific Objectives**

To determine the influence of the “social competences”, as we call them, as well as the specific organizational mechanisms implemented by each academic unit in academic performances.

To analyse the relevance of motivational factors and, especially, the attitudes of the individuals and teachers during the different stages of university life in relation to achievement (qualitative analysis).

To identify effective teaching practices which have a decisive impact on the continuance and graduation of students, with the purpose of designing a quasi-typology for each course of study.

### **4. HYPOTHESIS**

As regards retention and achievement at university (objective, from the point of view of performance, and subjective, from the point of view of satisfaction), the following play a key role in comprehension: a) psychosocial variables (effort, motivation, engagement); b) social competences (resilience, coping styles, cooperation and inclusion capacity, problem-solving skills,...); and c) effective organizational-educational practices, regarded positively by students (shared social representations in relation to the training received and their effectiveness, etc.).

The hypothesis includes elements stemming from different theories, particularly motivational/socio-cognitive and organizational as well as the more thoroughly internationally studied factors in relation to achievement, as it has been shown by the recent state-of-the-art.

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<sup>2</sup>Other factors related to achievement, such as engagement and internality, measured through specific tests, have been the object of the quantitative analysis and are excluded from this work.

## 5. METHODS

The quantitative and qualitative methodologies were used in order to account for and thoroughly understand the phenomenon of achievement in individuals studying in the UNCuyo Academic Units which exhibit highest retention figures. Quantitative techniques: files and semi structured questionnaires in order to assess the psychosocial and organizational aspects. They are included to the research design as intervening/independent variables (conditioning).

Qualitative techniques: open questionnaires were included at the end of a semi structured questionnaire. Detailed interviews and interviews to key informants were also added. Afterwards, hierarchic evocations were analysed.

Their application allowed us to know, on the one hand, the social representation self-perception shared by the students about the efficient educational practices developed by the institution, and which may result in greater commitment and involvement as proxy of their university experience success. On the other hand, the application of such instruments enabled us to assess the level of development of the social skills competences which are associated to achievement.

Those instruments were applied individually.

Regarding the approach, it is cross-sectional. Further studies are expected to be done (longitudinal design) in order to analyse the impact of the already considered variables on the labour market. The pursuit of the research work will allow us to control the development of the educational system quality indicators included in the semi structured survey required by CONEAU (Comisión Nacional de Evaluación de la Calidad, Argentina/ National Committee of Quality Evaluation, Argentina)

The population being studied includes samples of subjects studying at academic units which exhibit high performance results (according to statistics shown by UNCuyo) and who are attending the 4th year of their careers, that is, close to their graduation and who have overcome the critical drop out stage. The updated institutional data will complement the information already obtained within the central project on which the present work is supported.

Random start stratified and systematic sampling was used and it was done using the data provided by the Department of Statistics of the University President Office in agreement with the Representatives of each academic unit. Three-levelled analysis were made: descriptive, explicative (statistical), and particularly qualitative.

## 6. RESULTS

We discovered the factors which have an impact, especially, on academic achievement by courses of study and academic units, and then, transference was made to the institutional authorities. This transference will be extended to other Faculties and Universities (cooperative programs). We expect these findings to contribute, in the Faculties with less retention, to take measures aiming at a constant improvement of the system. Briefly:

a) At the psychosocial level, there appear dimensions, in the core of the shared representation, such as engagement and the ability to face difficulties (positive coping strategies). There also appears, in a significant manner, the sense of effort, the value given to the university degree as a positive tool for labour insertion, clear goals and well-defined life projects, entering University with the clear goal to conclude studies, previous

successful academic experiences, career choice based on vocation, prevalence of search for personal fulfillment over other factors.

b) At the organizational level, the students of each course of study revealed the strengths and weaknesses regarding administrative staff support, organizational quality, mechanisms of support (especially, when into difficult situations with their teachers or peers, difficulties with some subjects or life situation), institutional consulting devices. Finally, reference was made to extra-curricular activities which strengthen the socio-emotional bonds and favor the consolidation of social competences (i.e., being able to act in specific “situations”). On the other hand, it was determined that business stages, “alternation” (i.e., early insertion into the labour market – not widely spread at this University), represent positive aspects which help determining the present working conditions.

## **7. FUTURE RESEARCH DIRECTIONS**

At present, work is being done on the basis of university students’ achievement profiles in relation to the labour markets where other populations may perform: doctors and teachers. Models include core, sociocultural, psychosocial, structural and organizational variables. Methodology is quantitative and qualitative since we are interested in analysing the impact of diverse factors, differentiating those which are significant from those which may have negative effects and whose practices may be readjusted. Basically, we are interested in inquiring about the “sense” that the different actors give to their education and the importance it has in a world which aims at a greater saturation of graduates at the same time that university certificates are devaluing.

Besides, comparative studies with French universities are being done, bearing in mind that, in spite of the two contexts being different, the Argentine institutional culture considered, on many occasions, the French model as a reference. This work, which the author has developed for a long time (more than two decades), has made it possible to create a new theory that helps us to do a different reading of individual, organizational and macro levelled self-sustenance.

The essential inspiring objective is always the same: to know the factors that impact on achievement so as to transfer the information to the decision makers, aiming at changing inefficient practices. Without knowing such factors (quantitative) and dimensions (qualitative) it would be difficult to introduce changes based on empirical references rather than on ideological factors.

## **8. CONCLUSION/DISCUSSION**

For decades, achievement has been a worldwide concern, mainly due to its consequences at different levels: personal (self-realization), institutional (a priority in many countries which undergo institutional evaluation), organizational (especially labour organizations), and even national level. Education goes hand in hand with development and falls in the international quality rankings (PISA Project) constitutes a challenging situation.

Therefore, it is important to: a) make sui generis systemic analyses (Aparicio, 2007a; 2007b) that consider different interacting factors without overlooking the “reasons” that enlighten the actions of the subjects and without which the understanding of the deeper roots of failure would not be feasible; b) conduct “contextualized” studies which unveil the actual weight in “located” settings (here, each School presents differentiated levels and factors of achievement on which courses of action must be taken); c) contribute to the

theoretical development of the problem, addressing the factors historically included in investigations conducted on achievement in the light of new integrative perspectives. Concerning the factors/dimensions here analysed, the hypotheses confirm the findings of models produced in the North hemisphere as to the incidence of the organizational practices. The answers to our studies guiding questions bring out “reasons” which despite being non-observable or non-measurable, underlie the globally considered achievement rates.

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## Chapter # 18

### THE RESEARCH ON MOTHERS' OPINIONS ABOUT SCHOOL READINESS OF THEIR 66-72 MONTH-OLD CHILDREN

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#### ABSTRACT

The present research was aimed at studying mothers' opinions about school readiness of their 66-72 month old children receiving and not receiving pre-school education. The scope of the research consists of mothers from Konya -Turkey whose children receive pre-school education and do not receive any pre-school education. The sample of the research consists of 120 mothers in total- that is, 60 mothers having 66-72 months of children that receive preschool education and 60 mothers whose children do not receive preschool education. "Mother's View of Child's School Readiness Scale" was employed as data collection tool. It was found that there was a significant difference between mothers' opinions about school readiness of children and the condition of receiving-not receiving preschool education in terms of readiness from mother's viewpoint, intellectual-linguistic development, social-emotional development, physical development and the general total points. The same difference was not observed in the self-care skills.

*Keywords:* mother's opinion, child, pre-school education, school readiness.

#### 1. INTRODUCTION

Mention is made of the family in the life of children but it has to be divided into mother and father. Generally, mothers bear a different kind of responsibility from fathers in children's lives. For a child, the father is seen rather as a playmate but the mother is the person who meets the child's almost all needs (Kotil, 2005). Father and mother are important in the early years of life but when the children reach age 3 or 4, their interest in friends as well as in the family members increases. However, father, mother and the family environment are still important for children. Children aged six or seven are now faced with the task of entering into a new environment where they will spend a large part of their lives and they have to adjust to this environment. This new environment is the primary education institution (Kılıc, 2008).

Starting school is one of the turning points in a child's life (Polat-Unutkan, 2007b). Therefore, the child's introduction into school life requires a period of preparation (Cakmak & Yılmaz, 2009).

Once they start school, children are faced with the question of adapting to a new environment different from home and family life and they have to endear themselves and get approved by their teachers and friends in this different environment (Polat-Unutkan, 2007b). In this process, the mutual interaction between parents and the child has a key effect on the child's development. The process of adjustment involves a new experience not only for the children but also for the family. Children begin school with an inventory of experiences, habits and skills which they have so far acquired through their interactions with their families and immediate surroundings. Factors such as sending children to an educational institution in the pre-school phase, reading books to them from early developmental ages on, taking them to the theatre, the cinema, concerts, art exhibitions and museums and discussing what has been seen with them are significant opportunities offered to children in terms of pre-school education. Attitudes of parents towards child rearing and their treatment of children influence children's intellectual, cognitive, emotional and social development. This is a point specifically emphasized by social learning theorists and theorists of psychoanalysis (Erbay, 2008; Inal, 2012; Lokumcu-Tozar, 2011; Ulku, 2007).

One of the goals of pre-school education in Turkey is to prepare children for the programmed education which they will later attend. Not only had those receiving pre-school education but also those at home need to acquire the skills required to be successful at primary education. Both pre-school education and family have a significant role in the acquisition of these proficiencies (Dinc, 2012; Oktay, 2010).

In the new environment, children are for the first time faced with tasks such as participating in planned and programmed educational activities and learning to read- and write, which is the most important task in primary education, and acquiring basic arithmetic skills. In order to be able to meet the expectations of this new social environment and adjust to this new environment, children need to have a certain level of readiness (Erkan, 2011).

The concept of readiness has been used differently in the literature. The concept was for long used in conjunction with reading-writing or starting school. Today, it is generally used in the meaning of being ready (Oktay, 2010). Students in the first grade of Primary education have defined school readiness as attaining maturity required by the first grade of primary education and they pointed out that this maturity depends on parallel development of children's social, emotional, mental and physical developmental areas (Kocuyigit & Saban, 2014).

Readiness involves the features that an individual already possesses in a new learning situation. In addition to the age and the development of school age children, their attitude and motivation towards school determine the level of their readiness for school (Aydın, 2009).

Readiness, which is a larger concept than maturation, assumes an individual should possess the necessary preliminary information, skills and attitudes required to perform a task. Thus, readiness covers both the concept of maturation and the preliminary qualifications needed for the task (Kılıç, 2008).

As can be understood from all these definitions, the level of readiness to school, which may vary from one child to another, is a concept that involves a child's maturation in all areas of development in a balanced way together with a significant substructure and has a performance that allows demonstration of all characteristics (Lokumcu-Tozar, 2011).

There is no consensus in Turkey as to with what skills and proficiencies (competences) children should start primary education with. Irrespective of whether or not they have received pre-school education as well as their individual differences, children over 72 months are introduced into primary education. Which of the children that have started school possess the maturity for school is known by neither their parents nor their pre-school teachers. While some children are ready for school in terms of their intellectual development, they may not be so emotionally ready. Starting primary school will be a tough and stressful job for these children. Whereas some children manage this transition easily, others need support in this regard. A harmonious and smooth transition from home to primary education is made possible by possessing a degree of school-ready maturity. Therefore, questioning what skills and proficiencies the phenomenon of readiness to school is composed of is of huge significance (Kocyigit & Saban, 2014). Polat-Unutkan (2006) cited physical, mental, emotional and social and environmental factors among the major factors affecting readiness to primary education.

Assessing whether children are ready for primary education or not varies in different countries depending on different views (Esaspehlivan, 2006). Children are equipped with necessary qualifications for school readiness and as a natural result of this some inequalities are eliminated, thereby increasing their school achievement. In Turkey, on the other hand, "chronological age" is regarded as the fundamental criterion to start primary school and therefore children's shortcomings and aspects that need to be supported cannot be identified. A child's readiness to meeting the requirements of school and especially to reading and writing is a multi-faceted and complex phenomenon. Here, both children's individual development and abilities and the impressions they receive from their environment, that is, what they have learned before have a huge effect. Studies indicate that pre-school experiences have an important role in whether or not the children in the early years of primary education will be successful and happy (Kılıc, 2008; Yapıcı & Ulu, 2010). Trying to teach something to children who are not ready to learn it will not only lead to inefficiency but at the same time to failure, disappointment and humiliation in children (Erkan & Kırca, 2010; Lokumcu-Tozar, 2011).

As a result of parental observations and studies conducted in Turkey, one of the important factors in children's transition from pre-school education to primary education seems to be the social factor but in fact this is "family" (Ulku, 2007). The most important task in proper development of children in this period belongs to parents. In order for parents to perform this task, they need to develop positive attitudes towards child rearing (Erbay, 2008).

Studies conducted emphasize that views of the family or the teacher significantly affect the ways of rearing children and educational practices. Although there are some who argue that leaving the decision about a child's starting school to parents is inadvisable, (Kutluca-Canbulat & Yıldızbas, 2014), there are also others who suggest that not having a common vision about readiness to school on the part of adults who are involved in children's education will affect children's skills, attitudes and behaviors (Retold by Ozen-Altinkaynak & Akman, 2013).

Based on the views of mothers evaluating school readiness skills of children of mothers whose children receive and cannot receive preschool education opportunities appears as a significant issue that must be researched. The present research aimed at studying opinions of mothers on school readiness of their 66-72-month-old children that received and did not receive pre-school education.

## **2. METHOD**

### **2.1.Scope and Sample**

The scope of the research, which has a screening model in causal-comparative research design, includes mothers having 66-72-month-old children that receive and do not receive preschool education in the province of Konya-Turkey. The sample of the research consists of 120 mothers- that is, 60 mothers having 66-72 months of children that receive preschool education and 60 mothers whose children do not receive preschool education. In the study group, 71 mothers (59.2%) are primary school graduates, 32 mothers (26.7%) graduated from secondary education institutions and 17 mothers (14.2%) have bachelor's degree. 75 participant mothers (62,5%) are housewives, 13 participant mothers (10.8%) are officials, 13 participant mothers (10.8%) are tradeswomen, 19 participant mothers (15.8%) have other occupations. Fifty-five of mothers (45.8%) have daughters and sixty-five of mothers (54.2%) have sons.

### **2.2. Data Collection**

In the research, personal information form developed by the researchers was conducted on parents of children in order to obtain the information related to the parents, and 'Mother's View of Child's School Readiness Scale (MVCSRS) 'developed by Kotil (2005) was employed to evaluate mothers' opinions about children's readiness for primary school and development. Mother's Views of Child's School Readiness Scale consists of five dimensions including readiness from mother's viewpoint (20 items), intellectual and linguistic development (29 items), social emotional development (12 items), physical development (21 items), self-care skills (12 items), and 94 items in total. The scale is based on information that mother can observe at home. According to replication frequency, the behaviours of children are graded by mother as never (1), rarely (2), sometimes (3), often (4), always (5). The Cronbach Alpha value of the scale is .95.

### **2.3. Data Analysis**

The perceptions of mothers about school readiness levels of their children depending on the condition of receiving-not receiving preschool education were analysed through "Independent T-test".

## **3. FINDINGS**

In the study, in order to determine the mothers' perception of their children's levels of readiness to school depending on children's receiving-not receiving pre-school education, "Scale for The Child's Readiness to School According to Mother" was administered to the mothers. Table 1 shows independent t-test results conducted for total and sub-scale points of children's readiness to school scale according to mothers depending on the variable of receiving and not-receiving pre-school education.

*Table 1. Results of Dependent T-Test Conducted for Total and Sub-Scale Points of Mother's Views of Child's School Readiness Scale Depending on Receiving-Not Receiving Preschool Education.*

	<b>The Condition of Receiving Preschool Education</b>	<b>n</b>	<b><math>\bar{X}</math></b>	<b>S</b>	<b>sd</b>	<b>t</b>	<b>p</b>
Readiness from Mother's Viewpoint	Receiving Preschool Education	60	96,10	8,67	118	4,30	,000
	Not Receiving Preschool Education	60	88,78	9,88			
Intellectual-Linguistic Development	Receiving Preschool Education	60	137,30	9,58	118	4,73	,000
	Not Receiving Preschool Education	60	126,53	14,76			
Social-Emotional Development	Receiving Preschool Education	60	55,43	5,22	118	2,39	,018
	Not Receiving Preschool Education	60	52,88	6,38			
Physical Development	Receiving Preschool Education	60	100,55	9,87	118	4,93	,000
	Not Receiving Preschool Education	60	91,28	10,67			
Self Care Skills	Receiving Preschool Education	60	56,88	5,69	118	1,33	,186
	Not Receiving Preschool Education	60	55,55	5,26			
General Total	Receiving Preschool Education	60	446,26	29,56	118	4,87	,000
	Not Receiving Preschool Education	60	415,03	39,80			

When the t test results in Table 1 are examined, it is seen that there is a significant difference below the level of 0.05 for children receiving preschool education between mothers' opinions about school readiness of children and the condition of receiving-not receiving preschool education in terms of readiness from mother's viewpoint, intellectual-linguistic development, social-emotional development, physical development and the general total points. The same degree of significance in the difference was not observed for the self-care skills.

The results of the t test given in Table 1 show that in the readiness dimension from the mothers' points of view, the mean score of mothers whose children have received pre-school education is ( $\bar{X}$ =96.10) whereas the mean score of mothers whose children have not received pre-school education is ( $\bar{X}$ =88.78). In the mental-linguistic dimension, the mean score of mothers whose children have received pre-school education is ( $\bar{X}$ =137.30) while the mean score of mothers whose children have not received pre-school education is ( $\bar{X}$ =126.53). In the social-affective development, the mean score of mothers whose children have received pre-school education is ( $\bar{X}$ =55.43) whereas the mean score of mothers whose children have not received pre-school education is ( $\bar{X}$ =52.88).

In the physical education, the mean score of the mothers whose children have received pre-school education is ( $\bar{X}$ =100.55) while the mean score of mothers whose children have not received pre-school education is ( $\bar{X}$ =91.28). In the self-care skills, the mean score of mothers whose children have received pre-school education is ( $\bar{X}$ =56.88) whereas the mean score of mothers whose children have not received pre-school education is ( $\bar{X}$ =55.55). In terms of the general total scores, the mean score of mothers whose children have received pre-school education is ( $\bar{X}$ =446.26) while the mean score of mothers whose children have not received pre-school education is ( $\bar{X}$ =415.03). According to these results obtained from the study, a significant difference was identified in favor of mothers whose children have received pre-school education at a significance level of 0.05 between children's readiness to school from their mothers' view and whether or not children have received pre-school education in terms of readiness from the mothers' points of view, mental-linguistic development, social-affective development, physical development and the general total scores except for the self-care skills.

#### 4. DISCUSSION

The findings from the research showed that there is a considerable difference on behalf of children receiving preschool education between maternal opinions about school readiness of children and the condition of receiving-not receiving preschool education in terms of readiness from mother's viewpoint, intellectual-linguistic development, social-emotional development, physical development and the general total points. The same difference was not observed in self-care skills. Mothers whose children receive preschool education opportunities find their children more adequate in terms of school readiness skills.

Karataş (2009) describes the effect of preschool education on the child development as; socialization, ability of self-expression, support for cognitive development, academic learning, decrease in the rate of grade retention and dropping out, improvement in nutrition and health of children, better social emotional behavior development, more positive parent-child relationship, being self-sufficient individuals in adulthood and being individuals having high economic earning potential in future. In the study conducted by Senemoglu (1994), it is indicated that preschool education provides children with self knowledge of all features and self-acceptance, awareness of their own cultural aspects and other cultures' aspects, impressive communication via language, music, dance, drawing, and it contributes to skills such as multiple thinking and problem solving and creativity.

Receiving pre-school education makes a significant difference in terms of children's readiness to school (Erkan, 2011; Erkan & Kirca, 2010; Esaspehlivan, 2006; Lokumcu-Tozar, 2011). There is a significant correlation between the variable of receiving pre-school education and children's mathematics skills (Polat-Unutkan, 2007a). Moreover, it was found that listening, speaking, reading, dictation and writing skills of children who have received pre-school education are higher than those of children who have not received pre-school education (Ozcan, 2014; Topcu, 2012). In addition, it was seen that receiving pre-school education positively affected children's social skills (Erbay, 2008; Yener, 2014) and academic achievements (Ozkesemez, 2008).

According to a study conducted by Cakmak & Yilmaz (2009), families played the role of creating a reading circle for children and acting as a guide in ensuring children's readiness to school. It can be said that pre-school education is effective in terms of readiness to primary school and in this sense pre-school education program has served its purpose (Yazar, 2013).

Mothers are regarded as the first teacher of their children within the first three years of children's life. Especially mother's level of education is a factor that might influence the communication she establishes with the child. As the mother's level of education increases, so does her perception of the child as being ready to school. A significant correlation was observed between children's readiness levels to school and mothers' views about their children's readiness levels to school (Kotil, 2005).

## 5. CONCLUSION AND RECOMMENDATIONS

In conclusion, the research results showed that there is a considerable difference between mothers' opinions on school readiness of children and the condition of receiving-not receiving preschool education in terms of readiness from mother's viewpoint, intellectual-linguistic development, social-emotional development, physical development and the general total points. Consequently, future studies can be done in order to demonstrate the importance of preschool education and its effects on developmental stages of children, especially school readiness skills.

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## Chapter # 19

### TEACHING AND LEARNING IN TECHNOLOGY RICH SCHOOLS: TRADITIONAL PRACTICES IN A NEW OUTFIT

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#### ABSTRACT

Twenty-five years ago an educational project was carried out in a school class in Melbourne Australia using one-to-one laptop computing for educational purposes. The project took place well before initiatives by global hard and software corporate giants to develop one-to-one computer actions as a global venture in the pursuit of profit. A discourse of technology optimism has worked as a driver in these developments, particularly at school levels. In it computer technology is claimed to solve problems and create educational change and effectiveness when it actually can't and above all doesn't. In the chapter we examine aspects of the discourse at work through critical ethnographic research.

*Keywords:* Educational technology, IT, critical ethnography.

#### 1. INTRODUCTION

This chapter takes its departure from a 25 year old educational project at a girl's Methodist school in Melbourne Australia, which was one of the first school classes recognised as using one-to-one (1:1) laptop computing for educational purposes. This was well before initiatives by hard and soft-ware corporate giants to develop 1:1 computing as a global strategy in the pursuit of profit based on optimistic claims that computer technology can solve educational problems and create educational change and effectiveness (Ende & Dolfsma, 2005; Jagodic, Courvisanos, & Yearwood, 2009; Selwyn & Facer, 2013). This technology optimism discourse has been prominent part of the educational debate during the past 25 years (Nivala, 2009; Player-Koro, 2012b). It announces the capacity of technology to change school practices and outcomes in a progressive common interest, whilst at the same time enabling and supporting a take-over of pedagogy in a manner that allows schools and their agents and practices to be subsumed to the interests of corporate profit (Hjörleifsson, Árnason, & Schei, 2008).

Corporations have made vast profits from the sale of computer hard- and software to schools in 1:1 laptop initiatives as well as in other similar ventures, with little evidence of strong transformational effects or increased general efficiency (Player-Koro, 2012a; Selwyn & Facer, 2013). The technology optimistic discourse has in this way become a marketing strategy based on an over-trust in science that shapes policy and public investment in the interests of private corporations (like Microsoft, Dell or Apple). The present research has explored this through an imminent critique of technology optimistic policies concerning 1:1 laptop projects in which we confront the optimistic policy claims with the reality of educational outcomes and the strong demands of educational renewal in practice. We ask if a process of false marketing and an exploitation of education can be said to have taken place.

## 2. BACKGROUND: THE HUMBLE BEGINNINGS OF 1:1 PROGRAMS

1:1 laptop initiatives are now global activities that are very well known within education. However, there are certain things that are often assumed about them that are quite exaggerated and other things that are not at all well known. One of the latter concerns the origins of 1:1 computing in school in a 1:1 laptop program in 1990 in one school class at an independent girl's school in Melbourne Australia called the Methodist Ladies College (Johnstone, 2003) using a set of modest off-the shelf standard lap-top computers bought by the parents of the pupils. It signals that 1:1 initiatives, although often marketed as innovative new millennium projects, are actually quite old and that contrary to common understanding, they didn't start on the basis of research in California, Washington or Cambridge Massachusetts or research sponsorship from IT organization like Microsoft and Apple. They started on laptops that were bought from money provided by the parents of pupils at a girl's school in Melbourne and distributed to the class by teachers at the school (Johnstone, 2003). Moreover, contrary to recent hype about the value of IT in education (Player-Koro, 2012a) the intention was not to transform the learning culture, curriculum, and teaching-learning paradigm and practices of the school. Instead the hope was simply that the laptops would be valuable teaching and learning aids much like the textbook and pen and paper had been. Thus, the original 1:1 laptop initiatives weren't part of a global corporate venture; corporate capital became interested afterwards; nor was the initial project trying to transform educational culture and practices, but rather act as an aid in support of established educational practices. Also noteworthy is that 1:1 computing in the initial experiment did not result in any kind of significant learner-empowerment or educational-transformational effects. These are also claims that have been made afterwards (Bocconi, Kamylyis, & Punie, 2013; Kamylyis, Bocconi, & Punie, 2012), often with very little empirical evidence (Goodwin, 2011). They grew from an important link. The Melbourne experiment involved some business interests through the computer hardware dealer for the MLC-school, a company called Computelec. Computelec later became the Australia-wide software distributor and major retailer for Microsoft products that connected the Microsoft and the Gates Foundation to the Australian market and the project. These organisations recognised the possibilities presented by the experiment and then added economic incentives. They sponsored visits to Melbourne by teachers and school leaders in the early 1990s so American educators could learn from the Australian programme and bring the initiatives stateside (Johnstone, 2003).

There is a significant point to be made here about a common relationship between capital and education. Capitalist corporations are often keen to seem to sponsor education. It is good for their market image and laptop initiatives are often part of sponsorship packages (Ball, 2012). However, what has happened in the 1:1 case at hand here is more in line with another scenario, where capitalist organisations look for new possibilities for making a profit and then, once they have confirmed the presence of these possibilities, they invest money to expand and exploit them through, in the present case, the peddling of computers on a massive scale and the creation of new (spin-off) needs such as study guides, licensed software, e-educational courses and other digital learning tools (Ball, 2012). This has created an entire new edu-industry. It is one further example of how the capitalist class reaches into the heart of living culture to steal its ideas and then sell them back at a vast profit.

### **2.1. The investigation and its aims and methods**

The present chapter is based on the results from ethnographic research in four upper secondary schools in Sweden that examined whether the claims that are made about laptop initiatives are actually realised. The data has been produced through surveys, semi-structured focus group interviews with school principals and teachers, and video observations from everyday work in classrooms over a two-year period. This was done to help us gain empirically generated insight into what digital technology means both in and for education today. We wanted to make visible, describe and analyse everyday educational/ pedagogical work in these technology rich schools to see exactly how (or perhaps if) education really is made more innovative and productive by the use of 1:1 laptop technology.

Immanent criticism has played a vital role in the research. This is a method from critical theoretical research that sets out to detect contradictions by juxtaposing ideas such as those expressed in educational policy texts and promises with lived educational realities and actual outcomes. It locates distinctions between what something is claimed to stand for and what actually appears to be happening (Street & Copeman, 2014). The intended effect is one of surprise through the creation of a momentary apprehension of gaps in our common knowledge-producing tools. The intention is to provide a picture of both the daily teaching and learning as well as of the context surrounding these activities at the local schools under study that can be held up to and compared with the vision of optimism in official policy and marketization.

The four upper secondary schools in the research were all situated in relatively wealthy suburbs with a predominantly middle and upper-middle class intake. Sweden is known for its one-school-for-all principle of education, but since the decentralisation and marketization reforms of the late 1980s and early- to mid-1990s, profiled intakes have become increasingly common (Arreman & Holm, 2011) as has pedagogical profiling as a market strategy (Schwartz, 2013). This has been described generally as having negative effects of educational equity but in terms of the present project the combination of a middle-class catchment and an IT-profile could be assumed to be positive in terms of increasing the possibilities for successful one-to-one projects and effective learning outcomes. That was our assumption at least and the choices therefore represent positive case selections for investigating whether fundamental transformations in education have occurred through and in conjunction with the 1:1 initiatives. The following questions were given special attention:

- What teaching and learning patterns can be found in the educational practices in these technology rich environments?
- What discourses appear to structure these educational practices?
- What transformational potential is suggested by the data and analyses?

### **2.2. The theoretical framework**

This research is grounded in theoretical traditions in which educational systems are seen as part of society's instruments of social integration and control. This has important consequences, because from within this theoretical tradition, schools and classrooms are not reduced to mere transmission systems and 'the digital' part of the educational context is considered, along with everything else that 'happens' in educational organisations, as the outcome of struggles between different agents and discourses. Basil Bernstein's theoretical concept of *the pedagogic discourse* has been important to the research. The pedagogic discourse is realised and made visible through activities in the classroom and has its roots

in the modality (classification and framing) of the social relations of actual classroom practices, such as in the selection of subject content and establishing rules for the transmission and acquisition of knowledge and skills (Bernstein, 2000). This involved investigating how and why IT is being used in education and how this use (or non-use) is valued. The intention was to describe how the content and practice of education and teaching was formed in situations where language and communication work and are analysed as functional and even meta-functional tools that comprise sign systems for mediating human-world relations with ideational (i.e. they are 'about something'), interpersonal (i.e. they are about 'doing something') and textual (i.e. they are facilitated by 'the speaker/communicator's text-forming potential') elements (Halliday & Kress, 1976). From this perspective educational technology is assumed to provide important specific features that can be taken up directly in recorded observation protocol and dialogue that can be further analysed in the research.

### **2.3. Doing the ethnography**

Doing ethnography means basically trying to learn about people and their everyday lives based on long-term engagement and extensive participant observation by watching what is going on, listening and feeling. It produces a particular kind of sensuous practical knowledge because of this that has been gained from skills of perception and capacities of judgement that develop in the course of direct practical engagements with our surroundings and people in them (Beach & Player-Koro, 2012). Ethnography is particularly strong because of these characteristics in producing unique studies that provide detailed, in-depth descriptions of practices and meaning along with finely grained knowledge about the conditions of specific educational systems and their demands and practices.

For the present chapter empirical material has been produced through two years of participant observation of day-to-day activities in four upper secondary schools and the use of digital technology in the teaching process and interaction between students and teachers there. They were documented using a video recorder (in some cases) and by taking observational and transcriptional field-notes. The fieldwork involved two to three days each month during one year of observations along with two online surveys with teachers in 2012 and 2013, semi-structured group interviews with school principals and semi-structured focus groups meetings with 8 groups of 3-5 teachers.

The selection of classrooms for the first rounds of observation were made by the school principals (head-teachers) based on the criteria that the teachers there were particularly knowledgeable about IT and innovative in their use of it (4 lessons of approximately 1 hour each). This is in line with our intention to prove ourselves wrong about the limited use value of IT. The assumption was that these IT-committed educators would use IT extensively and inventively thus maximising the possibility for us to identify new use values in it.

## **3. RESULTS**

The different data were developed for somewhat different ends and provide different kinds of input. The survey will be presented first. It was used to provide a picture of how the pedagogical work of teachers was influenced by digitalisation. The results did not differ significantly between the two years. In this chapter we refer to the 2013 survey and the responses of 276 teachers who returned their completed questionnaire (147 woman and 129 men) from the initial sample of 352. The questionnaire was constructed with fixed interval items where the respondents were asked to express agreement or disagreement with a series

of statements. We asked standard questions about teachers' professional development, school improvement, assistance and support, and more specific questions about the teacher's use of digital tools in teaching, their attitudes towards the use of digital tools in teaching, the skill necessary to support students in their use of digital technologies, and changes in the teacher's work due to the introduction of digital technology. The teachers also had the opportunity to add their own comments in their own words in a number of open-ended questions.

The results of the survey were meant to provide a kind of overview of dispositions and understandings of practice. They showed that 201 out of 239 (84%) responding teachers used IT more than once a week in their teaching and that 40% of them used it on a daily basis. These teachers described search features, production and distribution of educational materials and the computer screen as a new tool for communication (where the projected screen image became in effect a new whiteboard) as the main reasons for using the computer. It was quite simply a better tool. Observation protocol supports these points (below).

Teaching from the front of the classroom was still the most common way of organising the lessons according to 23 % of the teachers who stated that teaching from the front was used in more than 50 % of their teaching time, whilst 61 % responded that this way of organising classroom work occurred in at least 30 % of their teaching time. This commitment to conventional regionalisation forms was also discussed during focus group interviews. The teachers said these things like:

The computer is second nature now... But teaching is no different ... I stand at the board... Before I had an overhead projector whereas now I use PowerPoint. ... Yes ... now it is natural... (Focus group interview 2012-06-12)

What is suggested here is how the use of the computer and the teachers' use of space created a focal point in the classroom around the whiteboard and projector screen, which were used for displaying the computer screen content in what seemed to be quite conventional way (see also fig.1) in front focussed ways as described in for instance Beach (2008). This fairly conventional regionalisation and appropriation of space applied even though, not despite, IT being fully integrated in the teachers' everyday work (Beach, 2008).

Text production was also an important reason for using IT according to the teachers. Sixty-eight percent of them stated that the computers were used for this purpose at least once a week, replacing in this sense pen and paper processes of text production and providing a way to collect, share and disseminate information between teachers and students. This was often done through the learning management system (LMS). Eighty-one percent of the teachers stated that they used the LMS system for communication around students work at least once a week. This administrative function became a kind of information exchange centre. These ways of using IT also came up during the interviews.

There has been a tremendous gain in communication. Students can retrieve articles from the Internet or go to any Twitter account and tweet directly with politicians for example. It's a big change [but] not pedagogically. IT provides tools for communication and has brought the world closer by helping students to listen to things they wouldn't have and find interesting texts. (Focus group interview 2012-06-14). I no longer [have to] make photocopies for students. I just put everything on the learning platform. (Focus group interview 2012-06-19)



I have not had to distribute a single paper so far. I have everything on the learning platform and the computer [A]. I can stream movies [and] no-longer use the usual textbooks. I search on specific topics [which] saves time and students get a different picture than just reading a book [B] (Focus group interviews A 2012-06-12 and B 2012-06-19)

The students and I can find the latest information on the web. I wouldn't-be without this now... Also, whereas before the students left their exams in my box, now they submit them through the computer... The difference is in communication. (Focus group 2012-06-14)

In relation to the research question concerning the teaching and learning patterns that are evident in technology rich educational practices the results here show that the 1:1 initiatives have resulted in a high frequency of use of IT as an integrated tool for teaching and that IT is a component of a digital infrastructure that is also used for the organisation of the education. The learning platform is a key component of this. But in many senses these changes don't represent changes in pedagogical principles or discourse. IT is replacing traditional media rather than changing principles of organisation and communication or transforming educational power relations. It has affected some working methods but teaching is organised primarily according to traditional patterns and power relations.

One example of consistency with the past is that the power centric relations of space that have been found in classrooms have not been reconfigured and, as in Beach (2008), the modality of education does not seem to have been affected significantly in terms of classification, framing, or pedagogic discourse. This is also in line with our initial starting scepticism. Previous studies have repeatedly shown a considerable lack of evidence regarding the transformation of education culture or enhancements of general educational standards (Balanskat, Bannister, Hertz, Sigillò, & Vuorikari, 2013; Goodwin, 2011; Larkin, 2011; Tallvid, 2015). Indeed in Sweden for instance these are often reported to have become considerably worse. At the same time as most of the Swedish schools have initiated or planned for 1:1 initiatives several international studies reports on drastic deterioration of Swedish pupils' academic performances<sup>12</sup>.

### **3.1. No significantly transformative changes**

Sometimes the explanation for the failure or absence of IT impact is made by pointing at the teacher as the major hindrance to the successful implementation of technology in schools (Drent & Meelissen, 2008). However, this cannot be said to apply in the present case, as most of the teachers were experienced IT-users who expressed a positive attitude toward technology and found it useful for managing their professional work. Thus an important point for us in this respect is to stress that it is not the teachers who should be regarded as failures. Instead, the use of technology should be analysed and understood in context and in relation to the complex web of policy demands and the different expectations and requirements that teachers are obliged to take into consideration. We need to identify and analyse also the discourses that appear to structure educational practices in conjunction with the adoption of 1:1 initiatives.

We attempted to do this in some of the focus group meetings, where teachers were asked to discuss how they planned and organized their teaching, what motivated them in

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<sup>1</sup>[www2.diu.se/framlar/egen-dator/](http://www2.diu.se/framlar/egen-dator/)

<sup>2</sup><http://www.skolverket.se/skolutveckling/forskning/didaktik/tema-elevperspektiv/ar-svensk-skola-lika-for-alla-1.195584>

this and what shaped and steered their work. In this discussion what was mentioned most often was the new curriculum for upper secondary school (Skolverket, 2011), together with the increasing demands made by national tests:

The upper secondary reform has affected us... Before we were multidisciplinary teams working with the same students. It was easier to use computers then. Now we are back in the subject divided teams and [so] we mostly use computers to share material on the learning platform. I have to prepare my students for national tests and this affects what and how I teach. My teaching is guided by these tests. Moreover pupils are not allowed to use computers in national tests. They have to write by hand [so] we were unable to use computers and work with texts on the computer. We have to write with pens in the lesson as well. (Focus group interview 2012-06-12)

These statements provide an example of issues that were brought forward by teachers concerning how educational policy is related to their work and how the field for policy production seems to have prevented them from making innovative transformations of their teaching, not only through the implementation of IT in their pedagogical practice but also more generally (Singh, Thomas, & Harris, 2013). They concern how performative demands from national testing, rather than technology, tend to structure the formation of the pedagogic discourse. Teaching is focused on preparing students for the national tests and learning is aimed at learning for getting good grades.

Another important way to identify the discourses that appear to structure educational practices was through the analysis of participant observation of day-to-day activities in classrooms. This analyse made visible the strong influence of conventional examinations forms that heavily structured the pedagogic discourse. Even in this case the tool used for seeking information and writing reports was the computer but there is no evidence whatsoever that the power controlling what counts as official knowledge or how it is examined has been changed:

You have to include the country's economic and political development in the report if you want to pass the exam. Look for information online [and] don't forget to submit the report for assessment by week 48 (Teacher to class: Civics classroom 2012-11-12)

Today you have to solve the exercises from the learning platform ... I'll show examples on the smart-board... Then you go on to the task and you can ask me if you have any questions... The exercises will help with knowledge and skills for answering the questions and performing the forthcoming tests. (Teacher to class: Economics classroom 2012-09-11)

The talk and use of space during the lessons under study reflect the common way of organising teaching and learning in schools historically (Johansson, 2007; Player-Koro, 2012a). The lessons started with the teacher standing in front of the class introducing the topic of the day, in these cases with help from digital technology (fig. 1). After that the teacher introduces the exercises to practice during the lesson. Whilst the students were engaged in 'practice', the teacher strolls among the students' desks, tutoring individual students one at a time or in small groups (fig. 2). During this period some students were occupied with the exercises as instructed whilst others were engaged in other activities with their friends or were surfing on their computers (fig. 2). At the end of the lessons the teacher was once again standing in front of the class summarising the lessons and

answering the students' questions. Many of the questions concerned the content and requirements needed to pass various assessed and graded activities such as homework and tests.

*Figure 1. Introduction.*



*Figure 2. Working on /with exercises.*



#### 4. DISCUSSION

The main findings presented in the chapter suggest that there is a frequent use of technology in classrooms but that this use is a form of conservative modernisation in a context of educational reforms that are structured by neo-liberal and neo-conservative movements toward high stakes performativity (Ball, 2003). These issues are clearly pressed down on teachers in their teaching and learning according to the present research in ways that could be considered to have highly traditionalising effects. The effects have been such that although the teachers at these schools has a positive attitude towards the use of technology, and despite them stating IT to be useful tools in their professional work, they have remained highly traditional in their basic pedagogical perspective and activities. Additionally, no signs have been given that the use of technologies has played a significant part in education innovation or a change in their views of education or of the use values of

education to pupils and for society. This does not mean that teaching has not changed. The point is instead that the introduction of IT in educational settings seems to lack the potential that is often referred to, namely that of transforming education culture and making teaching and learning significantly more effective. Indeed instead IT seems to be used within established power structures and relations that are in practice reinforced not challenged.

However, two points should be noted here. Firstly, starting from the initial Melbourne experiment and onwards, IT has been a tool for attaining traditional aims of knowledge development and improvement as a replacement for traditional pen-and-paper, which it has also arguably done somewhat more effectively than did the tools used in the past. IT has in other words been a tool for meeting the demands of education not changing them. Secondly, performativity demands on postmodern professionals and examination requirements are what are emphasised the most by the teachers and these externally imposed demands (the terrors of performativity in the terms of Ball, 2003), rather than the presence of technology, are what contribute the most to the structuration of their working activities and its content (Ball, 2003).

IT works in this way, as the data suggests through the regulative effects of examination-based performativity discourses on the instructional part of the pedagogic discourse. This can be seen in the selection of subject content and in the interactional patterns during lessons: i.e. in terms of pedagogic modality and the classification and framing of education content. Thus, even when IT was integrated in the teaching and learning activities observed, the examination demands worked through the teacher as an intermediary and were very much in control of what was selected as content and how this content was sequenced and paced. In the Durkheimian sense of education in the interests of social integration and control, there is little if anything that is really new about this.

In line with those of other extensive critical investigations our findings suggest that 1:1 initiatives has not had strong effects on pedagogy and teaching and learning activities. This, in that the teacher is still in control of the selection, sequencing and pacing of the content that the state determines to be official knowledge, exams are still the main structuring force behind what goes on during the lessons, and IT has had no general context independent impact on pedagogy as there is no evidence of a significant link between technology use and the transformation of educational practices (Goodwin, 2011; Livingstone, 2011; Skolverket, 2013; Tallvid, 2015; Yuan-Hsuan, Waxman, Jiun-Yu, Michko, & Lin, 2013).

A possible difference between our findings and those of others still exists however. In other research, the suggestion often tends to be that the full potential of the use of IT has not yet been reached, but that it can be (Bocconi et al., 2013). This line of reasoning springs from the conviction that IT plays a prime role as a key enabler for innovation in education (Kampylis et al., 2012). Our claim is that a process of false marketing has taken place within which technology is claimed to solve problems and create educational change and effectiveness when it doesn't and in ways that it cannot and as far as we know never has.

#### **4.1. Concluding remarks**

Selwyn (2012) argues that the field of educational technology tends to be 'an inward-looking and self-referential field of study' (p. 331) that is resistant to viewpoints that contradict the view of technology as a potential force of positive change in education. He suggests its arguments are narrowly focused, that they risk missing 'the bigger picture' and that they can be characterised by a lack of rigorous studies about what really takes place when technology is used (Selwyn, 2011, 2012).

In the present case this bigger picture involves both the understanding and description of what actually happens with education and the educational system and what takes place in an educational context when teachers and students have unlimited/ubiquitous access to technology. It isn't a 'nothing happens' picture. It is instead one that highlights how a superlative discourse of revolutionary changes in education through the introduction of IT is marketed by capital to influence policy makers, education planners, teachers, learners and parents to invest in projects like 1:1 initiatives: both economically, intellectually and perhaps even emotionally. The discourse shapes conscious practices but it is not real. It doesn't describe what is or even what is intended, but it does exploit current concerns with competition and performance and pressure agents to buy and use new technology.

There are at least three clear dimensions to consider in relation to this statement. One of them is that despite there being no concrete evidence available about the advantage provided by computers for intellectual learning, schools are being continually filled and re-filled by computer hardware, software and educational add-ons, that are also at the same time being constantly (and possibly deliberately) out-dated. The second is that because of this, the academic labour of teachers and pupils has been formed into a new economic labour power that is exploited in the interests of profit making by private capital. The third is that this contribution to the creation of a further means of exploitation of education by capital is surely not the point of education in the public consciousness (i.e. is not common sense) and nor does it seem to bring any significant benefits to the broader public commons.

The main results from our investigation thus paint a fairly clear picture. We want to talk about them at three levels. The first level is that capitalist corporations in the interests of profit have economically exploited a quintessentially educational initiative at a girl's Methodist school in Melbourne Australia, without any economic reimbursement to the agents whose intellectual activities became a source of unpaid labour power. The second is that this exploitation was a forerunner to the current mass exploitation of schools and the actions and people in them by the IT industries in the interests of further their private profits. The third is that technology optimism has allowed a marketization process that has worked in the interests of corporations and their pursuit of profit to significantly affect educational investments with very little significant gain to others and with at best marginal impact on education standards.

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## Chapter # 20

### **EFFECTS OF REAL-WORD VERSUS PSEUDO-WORD PHONICS INSTRUCTION ON THE READING AND SPELLING ACHIEVEMENT IN FIRST GRADERS**

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#### **ABSTRACT**

This study compares two methods of phonics instruction: real-words versus pseudo-words, on Lebanese first graders to determine the approach that will yield better reading and spelling achievements. To that end, two mixed level groups of three students each were selected. Students' achievement in reading and spelling both real-words and pseudo-words was tested before (pretests) and after (posttests) the intervention using four subtests of the Woodcock-Johnson-III Tests of Achievement. The intervention consisted of a total of 20 sessions (30 minutes each) of phonics instruction based on the Recipe for Reading program. Both groups received the same intervention and followed the same lesson plan. The only difference was in the type of word lists provided for each group. One group was exposed to real words only and the other group to pseudo-words only. Results showed that the phonics instruction based on real-words was more effective in improving decoding of real words, spelling of real-words, and spelling of pseudo-words. The effectiveness of the real-word method was very significant especially with at-risk students. On the other hand, the pseudo-word instruction showed slight improvement with average students in reading real words and pseudo-words, and spelling pseudo-words.

*Keywords:* decoding, pseudo words, spelling, first graders, Lebanon.

## **1. INTRODUCTION**

### **1.1. Overview**

Reading and spelling are the building blocks of the elementary school curriculum. Well-designed and well-implemented reading and spelling instruction yields several benefits that students will reap throughout their schooling years (Moats, 2000). Students who become fluent in reading in their early years, kindergarten, and first grade are more likely to enjoy reading and to develop their knowledge of words and language patterns (Cunningham & Stanovich, 1998). On the other hand, young students who fail to read well will dislike reading and will perceive it as a struggle (Juel, 1996). These students will face problems in their vocabulary growth, knowledge acquisition, and writing skills, and will become at a greater risk of school failure and lifelong problems with employment, self-determination, and social adjustment (Moats, 2000). Reading failure begins during children's first school years (Ehri, 1998; Pikulski & Chard, 2005) and the struggle goes on as they get older (Adams, 1990; Juel, 1996; Stanovich, 1986). Stanovich (1986) explains this phenomenon as the Matthew Effect where "the rich get richer and the poor get poorer" (p. 38). Students who are able to make letter-sound correspondence (phonemic awareness)



will have greater opportunities to reach automaticity and fluency. Students with weak letter-sound correspondence will perform poorly in reading and thus will start falling into a descending vortex of achievement that will be affected by the negative motivational consequences of failure.

Studies have found that classroom instruction is the best remedy for reading difficulty (Adams, 1990; Snow, Burns, & Griffin, 1998). Appropriate, skillful, and informed instruction can amend most of the reading and spelling problems that students face during their school years. Therefore, effective reading and spelling instruction must be provided in early school years to avoid having lifelong struggling readers and spellers. The most common instruction that can be implemented to fill this gap is phonics; however, the way to apply it is not definitive. Several phonics instructional approaches are used to teach reading like the analytic phonics, synthetic phonics, phonics through spelling, analogy phonics, and embedded phonics (National Reading Panel, 2000a). Every one of these approaches caters for different individual needs of different students.

The phonics approach follows an explicit method to teaching reading and spelling skills. It teaches students phonemes, graphemes, letter-sound correspondence, spelling patterns, and blending letters into words. As a result, better decoding skills can be achieved when systematic phonics instruction is applied (Stahl, Duffy-Hester, & Dougherty Stahl, 1998). As for spelling, it was found that systematic phonics is helpful for young students, who are at grade one or below, and not older ones (Ehri, Nunes, Stahl, & Willows, 2001; National Reading Panel, 2000b).

Recently, some reading specialists such as Steve Dykstra, Bill Keeney, Ellen Engstrom, and others have hypothesized that teaching phonics using pseudo-words (nonsense words) may be more beneficial than using real words (SpellTalk Discussion Group, 2013). Pseudo-words are used mostly in tests that assess students' reading and spelling achievement and are rarely considered as teaching tools. Educators who prefer using pseudo-words argue that students usually rely on guessing strategies or on their prior knowledge and memory to recall how words are pronounced and spelled. Thus, basing the phonics instruction on pseudo-words will increase the probability that students will develop decoding and encoding skills simply because they will be exposed to words they haven't seen, heard, or memorized before (Farrell, Osenga, , & Hunter, 2010). On the other hand, those who prefer using real words wonder why students should spend time learning words that are not real or meaningful. Practicing nonsense words, they would argue, will not lead to enriched vocabulary and improved comprehension so using them makes no sense. Since there is no general agreement and consensus on the best approach, more studies are needed to examine both methods. This study examines the effectiveness of two methods of phonics instruction, real words versus pseudo-words, on first graders to determine the one that will yield better reading and spelling achievements.

## **1.2. Purpose of the Study**

The aim of this study is to explore the better approach to teach reading and spelling, real-word vs. pseudo-words, and make recommendations to reading instructors both in the mainstream and special education.

## **1.3. Research Question**

Which phonics instruction method would result in more significant gains with first grade readers and spellers: real words or pseudo-words?

#### **1.4. Hypothesis**

The hypothesis of this study is that the phonics approach that is based on pseudo-words will lead to better results on both real word and pseudo-word reading and spelling tests, based on the assumption that students exposed to this approach strengthen their memory of phonics more than their memory of sight words when reading or spelling.

#### **1.5. Significance of the Study**

The utility of real words versus pseudo-words as screening and assessment tools has been extensively investigated (Byrne & Fielding-Barnsley, 1993; Farrell et al, 2010; Pullen, Lane, Lloyd, Nowak, & Ryals, 2005). Although an earlier study claimed that students skilled at decoding pseudo-words become independent and competent readers (Byrne & Fielding-Barnsley, 1993), only one published study has explored the use of pseudo-word as an instruction tool. Results revealed that pseudo-word phonics instruction during one month improved students' decoding skills faster than the real word phonics instruction (Cardenas, 2009). Finally, an unpublished dissertation compared the use of a combination of a reading instruction approach on kindergartners with real and pseudowords vs. word work instruction with real words only with respect to decoding accuracy and automaticity. Results suggested that that incorporating pseudowords within decoding instruction with emergent readers is just as effective as using real words alone (Madsen, 2014).

This study makes a unique contribution to the field of reading remediation in the hope of guiding teachers to the most effective strategies to maximize their students' reading achievement.

### **2. METHODOLOGY**

#### **2.1. Research Design**

The study is quantitative in nature and uses the quasi-experimental design. Intervention was applied to two groups: the control group which received real word phonics intervention, and the experimental group which received pseudo-word phonics intervention. The independent variable for this study is the type of phonics instruction (real word versus pseudo-word) and the dependent variable is the students' reading and spelling achievement.

#### **2.2. Setting**

The study was conducted in a middle-class private school located in the suburbs of Beirut that uses Arabic and English as languages of instruction. The intervention sessions took place in a classroom equipped with computers.

#### **2.3. Sampling and Participants**

A purposive-convenient nonrandom sampling technique was adopted for this study. Participants included first graders whose reading and spelling achievements range from average to at-risk. Six first graders were selected from different sections forming 2 triads consisting of one boy and two girls. The real word group is referred to as Real1, Real2, and Real3, whereas the pseudo-word group as Pseudo1, Pseudo2, and Pseudo3.

## **2.4. Teaching Material**

The *Recipe for Reading* (Bloom & Traub, 2005) was used. It relies on the synthetic approach, provides multisensory, explicit cumulative instruction, and phonetically controlled sentences, with built-in evaluation modules.

### **2.4.1. Recipe for Reading**

Recipe for Reading was adapted from the Orton-Gillingham approach and developed by Nina Traub and Frances Bloom in the 1970s. It is a research-based program that has had significant effectiveness on students' reading and spelling achievements compared to other intervention programs (Russo, 2000). It is a multisensory, comprehensive, systematic, and synthetic phonics-based approach that can be implemented as a main program or as a supplement for poor readers.

With respect to its content, the recipe program includes 105 lessons that start at the letter sound level then progress to sound blending. All the lessons follow the same format whereby students have to respond to sound cards, spell sounds, make words from letter cards, spell and read these words, and spell and read sentences from flash cards. One important aspect of Recipe for Reading is revision. Previous lessons that have been taught should be reviewed before any new concept is introduced (Russo, 2007).

In terms of its target learners, Recipe for Reading best fits the needs of beginning readers from kindergarten till grade three, as well as at-risk and struggling readers in grades one till six. It can be used in different instructional settings like inclusion, one-to-one, small group, and an entire class (Russo, 2007).

## **2.5. Instruments**

For the pre and post assessment, the following was used: The Woodcock Johnson III tests of Achievement (Letter-Word Identification, Word Attack, Spelling, and Spelling of Sounds). Pre tests and posts were administered end of April and at the middle of May respectively. Students' chronological ages ranged between 6-4 and 6-9.

### **2.5.1. Woodcock-Johnson III Tests of Achievement**

The Woodcock Johnson III Tests of Achievement (WJ III ACH) consists of 22 tests that measure reading, mathematics, and writing skills, as well as oral language abilities and academic knowledge (Wendling, Schrank, & Schmitt, 2007). For the purpose of this study, four subtests (Letter-Word Identification test, Word Attack test, Spelling test, and Spelling of Sounds test) were used to measure students' achievements in reading and spelling both real and pseudo-words. Other subtests were disregarded because they focused on certain skills that were not addressed in this study. The researcher administered these subtests two times, once directly before starting the intervention, and once directly after the end of the intervention. Mather, Wendling, and Woodcock (2001) described these four subtests as such:

*Letter-Word Identification test:* In this test, students are asked to identify and pronounce isolated letters and words like: g, r, cat, and palm.

*Word Attack test:* In this test, students are asked to pronounce non-words that conform to English spelling rules like: flib and bungicality.

*Spelling test:* In this test, students are asked to write the spelling of words presented orally.

*Spelling of Sounds test:* In this test, students are asked to spell non-words that conform to English spelling rules like: barches and smuff.

## **2.6. Procedure**

At the beginning, before starting the intervention, students' achievement level in reading and spelling of both real words and pseudo-words was determined (pretests) by administering four subtests from the Woodcock-Johnson III Tests of Achievement (Letter-Word Identification test, Word Attack test, Spelling test, and Spelling of Sounds test). These subtests were administered individually for the students in both groups. At the end, the same WJ-III subtests were administered for all the students to measure their improvement.

## **2.7. Intervention**

This study was conducted over a period of two weeks during the third term of the 2013-2014 scholastic year. Every group received 20 intervention sessions of 30 minutes each. Students were pulled out during their English sessions. The same procedure and intervention were applied with both groups. The only difference was in the content of the word lists provided in every lesson of the *Recipe for Reading* program. For example, the short /u/ sound was illustrated with read real words like *cup* and *jump*, whereas for the pseudo-word group, letters examples were replaced with non-real words like *lup* and *kump*. Intervention for both groups was provided by one of the researchers (Khalifeh Mohamad).

During these twenty sessions, students in both groups were introduced to 20 letters/sounds (one letter/sound per session). The order of presenting these letters and sounds followed the same sequence adopted by the *Recipe for Reading*. The letters taught are: c, o, a, d, g, m, l, h, t, i, j, k, p, ch, u, b, r, f, n, and e. The vowel lessons taught during the intervention included short sounds only.

At the end of every lesson, students completed some activities designed by the researchers to reinforce the concepts at hand. A review of the previous lessons was done at the beginning of every session.

## **3. RESULTS**

The four subtests of the WJ-III Tests of Achievement were administered by the researcher (Khalifeh Mohamad) at the end of April (pre-test) and at the middle of May (post-test) of the 2013-2014 academic year. This means that the students were at the end of grade 1.7 during the pretest and at the middle of 1.8 during the post-test. Students' chronological ages ranged between 6-4 and 6-9.

Students' results on the four subtests were tabulated to show their age equivalence (AE), grade equivalence (GE), and standard scores (SS) prior to and after intervention. The difference of the standard score results in pre-test and post-test was calculated for every student to show the individual level of improvement. Every group's mean standard score was also calculated prior to and after intervention and the difference was tabulated to show the average level of improvement for the group as a whole. Standard scores have a mean which is equal to 100 and a standard deviation (SD) which is equal to 15. Results are considered to be statistically significant if they have a +1SD.

### 3.1. Letter-Word Identification

Students of the pseudo-word group showed better results in the pretest compared to the real word group. Their GE ranged between 1.0 and 1.3 compared to K.6 and 1.2 to the real word group. Their mean standard score in the pretest was 8.34 points (102.67 - 94.33) more than that of the other group. In the post-test, students of both groups showed improvement in their standard scores. Again, the mean standard score of the pseudo-word group in the post-test was greater than that of the real word group but this time the difference was much less (2 points). It was noted that the students who got the lowest SS in the pretest made the greatest improvement which reached a +1SD (student Real1 and Real2). As a final result, the real word group showed more improvement in their ability to read real words in isolation although they started with a lower initial standing compared to the pseudo-word group. The results of the Letter-Word Identification subtest (pretest and post-test) for both groups are summarized in Table 1 below.

*Table 1. WJ-III ACH Letter-Word Identification Pre and Post Test Results.*

Student	Pre-Test			Post-Test			Difference in SS
	AE	GE	SS	AE	GE	SS	
Real1	5-11	K.6	92	6-8	1.4	107	15
Real2	5-11	K.6	86	6-9	1.5	102	16
Real3	6-6	1.2	105	6-7	1.3	106	1
	<b>Mean SS</b>		<b>94.33</b>	<b>Mean SS</b>		<b>105.00</b>	<b>10.67</b>
Pseudo1	6-4	1.0	97	6-9	1.5	105	8
Pseudo2	6-7	1.3	107	6-9	1.5	110	3
Pseudo3	6-8	1.3	104	6-10	1.5	106	2
	<b>Mean SS</b>		<b>102.67</b>	<b>Mean SS</b>		<b>107.00</b>	<b>4.33</b>

### 3.2. Word Attack

Students of both groups had equivalent scores in the Word Attack pretest. Every group had two students whose GE=K.8 and AE=6-1 and one student whose GE=1.2 and AE=6-7. The difference among these students in the standard scores is referred to the difference in their chronological age. The mean standard score for both groups was almost equivalent (97 and 96.67).

In the post-test, students of both groups showed improvement in their ability to read pseudo-words in isolation. The improvement was significant (+1SD) for both groups. The improvement of the pseudo-word group was slightly more than that of the real word group.

It was noted that the students who got the lowest SS in the pretest made the greatest improvement which reached a +1.46 SD (student Real2 and Pseudo1).

Overall, the pseudo-word group showed a slight more improvement (1.67 SS) in their ability to read pseudo-words in isolation. The results of the Word Attack subtest (pretest and post-test) for both groups are summarized in Table 2 below.

Table 2. WJ-III ACH Word Attack Pre and Post Test Results.

Student	Pre-Test			Post-Test			Difference in SS
	AE	GE	SS	AE	GE	SS	
Real1	6-1	K.8	95	6-1	1.5	108	13
Real2	6-1	K.8	89	7-5	2.1	111	22
Real3	6-7	1.2	107	7-5	2	114	7
	<b>Mean SS</b>		<b>97.00</b>	<b>Mean SS</b>		<b>111.00</b>	<b>14.00</b>
Pseudo1	6-1	K.8	92	7-5	2.1	113	21
Pseudo2	6-1	K.8	97	7-2	1.8	114	17
Pseudo3	6-7	1.2	101	7-6	2.2	110	9
	<b>Mean SS</b>		<b>96.67</b>	<b>Mean SS</b>		<b>112.33</b>	<b>15.67</b>

### 3.3. Spelling

Students of the pseudo-word group showed better results in the pretest compared to the real word group. Their mean SS was 99.67 and that of the real word group was 94.33, thus the difference between both groups was equal to 5.34 points.

In the post-test, students of both groups showed improvement in their standard scores. However, the mean standard score of the pseudo-word group (105.33) in the post test was greater than that of the real word group (103.67). The difference was equal to 3.66 SS which is equivalent to 0.24 SD.

As a final result, the real word group showed more improvement in their ability to spell real words in isolation although they started with a lower initial standing compared to the pseudo-word group. The results of the Spelling subtest (pretest and post-test) for both groups are summarized in Table 3 below.

Table 3. WJ-III ACH Spelling Pre and Post Test Results.

Student	Pre-Test			Post-Test			Difference in SS
	AE	GE	SS	AE	GE	SS	
Real1	5-8	K.4	88	6-5	1.1	102	14
Real2	6-1	K.8	89	6-7	1.3	98	9
Real3	6-5	1.1	106	6-8	1.3	111	5
	<b>Mean SS</b>		<b>94.33</b>	<b>Mean SS</b>		<b>103.67</b>	<b>9.33</b>
Pseudo1	6-5	1.1	98	6-7	1.3	101	3
Pseudo2	6-5	1.1	104	6-1	1.5	114	10
Pseudo3	6-5	1.1	97	6-8	1.4	101	4
	<b>Mean SS</b>		<b>99.67</b>	<b>Mean SS</b>		<b>105.33</b>	<b>5.67</b>

### 3.4. Spelling of Sounds

Students of the pseudo-word group showed better results in the pretest compared to the real word group. Their mean SS was 103.33 and that of the real word group was 97.0, thus the difference among both groups was equal to 6.33 points.

In the post-test, students of both groups showed improvement in their standard scores. Again, the mean standard score of the pseudo-word group (115.33) in the post test was greater than that of the real word group (112) by 3.33 SS points.

It was noted that the students who got the lowest SS in the pretest made the greatest improvement which reached a +1.33 SD (student Real2 and Pseudo2).

As a final result, the real word group showed more improvement in their ability to spell pseudo-words in isolation although they started with a lower initial standing compared to the pseudo-word group. Their improvement was statistically significant (+1SD). The results of the Spelling of Sounds subtest (pretest and post- test) for both groups are summarized in Table 4 below.

*Table 4. WJ-III ACH Spelling of Sounds Pre and Post Test Results.*

Student	Pre-Test			Post-Test			Difference in SS
	AE	GE	SS	AE	GE	SS	
Real1	6-1	K.8	94	7-2	1.9	112	18
Real2	6-2	K.9	91	7-5	2.1	110	19
Real3	6-6	1.2	106	7-5	2.1	114	8
	<b>Mean SS</b>		<b>97.00</b>	<b>Mean SS</b>		<b>112.00</b>	<b>15.00</b>
Pseudo1	7-2	1.8	109	8-0	2.6	116	7
Pseudo2	6-2	K.9	98	7-7	2.3	118	20
Pseudo3	6-8	1.3	103	7-8	2.3	112	9
	<b>Mean SS</b>		<b>103.33</b>	<b>Mean SS</b>		<b>115.33</b>	<b>12.00</b>

### 3.5. Comparison according to performance levels

Real1-Pseudo1 and Real2-Pseudo2 participants have equivalent performance levels and can be referred to as below average readers and spellers. Whereas Real3-Pseudo3 have also equivalent performance level but they can be referred to as average readers and spellers.

To better compare the rate of improvement of every student in terms of standard scores and compare it to his friend who has equivalent performance in the opposing group, a table (Table 5) was drawn to summarize these results for every test.

*Table 5. Comparison of Standard Score Improvements Between Students of Equivalent Performance Levels.*

	Letter-Word Identification	Word Attack	Spelling	Spelling of Sounds
Real1 vs. Pseudo1	15 - 8	13 - 21	14 - 3	18 - 7
Real2 vs. Pseudo2	16 - 13	22 - 17	9 - 10	19 - 20
Real3 vs. Pseudo3	1 - 2	7 - 9	5 - 4	8 - 9

#### 4. ANALYSIS AND DISCUSSION

The results of the Woodcock Johnson III subtests revealed that the phonics approach, regardless of the type of words used, helped students develop their decoding and encoding skills. The posttest results of the four WJ-III subtests showed that students of both groups have made good improvement in reading and spelling real words and pseudo-words as compared to pretests. This improvement was in many cases statistically significant.

The results also revealed that the phonics approach was more effective for at-risk than for average students. At-risk students were able to make significant improvements ( $\geq +1SD$ ) in the post-tests. When the intervention was initiated, most of the students were at the lower limit of the partial alphabetic level of reading and spelling development. Their knowledge of the alphabetic system was not complete, and they were incapable of decoding unfamiliar words. Most students were unable to read new words by analogy to familiar words because their lexicon of sight words was limited. As for spelling, given their partial knowledge of the alphabetic system, students used invented spelling by relying on the most salient letters in the word.

To measure the effectiveness of real word versus pseudo-word instruction, comparisons between the two groups as a whole then among students matched by level of performance are proposed.

For the former, the WJ-III results revealed that the real word group outperformed the pseudo-word group in reading real words, spelling real words, and spelling pseudo-words. The greater difference in improvement was in favor of the real word group in the Letter-Word Identification test despite the initial advantage of the pseudo-word group who scored higher in the pretest. The results of the Letter-Word Identification test and Spelling test can be attributed to the reading and spelling strategy that the students used, namely decoding and encoding by sight, relying mostly on rote memory. Students in the real word group were exposed to meaningful words repeated several times during the intervention sessions. When students look at words and read them, their alphabetic system knowledge is stimulated, and in turn, they form a connection between the word's grapheme and phoneme. Reading a word several times creates an amalgam that combines a specific decoding pattern, encoding and meaning and stores it in long-term memory (Ehri, 2000).

The pseudo-word group also read pseudo-words several times, yet their performance was not up to par. A possible explanation is that pseudo-words have no meaning so the amalgam that should have been created was not complete, consequently their retrieval was faulty.

The results of the Spelling of Sounds test which taps written phonics showed that the real word group made better improvement than the pseudo-word group even though their instruction was based on real words. This pattern is consistent with the research claims that spelling is more demanding than reading. Pseudo-word group members were not able to transfer their knowledge of pseudo-word reading rules to pseudo-word spelling. As for the real word group, their higher scores on the Spelling of Sounds test may indicate that they had depended on the *analogy strategy* to spell the pseudo words. Their emergent lexicon of sight words had allowed them to derive phonics rules for encoding.

When comparing the results of students matched by performance between the two groups, we find that the at-risk student in the real word group outperformed his peer in the pseudo-word group in all skills except Word Attack. The difference in improvement is recognizable. This implies that the pseudo-word instruction is not effective with struggling



readers and spellers who are at the lower limit of the partial alphabetic level of reading and spelling development where the learner needs to build a repertoire of words in their lexicon so that they can refer to when reading or spelling new words (Ehri, 2005). Since pseudo-words are meaningless, their encoding in long-term memory seems unstable relative to that of real words. However, if we compare the results of average students across groups, we find that the pseudo-word group made better improvement in all areas except spelling. The difference of the level of improvement between both students in the average group was minimal (maximum 2 SS) compared to that of the below average students (maximum 11 SS). The average students have developed a good knowledge of the alphabetic system and letter-sound correspondence and already have a good repertoire of words to refer to. This repertoire of words helps average students read or spell analogous words. However, if they encountered unfamiliar words which do not have a specific match in their lexicon, they fail at the task (Ehri, 2000; 2005).

In sum, phonics instruction based on real words was more effective in reading real words, spelling real words, and spelling pseudo-words. The effectiveness of the real word method was more evident with at-risk students. On the other hand, the pseudo-word instruction was slightly more effective with average students in reading real words and pseudo-words, and spelling pseudo-words. Thus, the hypothesis of this study was validated only for average students, but not for struggling readers and spellers.

## **5. CONCLUSION AND RECOMMENDATIONS**

### **5.1. Conclusion**

This study gave insights into the effectiveness of real words versus pseudo-words on the reading and spelling abilities of first graders.

Based on the findings, teachers are urged to avoid using pseudo-words in their phonics instruction for at-risk students, and focus instead on real words, while continuing to use non-words in progress monitoring and other assessment activities. For other students, including pseudo-words occasionally in their reading and spelling instruction can help reinforce decoding and encoding skills, and strengthen their knowledge of phonics rules.

### **5.2. Future Studies**

This study should be replicated across different schools, different grade levels and larger samples in order to be able to generalize the results. Moreover, a third experimental group may be added to the study that combines real words and pseudo-words intervention. Finally, a mixed-method (quantitative and qualitative) approach is recommended whereby participants are interviewed about the personal strategies used to read and spell words at various stages of the experiment.

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**Section 4**  
**Organizational Issues**



## Chapter # 21

### NEED FOR A DEMOCRATIC APPROACH TO SOCIAL JUSTICE IN EDUCATION AND TRAINING

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#### **ABSTRACT**

This chapter underlies the theory of justice as fairness along with certain capital ideas, such as social and cultural capital. The chapter also highlights the culture of silence and the issue of Western hegemonic discourse. The objective is to look at the connections between the findings collected from five high schools with diverse socioeconomic, cultural and racial backgrounds in South Africa, and the experiences from the work with refugees with a Norway residence permit. The author opts to find similarities between a well-resourced country and a country with an emerging economy. In addition, considering the current refugee problems, it is crucial for the critical examination of the current training and education of refugees in Norway. The research employed a mixed-method research strategy, integrating both qualitative and quantitative methods. The study showed that when focusing on social justice, similarities can be found in the two contexts, and this is the focus of the present chapter. The research about the South African education system indicated that the current approach to social justice was limited by a narrow interpretation of the country's present social inequalities, failing to consider the hegemonic nature of Western knowledge in the education system. This chapter argues that the current situation of training and preparation of refugees in Norway shares related limitations and calls for a democratic approach to social justice.

*Keywords:* social justice, cultural capital, social capital, hegemonic discourse, refugees.

#### **1. INTRODUCTION**

The Norwegian government has begun the work on developing a new holistic policy, focusing on adults who have been left behind in the work market. One of the target groups are immigrants with deficient language skills or educational level, or with unacknowledged competence (Kunnskapsdepartementet, 2014). This shows that even though Norway is a well-resourced country, some of the inhabitants are struggling to survive and get benefits from the society. Furthermore, the present refugee status indicates an increase in the number of refugees in Norway. Actions need to be taken to assure the basic needs of the refugees and also provide them with a socially just and quality training and education in order to help them become self-sufficient Norwegians. Most of the refugees come from a non-hegemonic knowledge tradition and might face challenges in the Norwegian society, which is based on a Western hegemonic discourse. A previous research conducted by Sønsthagen (2013), looked at similar issues in the South African context. Therefore, the author opts to examine the current introduction programme for refugees in Norway critically as compared to some of the previous findings from the research in South Africa.

A research conducted in South Africa in 2012 examined the extent to which five South African high schools with various socioeconomic and cultural backgrounds addressed the issues of social justice, in relation to learners' traditional, cultural, racial and social backgrounds (Sønsthagen, 2013). The approach to social justice was limited by a

narrow interpretation of the country's social inequalities and failure to consider the importance of Western hegemony, and cultural and social capital in the education system (Sønsthagen, 2013).

The differences between the South African high school system and the Norwegian introduction programme for refugees, particularly in relation to the available resources, will play an important role for the findings from South Africa and Norway. However, regardless of these differences, the objective of the present study is to perceive the connection between the two contexts and critically examine the Norwegian context while focusing on social justice. First, the study highlights certain important issues related to both the contexts. Thereafter, the concept of social justice as understood in this chapter is explained together with social positions and Pierre Bourdieu's three forms of capitals. The chapter further examines the importance of hegemonic knowledge, Paulo Freire's "culture of silence", and the methodology of the study before discussing the connections between both the contexts and examining the Norwegian context.

## **2. CONTEXTUAL BACKGROUND**

It is claimed that South Africa is one of the unequal countries in the world, with around half of the population living in poverty (Breidlid, 2013). Even though the government in the post-apartheid period has promoted a democratic society redressing past injustices, studies have confirmed that the neoliberal path followed by the government and the post-apartheid period has evidenced a dramatical worsening of inequality within the groups (Marais, 2011). Sefa Dei & Kempf (2006) claimed that the market received primary attention in the democratic period, contributing to the damaging effects on the education system, and reproducing inequalities in the general society (Marais, 2011). Grimaldi (2012, p. 1133) argued that through a neoliberal approach in education, "social justice is defined in the light of a minimal understanding of the concept of equality", ignoring structural factors, by taking a democratic educational approach, and dismissing the role of education as a social good. Thus, a minority of South African learners received quality education, which was distributed through discriminatory class and racial lines (Marais, 2011). The World Economic Forum Report (2014) ranked the quality of South Africa's poor educational system at 146 out of 148 countries.

Norway is both a constitutional monarchy and a parliamentary democracy. It is also considered to be a well-resourced country and a welfare-state (Thuesen, 2015). The Norwegian society values equality, non-sexism and non-racism, and freedom of speech. In 2014, around 8800 people got the refugee status and were accepted for a resident permit in Norway. The biggest refugee groups were from Eritrea, Syria, and Somalia (Utlendingsdirektoratet, 2014). In 2015, the numbers are likely to increase severely, considering that in October and November alone, over 16500 applied for asylum in Norway (Utlendingsdirektoratet, 2015). The Directorate of Integration and Diversity (IMDI) has the responsibility of settling the refugees with a residence permit in different municipalities of Norway. All refugees with a residence permit have the right and duty to attend the two-year introduction programme, and all municipalities that settle refugees are obliged to offer this programme. The aim is to provide basic Norwegian language skills and insight into the Norwegian society, with the goal to prepare the refugees for the workforce or education system. The programme consists of lessons in Norwegian language, social studies, and skills needed for entering the labour market, continuing education and career guidance. While attending the programme, the refugees also receive economic support allocated by the municipality (Justis- og beredskapsdepartementet Introduksjonsloven, 2005).

When looking into social justice in education and training, in particular, when the receivers come from a non-hegemonic background and the education and training system is based on a Western hegemonic discourse, the historical theories of Rawls (1971), Bourdieu (1997) and Freire (1970) holds considerable importance.

### **2.1. Theoretical Background**

There are several definitions of social justice, and it is not a straightforward process to define it. Nevertheless, the underlying goal of social justice is to “propose adequate mechanisms used to regulate social arrangements in the fairest way for the benefit of all” (Mncube, 2008, p. 79). Social justice does not entail equal treatment of all individuals in society; it rather indicates that the resources should be distributed in an equitable way. Furthermore, Rawls’s (1971) theory of justice is of absolute importance in understanding this study. He proposed social justice as a fairness-theory that includes two principles. The first is related to basic liberties and rights, and the second is related to the arrangement of social and economic inequalities. These arrangements need not be distributed equally; however, they should be for everyone’s benefit. Rawls (1971) named this as the difference principle. When the difference principle was combined with fair equality of opportunity, the “democratic equality” interpretation of the second principle was eventuated, which is the interpretation used in the present study.

‘Fair equality of opportunity’ should ensure that all individuals are protected against discrimination, and there is an availability of equal educational opportunities for all. According to Grimaldi (2012), the sole focus on equality of opportunity seems to be too narrow. With the inclusion of the difference principle, it becomes a wider and more appropriate approach. The main idea behind such an interpretation is that more attractive prospects for the most advantaged groups in society should not be established or secured unless they are of the advantage to those who are less fortunate (Rawls, 1971). In addition, an individual’s class position should not determine one’s chances of gaining cultural knowledge and skills, thus, “the school system should be designed to even out class barriers” (Rawls, 1971, p. 73).

People are born into different social positions that allocate them to different groups with diverse economic, cultural and social capital. Rawls (1971) stated that individuals are born into different social positions with different expectations in life. In addition to social and economic circumstances, the political system determines these life expectations. In societies with deep inequalities, like that of South Africa, such unequal opportunities and expectations are apparent because of the social position one is born into, which affects one’s initial chances and prospects in life (Marais, 2011; Rawls, 1971). This can be related to Bourdieu’s (1997) theory of capitals. A person’s social goods are dependent on his or her capital, which includes the values, access and resources to the person. Bourdieu (1997) presented capitals in three fundamental ways: economic, cultural, and social capital. The economic capital is directly convertible into money while the cultural capital can be convertible into economic capital under certain conditions. Furthermore, the cultural capital can be gained through education and used for increasing the individual’s economic capital. The social capital can be “made up of social obligations (connections), which are convertible, in certain conditions, into economic capital and may be institutionalised in the form of a title of nobility” (Bourdieu, 1997, p. 47). Bourdieu (1997) further argued that the educational system constituted of the cultural capital of the dominant group of the society, thus, reproducing advantages and disadvantages.



Habitus is another concept of Bourdieu and “(...) is a way of being which has been inculcated through patterns of behaviour in its history, culture, language and other norms” (Blackledge, 2001, p. 349). It determines how a person sees the world and the way he thinks and acts. This is linked to the education system, and it is argued that the habitus of the dominant group is hegemonic in schools, which “limits the educational opportunities of children from non-dominant groups because the schools demand competence in the dominant language and culture which can only be acquired through family upbringing” (p. 349). Breidlid (2013) connected habitus with the hegemonic ideology in South African schools. Looking at the goals of the introduction programme, one could argue that this system also has a hegemonic ideology (Justis- og beredskapsdepartementet Introduksjonsloven, 2005), reproducing “the socio-economic profile and value system of the nation” (Breidlid, 2013, p.107).

Several authors have written about the Western hegemonic discourse (Breidlid, 2013; Sefa Dei & Kempf, 2006). At present, the exclusion and othering of traditional knowledge systems of indigenous African people, in particular, seem to be relevant both in the South African context with a majority of African people and in the Norwegian context where the majority of refugees come from African countries. Even though the majority in South Africa came from an African background, the knowledge production and epistemology that the schools seemed to value the most have been westernised (Breidlid, 2013; Sønsthagen, 2013). Considering that Norway is a Western country, it is natural for the hegemonic discourse to be westernised. According to Ntuli (2002), the Western thought is built on a philosophy of division and control, where hierarchies of values govern the world. In addition, the West is also seen as a power system that emphasises modern science, modern medicine and key concepts, such as individuality, rationality, and progress, over the traditional knowledge systems (Breidlid, 2013). Several educational researchers from both Western and Southern countries have challenged the fact that non-hegemonic knowledge has been marginalised, and that Western knowledge has been universal and taken-for-granted (Breidlid, 2013; Sefa Dei & Kempf, 2006).

The work of Freire (2000) and his “Pedagogy of the Oppressed” also became relevant both in the Norwegian and South African context. In relation to the poor, Freire discovered what he called ‘the culture of silence’. He realised that the ignorance and apathy of the oppressed “were the direct product of the whole situation of economic, social and political domination – and of the paternalism – of which they were victims” (p.30). The people that were oppressed were kept “submerged” in a situation where “critical awareness and response were practically impossible” (p.30). In addition to this, Freire found that the entire educational system was a major contributor towards the maintenance of a culture of silence, which can be connected to Bourdieu’s (1997) concept of the education system as a reproducer of inequalities. Through a “critical and liberating dialogue, which presupposes action”, the oppressed can become a critical and engaged human being in his or her society (Freire, 2000, p. 65).

Freire’s “Pedagogy of the Oppressed” is located in the poorer, Southern part of the world. Nevertheless, Nordland (2009) claimed that Freire’s pedagogy is also highly relevant in the Western, richer world. As mentioned in the introduction, even though Norway is a rich welfare state, people feel left out of the general society, with relation to challenges such as language barrier, occupational positions, and colour of their skin. Those who are not able to follow the chase for higher education risk stigmatisation. The society has found its methods of organising the culture of silence, where several stigmatised groups do not stand up for their rights, accepting the fact that they are the losers of the society (Kunnskapsdepartementet, 2014; Nordland, 2009). In what Nordland (2009, pp.14-15)

called the “climbing society”, people are transformed into things, programmed to fit into the society’s logic, and fixed into the society’s culture of silence. Furthermore, Nordland stated that the inhabitants of the richer countries need to ask themselves whether the education received by their children will make them independent, critical and creative people, and prepare them to build a good society or not. Or, if the reality, in fact, is that those who want to move forward in life and see opportunities for progress, bend for the system that created the large injustices we see in the world (Nordland, 2009, pp.14-15).

### **3. METHODOLOGY AND ETHICAL CONSIDERATIONS**

The research about South Africa, including learners, teachers and principals, from five high schools of various socio-economic and cultural backgrounds required specific methods to answer the research questions. A mixed-method strategy, integrating qualitative and quantitative methods, was used. There were overlapping areas between the two methods, and several researchers combined them through mixed-methods in various ways (Moran-Ellis et al., 2006). By the use of qualitative interviews, focus group and observations, a clear picture of the particular participants’ views and attitudes was obtained, and through the questionnaires, the most general perceptions at different schools were examined. The focus on ‘knowing more’ was one of the goals of integration (Moran-Ellis et al., 2006). A detailed discussion of these findings can be found in Sønsthagen (2013).

Regarding the Norwegian context, the discussions and examples were based on the 2014-report from IMDI, and several experiences were gained and conversations were conducted while working with the refugees who attended the introduction programme. Around 60–70 refugees attended the introduction programme in the municipality, and a majority of them came from Somalia and Eritrea.

Quantitative researchers are often concerned with the validity and generalisation of their results, whether the methods investigated what it was supposed to investigate and whether the result could be transferred to other situations or subjects (Bryman, 2012). The present study did not aim at such validation or generalisation. Rather, it aimed to find the connections between the views and perceptions of the South African sampling unit and Norwegian introduction programme and to examine the content of the introduction programme based on the theory of social justice.

The way I view the world, together with my choices, interpretations and analysis of this study, will most likely be coloured by my upbringing in a social democratic country like Norway. Research cannot be value-free, and this needs to be recognised and acknowledged (Bryman, 2012). This relates to the issue of reflexivity, which Guba and Lincoln (2005) defined as “the process of reflecting critically on the self as the researcher, the ‘human as instrument’” (p. 210). All data used in the formulation of this study were kept anonymous, and the examples from the Norwegian context were based on a general overview and not on specific persons.

### **4. RESULTS AND DISCUSSION**

This section focuses on some of the connections found between the South African high schools and Norwegian introduction programme for refugees. The author has discussed the implications of these connections for the refugees attending the Norwegian introduction programme, in relation to social justice.

In the previous research on South Africa, the South African government failed to address the past divisions from apartheid, through a narrow approach to social justice and redress (Sønsthagen, 2013). This created a conviction amongst the participants that education reproduces inequalities rather than challenging them, which coincides with Bourdieu's (1997) viewpoint. The overall perception was that the people's socio-economic background, and to a certain degree, racial background, together with economic and cultural capital, determined their prospects in life. Thus, South African institutions conveyed the impression that some social positions were favoured over others. Rawls (1971) claimed this to be a natural fact that people are born into different social positions; nevertheless, when major institutions of the society favoured certain starting places over others, it became unjust.

In Norway, there is an increasing focus on academic education, and Lai (2013) warned against what she called "the master sickness", referring to the fact that more people are studying at master-level than ever before. In 2014, the county Sogn og Fjordane showed the lowest percentage (18%) of refugees who succeeded in attaining a job or joining the general education system directly after the introduction programme. The average percentage of such successful refugees in Norway was 44% (Integrerings- og mangfaldsdirektoratet, 2014). In 2014, during an informal review of the background of the refugees in the municipality considered for the study, it became evident that over 50% of the refugees had not completed primary education from their home country, and the majority of them attended Norwegian class at a lower level than was expected by the general education system and workforce. This may be one of the reasons why many of them ended up in the social welfare system. This shows that Bourdieu's (1997) concept of reproduction of inequalities was also relevant in this context and can be related to the Norwegian culture of silence, where refugees with a low educational capital were stigmatised, and silenced groups of the society (Freire, 2000; Nordland, 2009).

In addition, some of the refugees had bachelor degrees, and a few had master degrees from their home country. However, very few of them had papers from their educational institutes, and some of them had faced problems getting the degree approved by the Norwegian Agency for Quality Assurance in Education. The Norwegian labour force showed high demands regarding formal competence, and most jobs demanded, at least, a high school education and a certain level of Norwegian skills (Integrerings- og mangfaldsdirektoratet, 2014). Most of the employed refugees with degrees ended up doing jobs where higher education was not required. This coincided with IMDI's report, stating that working immigrants were overrepresented in jobs that did not require education (17% against 3% in the entire population). It can be claimed that Norway does not value the cultural, social and educational capital of the refugees in the country (Bourdieu, 1997). It might be argued that the Norwegian society creates inhabitants that bend for the system creating large injustices and stigmatised, silenced groups for themselves in order to move forward in life, rather than addressing these injustices (Nordland, 2009).

Both in South Africa and Norway, and in the world at large, it is argued that Western knowledge system and culture have hegemony while other non-hegemonic knowledge traditions play a more peripheral role (Breidlid, 2013; Glaser, 2013). The main understanding of the South African participants indicated that the Western knowledge and culture, together with Christianity, played a hegemonic role in the participating schools. Since Norway is a Western country, this knowledge and culture can be considered as natural. However, it can be argued that social justice in a wide approach is not achieved through the hegemony of Western knowledge. Through the focus of the introduction programme, one can question how socially fair the system is. At the same time, it is

important to note that the goal of the introduction programme is to train and prepare the refugees for a quality life in Norway (Justis- og beredskapsdepartementet Introduksjonsloven, 2005). However, this raises a question, whether this should be done at the cost of the participants' culture, self-worth, and self-belief, and if the cultural recognition and value are not as important for the minority population. Self-worth is an important part of Rawls (1971) justice as fairness-theory; thus, damaging the self-worth of learners and participants is an injustice, and it reproduces inequalities in the society (Bourdieu, 1997).

The majority of the South African participants saw core skills, such as science, technology and English, as the most important subjects to learn. None of the respondents answered cultural knowledge and skills to be the most important. The report, "Low education as a poverty trap" (Van der Berg et al., 2011), supported this view. One of their conclusions was that South Africa should focus on core skills in English and computer literacy in order to 'come out' of the 'poverty trap'. This coincided with a narrow, neoliberal approach to social justice in education, aiming at the labour market rather than cultural and social skills, and knowledge (Grimaldi, 2012). The core skills needed in the labour market is important for the learners so that they can enter the labour force. A clear picture is obtained when especially considering the World Economic Forum Report (2014) that ranked South Africa as the last country with regard to the quality of math and science education.

The focus of the Norwegian introduction programme can be questioned based on the narrowness and neoliberal approach towards social justice, at the same time of preparing the refugees for joining the labour market. The Norwegian values and skills were stressed. Among others, the introduction programme focused on the importance of being punctual, withdrawing payment if the participants were late or did not show any documentation of their absence. It should be noted that not wanting to attend work placement, for instance, a grocery store because of the contradictions with Islam (selling pork and alcohol) was not accepted as a valid reason. The refugees could decide not to attend; however, they would lose money for the time they could have been at work placement. Furthermore, the importance of Norwegian culture and language were also stressed for the refugees to get a job. The reasons for this focus were that these skills were considered as important in the society, and the introduction programme ensured that the refugees would be self-sufficient in the Norwegian society. If the refugees wanted to follow the introduction programme, they had to follow the rules set by the government. Occasionally, they were given the choice to leave the introduction programme; nonetheless, they would have few rights in the society. The Norwegian Labour and Welfare Administration would give them a minimum amount of money since they had denied the benefits of the introduction programme. In addition, non-attendance in the required amount of Norwegian lessons (550 hours) and social studies (50 hours) (Justis- og beredskapsdepartementet Introduksjonsloven, 2005), might lead to problems relating to the renewal of their permit. Thus, the refugees must see the importance of learning these core skills to enter the labour market.

Nevertheless, social justice requires more than a narrow, neoliberal approach focusing solely on economic terms. Cultural recognition and a feeling of self-worth are important parts of social justice and can be a way to diminish reproduction of inequalities and transform stigmatised, silenced groups into critically engaged human beings who can challenge the culture of silence (Bourdieu, 1997; Grimaldi, 2012; Rawls, 1971; Freire, 2000). The "notion of education as a social good", needs to be reaffirmed through a

different discursive framework focusing on democratic education (Grimaldi, 2012, p. 1151). A democratic approach to social justice and education is where structural factors are taken into account rather than a limited focus on the economics and labour market. This coincides with Rawls's point of view, who stated that:

“the value of education should not be assessed solely in the terms of economic efficiency and social welfare. Equally, if not more important is the role of education in enabling a person to enjoy the culture of his society and take part in its affairs, and in this way to provide for each individual a secure sense of his own” (1971, p. 101).

This indicates the importance of acknowledging the diverse knowledge traditions and cultures, rather than solely focusing on the hegemonic and Western knowledge and culture. It can be argued that cultural skills and knowledge are important in both contexts for several reasons, including identity building, a feeling of self-worth, and critical awareness, in order to create a more socially just society based on understanding, respect and tolerance. This coincides with Rawls' (1971) justice as fairness-theory, allowing all citizens to take part in their culture. A wider and democratic approach to social justice is needed, where education becomes a tool for social change, creating critical and engaged people equipped with the cultural capital required for participation and inclusion in the society and the skills relevant to the labour market.

## **5. FUTURE RESEARCH DIRECTIONS**

In this study, the views of the refugees in the Norwegian introduction programme have not been considered; it has been based on the author's observations and previous conversations from the time the author worked with the refugees, together with IMDI's report on integration and settlement from 2014. Therefore, further research needs to be done on such issues with the focus on the refugees' voices. Through a critical dialogue, one can give a voice to what can be claimed to be a stigmatised, silenced group in Norway, lacking words for their rights (Freire, 2000; Nordland, 2009). It could have been interesting to conduct interviews with refugees with a residence permit, with more or less the same interview questions as the South African learners were asked. In addition, one could interview the Norwegian class teachers and people working with the introduction programme to see what their perceptions are regarding social justice and hegemonic discourse in the introduction programme.

## **6. CONCLUSION**

Even though Norway is a well-resourced country and South Africa is a poor country with an emerging economy, a connection can be found when looking at the South African high schools and Norwegian introduction programme for refugees, many with an African background, with regard to social justice. This shows the importance of non-material factors when one looks at the importance of social justice in education. Even though both countries focus on the importance of being democratic countries, the content of both systems have been argued as reproducing inequalities based on a narrow, neoliberal focus on social justice that is based on economic terms. In order to achieve a wider approach to social justice, the differences in a social and cultural capital, as well as the cultural recognition needs to be taken into account. In this democratic approach to education, social justice may be achieved by ensuring that the South African learners and participants of the Norwegian introduction programme become critical thinkers who are not alienated in school or their programme, together with other social factors like race and religion

(Grimaldi, 2012). As Grimaldi claims, when focusing on limiting, neoliberal terms in an educational system, “any reference to progressive values such as education for citizenship, democratic schooling, active and critical thinking, students wellbeing and cultural recognition” seems to vanish (2012, p. 1150).

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## Chapter # 22

### LEADERSHIP AND APPLIED ETHICS IN EDUCATION: A MENCIAN APPROACH

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#### ABSTRACT

Applied ethics is focused on issues in private or public life that are subject to ethical judgments. Based on how conflicts between personal and professional values in recent legal cases (e.g., Keeton *vs.* Anderson-Wiley, 2010; Ward *vs.* Wilbanks, 2010) have interfered with ethical decision making, a question raised in applied ethics is whether integrating personal values and professional ethics in ethical decision making affects the morality of ethical decisions. The purpose of this chapter is to use the three-part division of traditional normative ethical theories identified by researchers at Brown University for making ethical decisions to describe and explore consequentialist and deontologist forms of ethical reasoning for deciding matters of morality in education. A literature search identified published frameworks that define the components of ethical decision making. Using these frameworks, a new framework, called the personal and professional values-integrated framework, is constructed. Consideration is given to areas and practices in the guidelines or rules for the process of forming ethical reasons and variations in reasons that are less easily accommodated by conventional ethical frameworks. The description of Will by the Chinese philosopher Mencius (371-289 BC) is used to gain insight into some of the implications of ethical decisions. It is demonstrated that leadership rules in education are realized by acknowledging the reasons for an action, and ethical decision making is defined as conforming to the criteria pertaining to these considerations as well as the professional conduct expected.

*Keywords:* ethical decision making, applied ethics, leadership.

#### 1. INTRODUCTION

Leaders play a critical role in groups by holding disproportionate responsibility in both setting goals and inspiring collective action to attain those goals (Hoyt & Price, 2015). The most important role of leaders, as argued in leadership studies, is to set strategic directions for their organizations and to do so even when facing difficult ethical dilemmas (Antonakis, Cianciolo, & Sternberg, 2003; Karp & Helgo, 2009). The values of a leader who provides a vision and mission for the organizational strategy are fundamental components of his or her strategic decisions (Bai, 2012). Bottery (2011) noted that educational leadership, as suggested by Ribbins and Gunter (2002, p. 359), has historically been “insulated by its characteristically pragmatic and essentially atheoretical tradition”, and Ribbins and Gunter further suggested that a research agenda needs to be built which identifies priorities within the field.

Within education ethics, the analysis of the ethical decision-making process has gained importance because a better understanding of this process may more accurately identify factors that facilitate ethical behavior (Ametrano, 2014). Research about the process by which individuals behave unethically has provided inconclusive results (Marquardt, 2010; Marquardt & Hoeger, 2009; O’Fallon & Butterfield, 2005; Watson, Berkley, & Papamarcos, 2009). It has been argued that no existing framework is robust



enough to explain the complexity of the human ethical decision-making process (Craft, 2013; O'Fallon & Butterfield, 2005). Teaching ethics might involve providing students with exposure to multiple ethics theories that can provide a framework for decision-making in order to ensure "increased awareness of ethical issues and enhanced decision-making skills" (Dzurainin, Shortridge, & Smith, 2013, p. 102).

Ametrano (2014) described becoming an ethical professional as a developmental process (Neukrug, Lovell, & Parker, 1996) that involves movement from memorizing standards toward learning to integrate professional ethics with personal values (Handelsman, Gottlieb, & Knapp, 2005). The ethical norms/incentives factor had a highly significant effect on measures of behavioral intent. Specifically, an organizational culture that emphasizes and rewards ethical behavior, and in which organizational leaders serve as positive role models, reduces the likelihood that tax practitioners will engage in overly aggressive actions.

Walker and Donlevy (2009) argued that personal conscience, relational reciprocity, common ethical principles, and professional convictions with constraints form a multi-frame analysis. They provided the facts and decisions of a Canadian legal case to demonstrate how such an ethical analysis is best suited for the attainment of personal and professional integrity amongst educational decision-makers. Joy (2007) stated that causes of wrongful convictions should be addressed rather than hoping and waiting for the existence of systemic change in legislation. Legal self-help remedies are outlined to prevent wrongful convictions. Smith (2010) noted that while there is a feeling of gratification for a conviction, representing the best ideas in making political decisions, there are dangers in assuming the rightness of one's conviction at all costs and being blind to any evidence to the contrary of that conviction. It mentions on U.S. President Woodrow Wilson's fourteen points the insisted Europe follow the end of World War I. Beckner (2004) noted that students need good leaders in education, professionals who show, through example, that they follow a system of personal and professional ethics consistent with the best social and personal convictions. Educational leaders are often faced with ethical dilemmas in the course of their daily work; they are required to make complex decisions in the best interests of their students and schools.

Bennis and Thomas (2002) pointed out that the ability to overcome adversity and learn from passion in both work and life has been linked to leadership ability in managers in various fields. The decision makers' thinking processes included vision, political astuteness, being tactical, being strategic, due diligence, and risk management; the ethical processes included respect for diverse opinions, integrity and trust, democracy, impact of policies, passion for public service, and intuition about doing the right thing (Jiwani, 2011).

## **2. ETHICAL DECISION MAKING AND PERSONAL AND PROFESSIONAL VALUES-INTEGRATED FRAMEWORKS**

In the education field, it is important that each individual feel personally and ethically responsible. The development of ethical decision making prevents the attribution of blame to someone else or some other department for his or her own ethical transgressions, thus encouraging him or her to take responsibility of his or her decisions. Making decisions that are ethical requires the ability to make distinctions among competing choices. Ethics elucidates how a conscientious person should behave by providing a way to choose among those competing options. Crossan, Mazutis, and Seijts (2013) model applies to EDM in

education, but the focus in this chapter is on EDM to promote the integrity of subtle ethical choices in education. According to Crossan et al. (2013), some examples of EDM as applied to education in the context of leadership and ethics include Rest's (1986) four-component (moral awareness, moral judgment, moral intent, and moral behavior) psychological process of EDM, Kohlberg's (1969) theory of cognitive moral development, and Jean Piaget's (1932) study of moral development in children (Biggs, Schomberg, & Brown, 1997; Stephens & Smith 2009).

The inclusion of EDM in a new personal and professional values-integrated framework as a part of ethics education to help students to identify (ethical sensitivity) and think through ethical issues (ethical judgment) in the education field has been subject to very limited research to date (Kenny, Lincoln, & Balandin, 2010). As Crossan et al. (2013) noted that Hursthouse (2007) pointed out that a useful heuristic for the categorization of normative ethics involves three major ethical frameworks: consequentialism, deontology, and virtue ethics. The Markkula Center's five sources of ethical standards and Crossan et al.'s (2013) ethical decision making require an ethical structure. This study integrates Markkula Center's five sources and Crossan et al.'s (2013) decision-making model is used to ascertain how far the new consequentialism can approach deontology in constructing a personal and professional values-integrated framework and how difficult this expansion could be. In the context of the deontological principle of double effect, an informational approach can show that there is an unavoidable divergence between deontology and consequentialism, a disparity that shows genuine dimensions in practical reasoning.

### **3. ETHICAL DECISION MODEL**

The Markkula Center for Applied Ethics (2009) offers one suggested model for assessing the ethical nature of a decision. Ethical decision-making should apply at least five different understandings of ethical standards. These five understandings of are the utilitarian approach, which deals with consequences; the rights approach, which implies particular duties to be fulfilled; the fairness or justice approach, in which equals should be treated equally; the common good approach, with interlocking relationships in society as the basis of ethical reasoning; and the virtue approach, which implies acting according to the highest potential of one's character and on behalf of values like truth and beauty.

### **4. CONSEQUENTIALISM**

The word "consequentialism" identifies a general approach to moral reasoning within which there are several somewhat similar moral theories, each with variations (Keith, 2005). Grayson (2007) claimed consequentialism is about the moral rightness of acts and the embodiment of the idea that the "ends justify the means" (p. 2-2). The only attribute that determines the morality of an action is its results or consequences. Consequentialism holds that whether an act is morally right or not depends only on the consequences of that act or of something related to that act, such as the motive behind the act or a general rule pertaining to acts of the same kind. Consequentialism has its roots in the work of John Stuart Mill (1806-1873); Mill espoused the idea of utilitarianism. The permissibility of actions is determined by examining the situation's outcomes and comparing those outcomes with what would have happened if some other action had been performed.

Consequentialism holds to the utilitarian approach; it deals with consequences: “Actions, including institutions, laws and practices are to be justified only by their references to consequences” (Smart & Williams, 1973, p.79). In the *Encyclopedia Britannica* (2006), however, it is pointed out that consequentialists also differ over whether each individual action should be judged on the basis of its consequences or whether general rules of conduct should be judged in this way and individual actions judged only by whether they accord with a general rule. The former group hold to “act-utilitarianism” and the latter “rule-utilitarianism.”

#### **4.1. The rules for consequentialism**

Happiness is good in the eyes of consequentialists. For example, Jeremy Bentham’s (1748-1832) act-utilitarianism considered the quantity of pleasure as the measure of sound ethics, and Mill’s rule-utilitarianism considered the quality as well as quantity of pleasure as the foundation for sound ethics. If the act is right, it creates good consequences that are good for everyone affected. Good consequences must be impartial, in so much as oneself or family members should not count more (or less) than anyone else.

##### **4.1.1. The Mencian approach**

One variation of the consequentialism approach is known as ethical egoism, or the ethics of self-interest. In this approach, an individual uses consequentialism based on a broader conception of relatedness to produce the greatest amount of good for him or herself. Ancient Chinese philosophers, like Mencius, claimed that human nature is good (Loden, 2009), and early modern thinkers in the West, like Thomas Hobbes (1588-1679), may be considered forerunners of this approach (Bonde & Firenze, 2013). The Mencian approach to ethics is focused on the moral sentiment of the heart-mind for discerning what is good and right, thus emphasizing moral insight.

### **5. DEONTOLOGISM**

If one subscribes to the objective approach to ethics and moral action, the system used to determine and evaluate actions is one that may be described as “non-consequential”, in other words, deontological (Beckner, 2004, p. 52). Deontologism is duty ethics. Deontologism is a rights approach, in so much as rights imply particular duties. According to Griener (2005), deontologist ethical decision-making rules may be: (a) Universal, or impose obligations on everyone, or (b) role specific, or impose obligations only on people who hold certain positions (e.g., professional). Deontology is critical of all utilitarian approaches because utilitarianism fails to recognize certain central feature(s), such as the obligation to respect the essential autonomy of all human beings.

#### **5.1. The rules for deontologism**

Deontologism is a kind of ethical theory that puts its emphasis on universal imperatives like moral laws, duties, obligations, prohibitions, and so on, and is sometimes called “imperativism” (Terravecchia, 2001). A good will is intrinsically good—good in and of itself, not just instrumentally good. Immanuel Kant’s (1724-1804) deontologism considered moral value, which depends on the will, which means the end results cannot justify the means. Morality is a system of categorical imperatives; there are no ‘ifs’ about them. Ultimately, there is just one basic law: The categorical imperative, which consists of three formulations. These are the following: (a) “Act as if the maxim of your action were to become by your will a Universal Law of Nature,” which is the “universalizability” law;

(b) “Act in such a way that you always treat humanity, whether in your own person or in the person of any other, never simply as a means, but always at the same time as an end;” and (c) “Act always on the maxim of there being such a will in us that can at the same time look upon itself as making universal law” (adapted from Field, 1996, p. 3).

## 6. CONCLUSION

As Ametrano (2014) noted, conflicts between personal and professional values from recent legal cases (e.g., Keeton vs. Anderson-Wiley, 2010; Ward vs. Wilbanks, 2010) seem to have interfered with ethical decision making, raising questions about whether the integration of personal values and professional ethics in sound ethical decision making makes a difference. Crossan et al. (2013) pointed out that Nyberg (2007), argued: “[T]raditional ethical theories (consequentialism and deontology) are not suitable ... since universal principles and rules leave little room for the ambiguity and [the] everydayness of situated work activities.” (p. 587). These theories pose challenges with respect to capturing complex organizational practices, especially situations with information uncertainties and ambiguities; situations that involve ethical leadership predicaments; and situations with moral dilemmas embedded in the decision-making context (Beabout 2012). The Markkula Center for Applied Ethics (2009) believes that students can become ethical leaders and has taken steps to create a culture of awareness about decision making with respect to ethical dilemmas.

Because Mencius assumes a state of nature wherein human beings have moral resources that they can voluntarily call upon at any time (Im, 2002), it would seem that having the necessary capacity to know and act on the rationale of morality organically translates into an ability to act morally. The Mencian consequentialism of the virtue ethics model identified goods, such as the goods of kinship relationships, as both intrinsically and instrumentally valuable, showing how self-cultivation leads to a transformed bodily appearance; it is an analogical kind of reasoning relying on shi (this is right; 是) and fei (is not wrong; 非) attitudes, rather than a deductive style, thus drawing on beliefs and desires that are familiar to Western models of action (Olberding, 2015). To guarantee ethical leadership, a leader is required to embark on a continuous journey of self-cultivation of morality and virtue ethics. To enable the success of educational ethics, styles of leadership should be chosen in accordance with the role and character of decision making and fairness as associated with the virtue of justice (Crossan et al., 2013).

In this chapter, ethical processes for making ethical decisions about students’ values with respect to ethics and state law as well as integrating their professional lives with their social lives were outlined in the scenarios described. The process and components discussed in this chapter can help students identify appropriate levels of accountability, think about how professional ethics can be integrated with their personal values, and provide ideas for the assessment of the rightness/wrongness of behavior.

In this study, a review of the context of leadership and ethics literature has demonstrated the symbiotic relationship between professional and personal ethics. In addition, by relating the literature on ethics to leadership and ethics, it has shown that professional and personal ethics are underpinned by ethical values that influence the outcomes of professional and personal processes. In short, more effort is required in the field of education to develop a deeper understanding of both ethical leadership and Mencian intuitionism and their interface with applied ethics.

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The Educational Ministry of Taiwan has honored Prof. Tseng for her accomplishments in the production of multi-media educational materials in years 1998 (Bronze Medal) and 2000 (Gold Medal). In 2006, Prof. Tseng was invited to join the Higher Education Evaluation and Accreditation Council of Taiwan as an evaluator until 2013. In December 2011, the Ministry of Education honored Tseng's accomplishments with respect to applying a life-long learning model. Tseng's recent activities have expanded beyond music education to social welfare. She currently serves on the board of Young Women's Christian Association (YWCA) of Kao-Hsiung as President.

## Chapter # 23

### FINANCIAL EDUCATION AND ITS POLICY IN JAPAN

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#### ABSTRACT

Some developed countries conduct financial education in primary school. Financial assets which individuals can access increase and they are more and more necessary for individuals to have financial asset, so financial literacy for individuals is also needed to protect them. Accordingly, the importance of financial education from younger age is more and more necessary. However, the international standards and method of financial education haven't been established yet. That's why they differ from countries.

Buy the way, financial education has been conducted in Japan, and it shows great result these days. This study shows problems that financial education in Japan has had, and what is financial educational innovation that shows great result by international comparison. The result of this study can be a good example for countries that will conduct financial education in the future.

This study surveys financial education policy in Japanese government, then, previous studies, investigation reports and interviews about financial education cases that are done in Japanese educational institutions. Specifically, this study surveys financial education in U.S., U.K., Australia, and compares Japanese one with them. Also, this study surveys examples of financial education by public institutions and international institutions such as financial education project by OECD. This study shows as below.

- Financial education in Japan has problems about teacher's financial acknowledgement, educational materials and lack of relationship between actual life and financial economy.
- The collaboration between government and educational institution to solve problems above may cause financial educational innovation.
- The development of financial education in Japan can be a good example for countries which need financial education in the future.

*Keywords:* financial education, educational innovation, academia-industry-government cooperation, education policy.

#### 1. INTRODUCTION

The importance of financial education has been increasing in modern economic society. Financial education in this thesis refers to the report (OECD, 2012) issued by OECD/INFE (International Network on Financial Education) on August 2012. The report defined financial education as *"the process by which financial consumers/investors improve their understanding of financial products, concepts and risks and, through information, instruction and/or objective advice develop the skills and confidence to become more aware of (financial) risks and opportunities to make informed choices, to know where to go for help, and take other effective actions to improve their financial well-being"*. (OECD, 2012, p. 7). These days, we can see many developed countries have been doing financial education positively.



Japan, which has the second highest volume of household financial assets thinks financial education important similar to United States of America, which has the highest volume. In the 2000s, government mentioned about the importance of financial education and had been doing many kinds of actions in Japan. However, in an early stage of financial education in Japan, they can't evaluate educational effect positively, because the financial education method wasn't established. However, the method of financial education has caused in Japan, educational effect and reputations are increasing. The development and innovation in financial education in Japan can be a good model for other countries that are going to set about it.

Therefore, this thesis introduces new perspective and innovation of financial education in Japan, and conducts international comparison.

In this thesis, we tried sending out questionnaires but couldn't collect enough number of replay to analyze. Also, the information from financial associations, educational institutions and official institutions is allowed to refer for our study, but not allowed to show individual names and institution names on this thesis because it is not official answer. That's why we use a lot of second-hand data, and we apologize for it.

## **2. BACKGROUND**

There are many factors promoting financial education. For example, it is required to improve financial literacy and financial actions for the better after the latest financial crisis (Lehman-collapse), it is required to form financial assets individually in global economic capitalization and financial deregulation, individual can access many kinds of financial products such as stock, investment trust, foreign exchange, money management fund (MMF). And many developed countries can't guarantee a pension in the future because cost of social security is increasing.

For example, according to homepage of Ministry of Finance, in 2015, total cost of social security in Japan occupies about 25% of GDP, and more than 50% of cost of social security in Japan is spent for the National Pension. If this situation lasts, Japan will face economic collapse, so the amount of the National Pension is decreasing. That's why Japanese government recommends for people to invest for financial asset as a way to reserve for old ages. Accordingly, it is important to enhance people's financial literacy.

Besides, the number of financial crime targeting individual is increasing, so it is required to develop individual financial literacy to protect consumers. Thus, financial education is one of the most important social policies not only for elderly people who tend to invest excess cash but also for young people.

In the 1990s, developed countries started to conduct financial education, but there is no global standard financial education method by for now, and every country tries to find better methods. Rather financial education might have to be different from economic characters in each country mentioned OECD (OECD, 2012, p. 7).

By the way, what is the aim of financial education in Japan? There was no guide to show the necessity of financial education, but a study group on Financial Education (Study Group of Financial Economy Education) formed by Japanese Financial Services Agency showed an official guide. According to this guide, the aim of financial education is summarized as below.

- Financial literacy as a life skill
    - No one in modern society can avoid involvement with financial matters.
    - It is important to make life planning a habit and acquires the knowledge and judgment needed to appropriately select/use financial products in order to achieve financial independence and lead a better life as a member of society.
  - Financial literacy to encourage the provision of sound, high-quality financial products
    - Government regulations alone can only go so far in achieving user protection; moreover, excessive regulation could hinder innovation by financial institutions.
    - As users improve their acumen in selecting financial products, better financial products can be expected to become prevalent.
  - Financial literacy encouraging the effective use of household financial assets in Japan
    - The majority of Japan's approximately 1500 trillion yen in household financial assets is held in cash and savings. One reason for this is inadequate understanding of the benefits of diversified, long-term investment.
    - If households are encouraged to engage in diversified, medium to long-term investment, the effect would be to help make available to growth sectors a sustained supply of funds.
- (Source) Financial Services Agency (2013) p. 1.

As you can read, the aim of financial education is to give individual profit as well as to develop economy of country and local area by “Financial Literacy”. This way of thinking evokes the idea of “Social Common Capital” by Hirofumi Uzawa (Uzawa, 2008), who has taught in the University of Tokyo, the University of Stanford, the University of California at Berkeley and the University of Chicago. In Japan, it is sometimes treated with negative image to study about financial transaction and asset formation and to make a profit from investing financial products in Japan even now. However the system of finance is one of the public goods in modern society and to invest unemployed capital in capital market temporarily can develop people seeking funds and society. Investors give society funds to make new value so that getting return as an equivalent for their investment should not be had a guilty (Speculation should be apart from this matter.) although we think as such, the Financial Services Agency in Japan defined the aim and value of financial education as above and promoted financial education in many kinds of means and support. After that new development of financial education in Japan has begun and has formed an innovative financial education system.

Related to the trend, Mr. Kikuo Iwata, who is Deputy Governor at Bank of Japan that is the central bank in Japan, explained as below at “Special Address at the ADBI-Japan-OECD High-Level Global Symposium in Tokyo” in 2015 held in Tokyo, Japan.

“...In addition, with the declining birthrate, the proportion of people aged 65 years and older is expected to rise to nearly 30 percent by 2020. Considering the large burden borne by the working-age generations, the role of public pensions will become smaller. In other words, each individual's efforts to achieve financial independence in their retirement period have become more important. Encouraging elderly people to work longer is one important factor, but so is improving financial literacy. Starting lifetime planning while still young and reserving assets for retirement will help.”

(Bank of Japan, 2015, pp. 1-2)

However he also said as below and mentioned about the necessity of politics to improve financial literacy in Japan.

“However, there are worrisome signs that financial literacy associated with lifetime planning has been undermined.

As I mentioned earlier, households' financial assets have been growing. However, at the same time, the number of households that do not have such assets has been increasing recently. This trend has been observed in a wide range of income groups, including the high-income group. The backgrounds to this are varied, and problems related to financial literacy represent one of the factors. One example is a weaker awareness of the importance of lifetime planning.

There are various concerns regarding children as well. In this affluent society that is undergoing demographic changes and rapid progress in technology, children could lose their sense of the value of money. For example, we have the so-called "six pocket problem."

This refers to a phenomenon in which a child is indulged with money given by the parents and grandparents of both the father and mother. Another is the "invisible money problem"; that is, a situation in which a child does not feel that they actually paid a price for something, given the increasing use of electronic money. In both cases, children have fewer opportunities to realize, through the first-hand experience of using physical money, that there are limits to the money we can spend.”

(Bank of Japan, 2015, pp. 2-3)

Anyway, it is more and more necessary to improve financial literacy and to conduct financial education in Japan these days.

### **3. NEW DEVELOPMENT AND INNOVATION OF FINANCIAL EDUCATION IN JAPAN**

We can say that financial education has been conducted since the 1960s, the period of rapid economic growth, as a view from just protecting consumers. It was after 2000, when the Financial Services Agency thought financial education of an important policy, and after 2005, when they declared items to be done soon, that modern financial education was conducted. After that, a government, schools, local governments and financial institutions have developed and conducted many kinds of financial education independently. However Study Group on the Promotion of Financial and Economic Education (2014) found that 95 percent teachers who have conducted financial education in junior and senior high school had some difficulties in their financial education. Main difficulties are shown as below.

- The focus on understanding terminology or systems makes it difficult for students to relate lessons to their actual lives.
- Students learned the information, but found it difficult to pick up abilities or attitudes.
- Lack of expertise among teachers makes it difficult for students to understand the relationship between risk and return in investment.
- The main features of financial products were not necessary to teach until after high school.

Such kind of indication causes the dramatic change of financial education in Japan. For example, Japanese government showed the aim of financial education (Figure1) and the

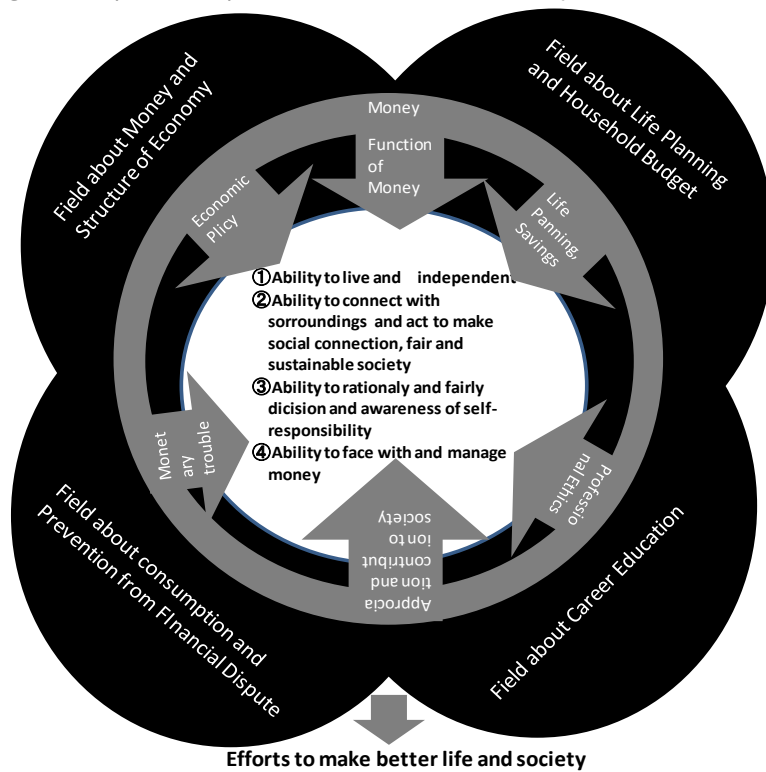
way to achieve it and industry-academia collaboration has been promoted. For example, Tokyo Gakugei University, University of Tsukuba and KAGOSHIMA University develop programs of financial education and conduct them collaborating with financial institutions in the suburbs (Some of them started it before 2013). This kind of industry-academia collaboration conducts required education and gets great results in each local area.

We introduce industry-academia collaboration about University of Tsukuba. University of Tsukuba collaborated with Mitsubishi UFJ Financial Group to invent financial economic educational support program for higher-grade students in primary school as an educational support CSR. Specifically, they created a web site and a guidance book with DVD to learn financial economy. The web site consists of four themes "Use", "Savings", "Lending", "Financial Activity", and uses cartoons students not to get bored. This web site is run by NPO who has many experiences to invent classes with industry and academia. This program is continued still now, and its homepage has been updated,

and become more effective. That's why more and more users join this program.

The efforts of industry groups also cause this kind of innovation and improve education effect significantly. For example, Japan Banker's Association which most of Japanese banks belong to distributes Web contents, CD-ROMs and pamphlets for free to tell people the roles of banks and promote people to use them appropriately. They make separate educational materials for elementary school, junior high school and senior high school and offer special educational programs for teachers for free. Japan Specialists from Banker's Association have classes at school, sometimes.

Figure 1. Purpose of Japanese Financial Educational System.



(Source) The Central Council for Financial Services Information(2015) p.19.(Author Modified)

Furthermore, the most effective system that Japan Banker's Association offers is the school designation system of financial education. This system designates mainly high schools to concentrate on financial education and offers various education programs for students for free. This system has just started, but they had taught more than 20 schools by last year.

In addition, Japan Securities Dealers Association conducts financial education. They invent and provide financial educational materials (printed version, web version) for school, also have seminars for financial educators. For example, they provide "Stock Learning Game" for junior, senior high school and university students. This game was created referring to "Stock Market Game". In this game, students do imitation trade using virtual initial money (about 100 thousand dollars). Students can learn not how to increase investment return but the system of economy and capital market experiencing social situation change. This game needs to be played by not individual but a group consisted of some students. Players need discussion in order to learn decision-making process reasonably in economy.

Japan Securities Dealers Association monitoring the state of implementation of this game (Japan Securities Dealers Association, 2015, p. 5), 35480 students from 830 schools played this game last year. The details were 236 junior high schools (28.4% of all), 383 senior high schools (46.1% of all) and 180 universities (21.7% of all). The reasons that schools let students play this game were mainly to enhance interest of economy and society, or to realize living economy and society. After playing the game, about 95% students was satisfied with it more students were interested in politics.

We have never gained this kind of achievement we can say that Japan Securities Dealers Association and schools collaboration caused a big impact financial educational innovation.

In addition, Bank of Japan or Japan Financial Agency contributes financial education positively. Anyway, financial education in Japan is solving problems by industry-academia collaboration and industry groups and making effective educational methods. New development and innovation of financial education in Japan will be meaningful precedents for other Asian countries having similar sense of values as well as other countries exclude Asia to develop financial education system in the future.

#### **4. OTHER COUNTRIES CASE**

Anglo-Saxon countries such as United States of America and United Kingdom are the birthplace of financial education. So we would like to introduce examples of representative countries shortly. We mainly refer to Kurihara et al. (2014) in this chapter.

First, United States of America has financial education programs in each State or school, though these are not public program. Especially the representative is an NPO corporation, Jump\$Start which more than 150 institutions interested in financial education invested and established. Jump\$Start conducts financial education investigations and financial literacy investigations of university students. (Kitano, Nishio, Ujikane, & Osanai, 2014, p. 299).

In detail, they prepare more than 800 educational materials and offer the system to learn knowledge about finance through SNS and Internet games. VISA also offers educational materials for free, which enables from children to adults to learn finance through games and textbooks.

In United States of America, Financial Literacy and Education Commission was established in 2013 and started to develop public financial education. In England, financial

education is part of official educational curriculums called Personal, Social, health, and Economic Education. According to the formal document by Department for Education that is in charge of educational policy, financial education is conducted for from 11 to 16 years old students connected with mathematic. (Department for Education, 2013, p. 103).

In Australia, after Melbourne Declaration on Educational Goals for Young Australians in 2008, national curriculum has been made. Financial education plans to be done about personal finance in Business and Economics curriculum for 5th grade students in elementary school though this is still draft curriculum in May 2015. (Miyahara, 2014, p. 18) The other countries such as Germany and French become to conduct financial education positively.

Every country that started financial education earlier than Japan has different systems. However, to think about United States of America is highly expected to introduce public financial education systems, we can say that government will play important roles and companies and industry groups will support it. (Government plays important roles in Germany and French.) Unfortunately, there are not so many results of study that show financial education system works effectively. To compare with Japanese case, industry-academia collaboration and collaboration with industry group improve financial education greatly in Japan. Therefore Japan is required to make financial education system as social policy to be a good model to such countries.

## 5. CONCLUSION

This thesis shows the meaning of financial education and new development and innovation, also surveys about United States of America, United Kingdom and Australia and refers to the different points with Japan. This study shows as below.

- Financial education in Japan has problems about teacher's financial acknowledgement, educational materials and lack of relationship between actual life and financial economy.

- The collaboration between government and educational institution to solve problems above may cause financial educational innovation.

- The development of financial education in Japan can be a good example for countries which need financial education in the future.

This thesis shows that new development of Japanese financial education and innovation, but it will take a few years to get a full-scale result. The importance of financial education is increasing in present society, so it is required to conduct better conducts in schools by trial and error. To improve financial education, it can be great support the view from not only economics but also education policy, teaching methodology.

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## Chapter # 24

### EDUCATION AND TRANSITION TO WORK: PROMOTING PRACTICAL INTELLIGENCE

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#### ABSTRACT

This chapter considers a number of questions in the current discussion on the transition to work, most notably the definition of the pedagogical approach by which the issues at hand are investigated, the review of the relationship between education and development in reference to employability, and the interpretation of the right to education in light of the precarious nature of the productive processes. This contribution also points to the relevance of the notion of “human development” as explored by Martha Nussbaum, professor of Politics and Philosophy at the University of Chicago, and Amartya Sen, who was awarded the Nobel Prize in Economics. It ends with a reflection on a welfare model supported by people empowerment that enhances individual capability. The argument put forward is that major shortcomings can be found in welfare systems in terms of employability. Against this background, the author welcomes a system which enables the full development of human development. In this sense, social scientists should engage in pursuing new avenues for creativity in order to build a new approach to social responsibility.

*Keywords:* competence, human development, practical intelligence, capability, liberty and new welfare.

#### 1. THE NOTION OF WORK: A PEDAGOGICAL PERSPECTIVE

Pedagogy sets itself as an important component of the “culture of development”. In this connection, ascertaining whether certain aspects concerning changes in the way people work – either at a conceptual and practical level – and the manner today’s work culture can be supported and addressed by pedagogy is crucial in the present analysis. This is particularly the case when devising strategies to further professional and social development.

Work thus plays a major role in human development while gaining civil and educational values, which are dependent upon cultural and geographical factors in one’s social history<sup>1</sup>.

Work lies at the heart of the “social question” which currently has been given momentum. This is particularly the case if one considers factors such as business relocation and the supremacy of finance over economics, which set the conditions for ongoing inequalities worldwide, to the extent that in some countries rights such as freedom and

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<sup>1</sup>For a more detailed analysis on the notion of “work” from a pedagogical perspective, see my book: Alessandrini (2004), *Pedagogy of human resources and organizations*, Milan: Guerini, and the bibliography therein. An attempt has been made to provide a brief overview of the main interpretations of work in pedagogical terms in Renaissance, Enlightenment and Modernity.



democracy are jeopardized. In this connection, reference has frequently been made in the West to the concept of the “erosion” of social capital, with the middle-class which now face hardship and social imbalance which might endanger civil coexistence.

If one were to reconstruct, yet ideally, the historical and semantic characteristics through which the concept of “work” has been referred to as a source of humanization over the years, mention should be made of figures such as Augustine of Hippo, Benedict of Nursia, Comenio, as well as Rousseau, Locke, Frobel and Hessen. Yet this effort, albeit fascinating, is beyond the scope of this chapter and priority will be given to other questions (Alessandrini, 2004).

The notion of “work” has been investigated during the nineteenth and the twentieth century by scholars with a different educational background – economics, sociology, labour law, and so forth – who have examined a wide range of topics which formed the basis of modernity. Among other topics are the relationship between individuals and social groups, the forms of power and authority in socio-organizational contexts, delegation systems and management structuring, workers’ safeguards and rights (Accornero, 1997; Dell’Aringa, 2011; Friedmann & Naville, 1963; Izzo, 1991; Tronti & Centra, 2011; Zamagni, 1997).

An overview of the modern concept of “work”, if cursory, calls for the following question: At which point has “work” become the driving force of society in conceptual terms? In order to provide an answer to this question, mention should be made of a fundamental economic theory. It was Adam Smith in 1776 who explained the wealth of nations considering the ratio of productive workers out of the total population. This novel approach was illustrative of the central role of work in society, as opposed to the traditional feudal system which was still in place in British society at the time of his writing (Smith, 1776).

The growing importance placed upon the notion of work throughout 1800 and 1900 in proto-industrial society represents a unique phenomenon, chiefly if one considers individual behaviour. As pointed out by the German sociologist, Ulrich Beck, “industrial society is in all its aspects a society based on salaried employment” (Beck, 2000).

With time, the concept of “work” will also become the subject of a special area of investigation in human and social science, with social pedagogy which broached the main anthropological and educational aspects.

In the last thirty years, a number of significant changes in the regulation of the employment relationship – e.g. de-standardisation – led to the establishment of certain “drivers”: the gradual decline of the Fordist system of production, the emergence of the networking system, and the consolidation of information and the knowledge economy. Accordingly, changes in the notion of “subordination” and a review of work hierarchies – particularly in large-sized enterprises and the public sector – have been key components in today’s world of work. Another main element which is worth mentioning is the rise of numerous contractual arrangements, the growing relevance of self-employment, as well as the increase in precarious work, which can be found particularly in those sectors marked by low levels of protection.

Echoing Bauman and his famous metaphor, the precarious nature of employment has become an endemic aspect of the “liquid society”. Factors such as temporariness, uncertainty, and vulnerability, are increasingly characterizing the interaction between work and the individual. Indeed, the emergence of more flexible forms of work places upon the individual certain responsibilities and assigns him more bargaining power which thus far has been the preserve of external entities, such as trade unions and social partners. The Italian labour market is particularly fragmented and certain ongoing trends can be seen,

viz. increased unemployment levels for a qualified workforce, high rates of precarious work if compared to stable employment, noticeable differences in terms of employment at territorial, sectoral, and geographical level, chiefly between the North and the South.

The structural changes occurring in the employment schemes increased the levels of flexibility, but this came along with uncertainty and discontinuity, mainly as a result of the economic crisis.

The question at hand that needs to be addressed by scholars of social science and pedagogy is to what extent the foregoing transformations affect the anthropological perspective underlying the notion of “work”, on which dignity and identity are premised. Indubitably, the economic downturn had a particularly strong impact on the most vulnerable groups that is young people and those over 50 years old. Against this background, one might ask in which respects precarious, unqualified and low-paid employment can legitimate one’s identity. In order to ask this fundamental question, it is necessary to recall that the increasing levels of service economy also caused rifts between individuals at a collective level and altered the ensuing social integration. In the past, and in line with the central role of salaried employment in a Fordist-type society, employment status was the only way to gain social citizenship. Things work differently today, for there are many factors which contribute to challenge this state of play.

Previously, continuity of employment was associated with maintaining the same employment status. Nowadays, on the contrary, the increasing discontinuous nature of education and professional career jeopardizes the identity construction and the individual social and ethical background.

The relevant debate is marked by diverging views. On the one hand, there are those who favour an approach based on economic and functionalistic education. On the other hand, proponents argue for an inclusive approach according to which society should invest in people and their talent, irrespective of their occupational status. Whether one approach or the other prevails is dependent upon legislation regulating the welfare model deemed as most effective, and the ensuing concepts of citizen and citizenship.

The pedagogy of work – also in consideration of the range of interpretations conveyed by new meanings over time – questions the merely functionalistic approach of the existing relation between work and individuals. The pedagogical notion of “work” can be looked through a dualistic approach, which serves to promote an educational dimension and to prepare the individual to social commitment (Here “social commitment” refers to both the idealistic perspective related to the ethical State and the more active engagement to democratic participation to public life).

Evidently, the latter echoes Dewey, as he argued that “the educational process is one with the moral process”, adding that “according to this novel approach—gaining skills and possessing knowledge and education is not to be intended as the final goal, but as an indication of growth and a reason to carry on”. Dewey also maintained that “Democracy has different meanings, yet its moral meaning lies in deciding that the supreme evaluation of political institutions and productive assets draws on the contribution provided by every member of society to steady growth” (Dewey, 1916).

## **2. THE RELATIONSHIP BETWEEN EDUCATION AND DEVELOPMENT**

Over the last few years, educational levels in Italy have been universally reported to be on the increase, yet whether the skills gained are marketable rests on a number of variables (geographical area, gender, industry and so forth). In this connection, it might be useful to recall that the relationship between unemployment and enrolment rates in Italy is

less significant if compared to that in the United States or the rest of EU Countries. Somewhat paradoxically, within the Italian economy it is difficult to provide positions requiring high-level qualifications.

If one looks at the main EU publications – among others the Delors Report and the e-Europe Report from the Lisbon Conference – a “European” perspective prevailed. This is because economic and civil development bring together resources on education and networking, social support and cohesion.

This set of principles laid the foundations for “the European route towards a knowledge society”, and, since 2001, fostered a new approach to work and learning. This approach can be regarded as an alternative one and involves aspects such as employability, access to knowledge networks, strategies to overcome the digital divide, the role of universities in local development, and the promotion of small and medium-sized enterprises. Tellingly, what has emerged from the EU documents is support provided to education as pivotal to foster democracy. Investing in individual and organizational learning furthers equity and social cohesion, and thus better “educability” also by opening up access to knowledge to disadvantaged people and promoting their employability.

Another element which is increasingly and universally acknowledged as crucial is that of placing formal, informal and non-formal learning on the same footing. Indeed, vulnerable groups – low-skilled youngsters, the unemployed, socially disadvantaged people, workers facing skills obsolescence, and people with disabilities – are those who are concerned the most about this aspect. Providing support to individuals and widening their range of opportunities are tools to promote lifelong learning in Italy. A number of provisions – among others Act No. 236/1993 and Act No. 53/2000, as well as the setting up of ad-hoc funds called Interprofessional Funds – contributed to emphasize the significance of educational plans, whether at local and company level, agreed upon by social partners through specific joint bodies which help to identify specific research areas.

In this connection, workforce planning – particularly in terms of supply and demand analysis – as well as the strengthening of those actors who carry out such activities becomes pivotal.

The most recent data on investments on lifelong learning reveal that Italy ranks poorly with on-the-job training in relation to other European countries. In addition, the OCSE indicators show that investment in adult education in Italy is far from deserving of this name, and available financial resources are unequally distributed among different funds, with this state of affairs which produces serious forms of diseconomy.

The first detail to emphasize, is the positioning of Italy in the 20th place of European rankings for participation in lifelong learning by individuals (employed or not) included from 25-64 years of age. In this ranking, our country was still the fourth-last place in 2007. The average levels of adult participation in the activities of formal and non-formal education and training remain all the time lower than the average European levels. The levels of participation in non-formal activities by employees, evidently as a result of a long process of growth of lifelong learning system.

Hence the need to review the system of lifelong learning not only as an important component of labour politics but also in view of establishing new forms of welfare state governance. In Italy, there is a common consensus on the part of institutions and social partners about the effectiveness of certain initiatives carried out on an experimental basis – e.g. awarding credits to certify the level of expertise – or the provision of the Citizen’s Training Booklet (Grimaldi, 2010).

As far as the Public Administration is concerned, it is undisputed that the set of educational values in the public sector needs to be revisited in light of new elements that can foster the establishment of new learning process encouraging real innovation. Emerging from a recent survey conducted by the Italian Ministry of Labour, 2020 projections on labour demand and supply show that Italy may face difficulty in dealing with future changes in the labour market. As for labour demand, a number of surveys carried out by CEDEFOP point to a trend towards a services and knowledge economy, which will call for highly-skilled workers. Strategies enhancing adult education are an integral part of an effective welfare model, for they further protection through the commitment and the central role carried out by individuals. Some considerations can be made, if in passing, also on vocational training which concern funds for education and the role of pedagogy more generally, which can fuel the theoretical debate and give rise to political solutions (Alessandrini, 2010): a) Individual development needs to be accomplished within a more articulated system of skills certification and mapping, which should bring together technical expertise and relationship skills (knowledge sharing, reciprocity, trust, and commitment); b) Vocational guidance –which includes skills assessment, coaching, and individual interviews – should be given priority, to help boost employability, particularly among younger people; c) Vocational training programmes for adult workers should be devised to favour the transition between jobs, particularly if one considers the precarious nature of many occupations. In this connection, they should enter such programmes while waiting for a new job; d) On-the-job training should be implemented in order to foster growth in terms of social capital. Favouring active participation to working life – at both individual and collective level –might benefit workers in cultural and professional terms.

The latest data on unemployment figures in Italy show a slight decline with the introduction of Job Act – law through which the government Renzi is called to make the reforms related to the world of work and that they are directly and indirectly involve anything that is connected with the work itself – in 2015.

### **3. THE NOTION OF “COMPETENCE”**

The competence is the ability of people to put together knowledge, interpersonal skills, know-how, attitude realizing not only controllable performance, but also intentionality towards goals development that can be own and their organization. In other words, it's planning skill into concrete action, observable and unobservable (“knowledge in action”).

It must be considered undoubtedly a significant step forward in relation to a wide path now – although uneven – which has finally given in recent years concreteness to a theme consolidated both national and European level. Then it encoded with European Council recommendation in December 20th, 2012 (2012/C 398/01) in terms of knowledge validation, skills and competencies acquired through non-formal and informal learning.

On “competence” issue is currently available in both pedagogical and psychological literature very wide and varied. But now it's necessary to deal with devices ECVET (*European credit system for vocational education and training*) and EQF (*European Qualification Framework*), beyond theoretical and basic approaches, combining a

conceptual representation in European documents shared with domain for experimentation and research. The “qualification” is the aim of validation formal process of results obtained from a person with a precise standards<sup>2</sup>.

The agreement concluded on 12 February 2010 concerning a set of guidelines on training is intended to devise a national system of professional standards and skills certification. In this connection, it might be useful to provide a cursory overview of the notion of “competence”, a concept conveying a wide meaning which has been given much exposure in the literature (Alessandrini, 2005; Cambi, 2004; Civelli & Manara, 1997; Boam & Sparrow, 1996; Di Francesco, 1994). It is this notion which helps to define the level of professionalism in educational paths and organizational analysis. According to the relevant literature, what is meant by “competence” is “a combination of proficiencies” where a range of skills comes into play, e.g. technical, theoretical, methodological skills, procedural and operational abilities and relationship skills allowing people to operate in ever-changing contexts. When it comes to education and training, investing in someone’s competencies might be seen as an attempt to help adults further develop their skills. In this sense, gaining competencies becomes even more important for it exemplifies the way individuals behave and express their potential in a given organization. The essence of “competence” lies in the individual ability to combine different proficiencies – hence the evolutionary dimension – taking as its starting point already existing cognitive, emotional and valuable experiences, not only to produce controlled performances, but to promote the willingness to develop planning capacity so as to take concrete action. As such, the idea of “competence” thus refers to a process marked by dynamic and evolutionary aspects. One must certainly agree with the argument that work must be investigated considering the concept of “competence” – particularly at the time of planning training activities. Yet it must be acknowledged that the skills evaluation for certification purposes necessarily needs to take a wider approach than that examining the production process. Such analysis necessitates an inclusion of ‘transversal’ competence, and emphasis on the role of those emotional and cognitive components which act as a catalyst for individuals to contribute to their own learning. A number of studies – among others, the PIAAC project mentioned above – highlighted the positive effects that workplace training has on workers<sup>3</sup>. Informal learning provides an important contribution in terms of skills acquisition, whereas – to the contrary – skills decline might frustrate previous efforts in terms of educational attainments. According to OECD (2011), taking into account learning outcomes in formal education only, thus disregarding the effects of informal learning, would compromise the evaluation of human capital.

Therefore adult learning (European Commission, 2011) is found in the heart of active welfare and understood as an integral part of a new safety net that helps to build the subject himself (engagement).

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<sup>2</sup>The SME-QUAL project aims to improve the quality of training systems for SMEs, by incorporating the ECVET provisions foreseen in the Recommendation of the European Parliament and of the Council establishing the ECVET system ([www.smequal-project.eu](http://www.smequal-project.eu)).

<sup>3</sup>The 2008 PIAAC Programme aimed at assessing the skills of the adult population –viz. those in the 16 to 65 age group – and it is fully compliant with strategies of lifelong learning, for priority is given to those job-related skills regarded as fundamental in terms of economic growth, therefore widening the evaluation criteria for this share of population. The Ministry of Labour and Social Affairs oversaw the implementation and coordination of the PIAAC Programme at an international level, whereas ISFOL fulfils planning duties within the national boundaries. The programme consists of a direct skills evaluation for both theoretical and more practical reasons related to aspects of methodological research which impact on reliability of evaluation. The survey provides an assessment for two sets of skills in adults: skills acquired at the workplace and cognitive functions.

#### 4. HUMAN DEVELOPMENT

Human development can be examined from perspectives other than those including quantitative analysis – based on a merely functional approach which considers economic growth – which might also investigate the issue referring to aspects such as social life as a whole. According to Martha Nussbaum, profit is the means intended to support human existence, yet “the aim of global development, as well as that of effective national politics, is to allow people to live a purposeful and creative life, developing their potential and organizing a meaningful life in line with their dignity” (Nussbaum, 2010).

In this sense, there is common consensus that it is necessary to investigate the pathways to human development in a more detailed way, thus beyond merely calculating the GDP. Here, it might be worth recalling the Human Development Index (HDI), according to which national development should be measured not only on the basis of national income – although this was common practice in the past – but also taking account of such aspects as life expectancy, literacy rates, multidimensional inequality, gender imbalance and extreme poverty. The Human Development Index appeared for the first time in 1990 in a report published by the United Nations Development Programme. As already pointed out, the premise behind the establishment of this index was that – apart from national income – the development of a country should be measured also controlling for such elements as life expectancy and literacy rates, for which data were already available in other countries for comparative purposes. The human development perspective affected a whole generation of policy-makers and social development experts, also those within the United Nations.

Economic growth in its own right does not improve the quality of life, especially if one considers sectors such as health care and education. In a recent publication, Martha Nussbaum has shown that an increase in GDP does not impact on political liberty. China and India are suitable examples of this trend. In a similar vein, the US gained 1st place in GDP rankings, yet placing 12th on the Human Development Index. Overall, average HDI rose by 18% since 1990 and 41% by 1970. This year, the HDI Report provides three new criteria to measure the development rate: multidimensional poverty, gender inequality and extreme poverty. HDI is measured for the majority of world countries, providing valuable insights to both economists and experts of social science<sup>4</sup>.

#### 5. DEVELOPMENT AND PRACTICAL INTELLIGENCE

The issue of development calls to mind the needs to promote the wealth of practical skills which are somehow related to the notion of “practical intelligence”. Simply put, drawing on the concept of *homo faber* (*subject worker*) becomes pivotal to devise policies in education which help to boost employability while increasing individual potential. Here it might be fitting to make mention of *The Craftsman*, the first of three volumes by Richard Sennett (2008), who praises craftsmanship as a necessary skill to face everyday life, the result of the interconnection of technical proficiencies and human thought. According to Sennett, workshops are places of culture where social rituals – or solidarity of

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<sup>4</sup>The Human Development Report classifies the countries surveyed according to the Human Development Index (HDI), which considers three main indicators at a national level: life expectancy, educational levels (enrolment in primary, secondary and tertiary education, schooling of adult population) and adjusted GDP per capita (which is often expressed in PPP US\$).

a ritualized kind – have been established with time. The idea of autonomous work underpinning the concept of “citizen/craftsman” have existed since Ancient Greece, and further developed in China, Italian Renaissance and the Encyclopaedia movement.

According to Sennett, technical expertise means “narration”, ongoing reflection which can also turn into “obsession” with quality. It is embedded in the community and translates into criteria, rituals, and rules. It means re-elaborating through language and, finally, challenging entrenched dogma.

It is the education system which should prioritize issues such as practical, cooperative and collaborative learning, providing the fundamentals to run projects and developing entrepreneurial skills also related to practical intelligence. In Sen and Nussbaum’s terminology, capability is the real potential upon which “human flourishing” is built (Nussbaum, 2010).

People’s wellbeing goes far beyond their wealth, for it involves the opportunity to develop their life plan in accordance with their capability. Hence the reference to a new economy, concerning human development, which should promote either personal growth or wellbeing and support the setting-up of active policies intended to further such development. One might dare to talk of “hermeneutics of practice” (Mortari, 2003). Practice does not rest upon theories worked out beforehand, but it is dependent on the ability to interpret ever-changing reality, a task which is possible only through everyday experience.

Far from being granted at once, such capability is the result of ongoing interpretation and “contextualisation”; this is the main essence of thinking, which thus starts from experiencing.

In Italy, the relationship between practical knowledge, learning and employability is a thorny issue which has been the subject of a number of proposals put forward by relevant authorities at a regional and company level. However, major shortcomings exist, particularly in terms of skills certification gained through on-the-job learning. The apprenticeship system – which has been devised by the Legislator to favour the matching of labour demand and supply, is still regarded merely as a contractual arrangement to reduce the labour costs and make this working scheme a temporary one (Alessandrini, 2013; Bertagna, 2011; Senatori & Tiraboschi, 2008; Tiraboschi, 2011).

## **6. CAPABILITY AND EMPOWERMENT**

By developing “educational capital”, people empowerment is the first step towards “substantial freedom” that is – to use Sen’s words – “a kind of freedom which involves the capability to convert available goods and resources into freedom to pursue one’s objectives and goals, conduct alternative lifestyles and develop one’s life plan according to individual values”.

Capabilities are thus essential rights that, yet differently, need to be safeguarded and granted to all citizens. The theoretical framework underlying the capability approach was already formulated by Sen in the mid-1980s. Recently, the original frame of reference was expanded by a number of authors to consider such aspects as public policy and to investigate issues such as law and ethics from different perspectives (among others, Berti, 2004; Robeyns, 2005).

Protecting human dignity calls for high levels of capabilities on the part of citizens. According to Nussbaum, ten capabilities are necessary to accomplish social justice,

which can be classed in internal capabilities (personal traits, intellectual and emotional capabilities, capabilities in terms of perception and movement) and combined capabilities (resulting from interaction with environmental factors) and might result in certain “functionings”.

“Agency” is another important concept in Nussbaum’s capability approach, for it clarifies the process intended to change values and objectives. By way of example, let us imagine a high-school professor which needs to provide young students with some theoretical insights on sustainability. To do so, he might refer to relevant literature and reports. This state of play represents a set of values. However, whereas the same professor commits himself to implement these values – e.g. for instance, by developing innovative items in the academic programmes and supporting research groups which set-up out-of-school initiatives (through the Internet, web communities and so forth) – he prompts his students to develop a number of agents, for he sets some objectives in order to endorse certain values. A just society should be accomplished throughout the realization of equality concerning the capabilities of its members. Consequently, it is not utility that should be pursued – e.g. to redistribute primary goods – but to develop capabilities to utilize such goods, in order to convert them into standards of living. As discussed earlier, Nussbaum talks of ten capabilities, most notably:

1. Life. Being able to live to the end of a human life of normal length; not dying prematurely, or before one’s life is so reduced as to be not worth living.

2. Bodily Health. Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.

3. Bodily Integrity. Being able to move freely from place to place; having one’s bodily boundaries treated as sovereign, i.e. being able to be secure against assault, including sexual assault, child sexual abuse, and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction.

4. Senses, Imagination, Thought. Being able to use the senses, to imagine, think, and reason, and to do these things in a “truly human” way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training. Being able to use imagination and thought in connection with experiencing and producing self-expressive works and events of one’s own choice, religious, literary, musical, and so forth. Being able to use one’s mind in ways protected by guarantees of freedom of expression with respect to both political and artistic speech, and freedom of religious exercise. Being able to search for the ultimate meaning of life in one’s own way. Being able to have pleasurable experiences, and to avoid non-necessary pain.

5. Emotions. Being able to have attachments to things and persons outside ourselves. Supporting this capability means supporting forms of human association.

6. Practical Reason. Being able to form a conception of the good and to engage in critical reflection about the planning of one’s own life. This entails protection for the liberty of conscience.

7. Affiliation. Being able to live for and toward others, to recognize and show concern for other human beings, to engage in various forms of social interaction; to be able to imagine the situation of another and to have compassion for that situation; to have the capability for both justice and friendship. (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedoms of assembly and political speech.). Having the social bases of self-respect and non-humiliation; being able to be treated as a dignified being whose worth is equal to that of others. This entails, at a minimum, protections against discrimination on the basis of race, sex, religion, caste, ethnicity, or national origin.



8. Other Species. Being able to live with concern for and in relation to animals, plants, and the world of nature.

9. Play. Being able to laugh, to play, to enjoy recreational activities.

10. Control over one's Environment. Being able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association. Being able to hold property in terms of real opportunity; having the right to seek employment on an equal basis with others; having the freedom from unwarranted search and seizure. Being able to enjoy the right of property.

## 7. CONCLUSION

According to Sen (2000), three elements need to be considered in order to appreciate the role of capabilities: the direct relationship with human wellbeing and freedom, the indirect impact of capabilities on social changes, and the indirect effect that capabilities have on economic production. In Sen's terminology "the welfare of capabilities" allows individuals to demand the exercise of their own rights, first of all learning. This right is a lifetime one and relates in important respects to the right to citizenship. The validity and forward-thinking which characterize "lifelong learning" – a concept which has been circulating since the 1990s – should be given more significance and form the basis of new welfare. There is a need of developing political awareness of the issue. This includes widening the right to education through life, devising a system of skills certification and validation to ensure full active participation to social life. To do so, people should be helped to familiarize themselves with such an evolutionary approach, focusing on capability through "lifelong guidance".

The key aspect of development as freedom – which also recalls the title of Sen's volume – lies in the idea of economic growth combined as democratic development arising out of everyone's participation (Margiotta, 2015) – thus not of the elite on an exclusive basis – to opportunities in terms of people's capabilities, for they improve themselves through education and training.

By way of conclusion, one might quote Sen, who has argued that "Development is a great adventure to live through freedom". This passage is significant, for the development Sen is making reference to is far from being accomplished.

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## ADDITIONAL READING

Link Buona Scuola: <https://labuonascuola.gov.it/>

Link Jobs Act: <http://www.jobsact.lavoro.gov.it>

Link SMEs: [www.smequal-project.eu](http://www.smequal-project.eu)

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## Chapter # 25

### A STUDY OF THE EFFECT OF A COMPUTER ENVIRONMENT BUSINESS GAME

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#### ABSTRACT

In Japan, entrepreneurs are expected to have the ability to produce new business model ideas based on innovation and their capability as entrepreneurs. However, teaching methods in higher education institutions that offer Business management education programs have yet to be established. Business management education that motivates university students to be entrepreneurial and innovative is required for the development of society. A business management educational program is implemented in the School of Economics of a National University in Japan. In this program, a business game was implemented based on a business-game computer environment. The purpose of this study was to verify the effects of a computer environment business game by analyzing 24 student comments via e-mail after the experiment of business game running using a text mining analytics tool. Therefore, this chapter reviews the previous research on entrepreneurs and business-game-based education and the ability of entrepreneurs. Our analysis confirmed that a various virtual experiences of entrepreneurship could be provided by playing the business game. A regular business management education program conducted in the classroom cannot provide the virtual experience feature. The introduction of this business game into business management education serves to nurture entrepreneurship skill: Associating skill, Questioning skill, Observing skill, Networking skill, Experimenting skill. This chapter examined the educational effect of a business game on the perspective of entrepreneurship in order to clarify whether a business game would be effective for nurturing strategic entrepreneurs.

*Keywords:* entrepreneurship, innovator`s DNA, Business Management education, text mining analytics.

#### 1. INTRODUCTION

The School of Economics of Wakayama University utilized a business game program provided by the School of Management of the Yokohama National University, called the bakery game, in a database management class. In this study, we examined the educational effect of a business game (e.g.: virtual experience) on the perspective of entrepreneurship (spirit of entrepreneurs and entrepreneurs' activity). Therefore, this study clarify whether a business game would be effective for nurturing entrepreneurs. A study of this chapter is based on an experimental case study by utilizing a business game in a class.

According to the small and medium-sized enterprises White Paper Japan (2014), changes in the economic and social structure of the region have emerged due to changes in the population and regional industrial structure. In 1986 circa, most of the region prefecture, except for those in Hokkaido, the central industry that was responsible for the

employment was the manufacturing industry. However, in 2012, the number of employees in the manufacturing industry decreased, and other industries (retail, service industry, health care and welfare) increased. Due to these changes related to different social structures in each region, diversification of industry of the region should be progressed to support the employment.

On the other hand, according to the small and medium-sized enterprises White Paper Japan (2014), decreases in the regional area population, especially in several municipalities in mountainous areas, the population significantly decreased. In order for small and medium-sized enterprises of the region that faced economic and social structure changes to develop sustainably, there is a need for new business development through the use of regional industry-specific production factors (regional management resources). Additionally, a variety of initiatives for regional activation of regional residents have been required to support the demand of the region to insure vitality in living. In recent years, the number of closed businesses continues to increase. In 2003, 16,255 companies were closed, which increased to 28,943 in 2013. The reasons for closures include the following: Aging and health problems of the management (48%), uncertainty of the business(12%), major trader or customer goes bankrupt including the case of transfer (7.8%), family problems within the management (nursing care, aging, education, etc.)(4.9%), avoidance of further deterioration of business management (4.4%), and a lack of successors (4.2%). In addition, the number of entrepreneurs, which was 292,000 in 2002, had declined to 223,000 people in 2012. The following reasons are included for the lack of entrepreneurs the low rates entrepreneurs in Japan.

1. Low level of entrepreneurial-oriented: "Insufficient education system", "Willingness stable employment", and "Lack of recognition of entrepreneurship as a career".

2. Instability of life and income after entrepreneurship: "Unstable life", "Lack of a safety net" and "Difficulty with re-employment".

3. Procedures and costs for entrepreneurship: "Entrepreneurial cost", "Complicated entrepreneurial procedures".

According to the IMD World Competitiveness Yearbook (2014), Japan was in 1st place of all 59 countries of the survey subjects until 1993. However, since then there has been a gradual decline with Japan being in 21st place as of 2014. This result shows that for Japan has not been considered a competitive international country at present time. This survey indicated a lack of entrepreneurship (55th place as of 2014) as one of the factors for the declining international competitiveness of Japan. The world evaluates Japan as lacking entrepreneurship. Porter (1990) indicated the entrepreneurship of Japanese companies as follows: A new generation of corporate managers is now taking the lead of the industrial world in Japan. In many cases, they are replaced with the former corporate founders and entrepreneurs that established their companies after World War II. In this process there exist risks that foresight and a good atmosphere for business establishment could be lost and that bureaucracy and conservatism could emerge. He also indicated the following issues for Japan.

- (1) Absence of corporate managers with entrepreneurship;
- (2) Organizational design where talented individuals cannot be utilized;
- (3) Rigid organizations;
- (4) Fragile system architecture;
- and (5) Inconsistency in the whole business strategy.

On the other hand, Kutsuna (2012) mentioned that the companies and corporate managers in Japan lack entrepreneurship and strategy thinking ability.

## **2. PREVIOUS RELATED RESEARCH**

This section reviews the previous researches on entrepreneurs and business-game-based education and the disruptive innovation ability of entrepreneurs.

### **2.1. Previous Related Research on Entrepreneurs**

This subsection reviews the previous researches on entrepreneurs. According to McClelland (1961), entrepreneurs are defined as "those who organized the company or business unit, enhancing its productivity." Brockhaus and Horwitz (1986) concludes that there is no comprehensive definition to Entrepreneur, which is common at present time. According to Matsuda (1998), the important experiences for successful training of entrepreneurs are as follows: 1. Experience in the community and in the home (the importance of understanding the society as a human), 3. Experience in education (the need for entrepreneurial education), 3. Workplace experience (a provision for the opportunity to gain experience through entrepreneurial practice) and, 4. Experience in incubator. According to Tanaka (2006), what is required in the era of change in terms of the Japanese companies and the Japanese economy is the realization of economic growth through innovation and entrepreneurship. Therefore, it is necessary to increase the individual's ability, and it is required to increase the "new challenger" in entrepreneurship. Conditions that generate the entrepreneurs of the local industrial regeneration, is considered as the image of the entrepreneurs in the community during a period of change. And, Tanaka (2006) mentions entrepreneurship is one choice when it comes to a job career. However, compared to other careers, there is considerable risk. Certainly, entrepreneurship puts ones entire life at risk, while an event that pulls the trigger is required. In addition, Tanaka (2006) mentions the road to entrepreneurs depends significantly on the personal qualities and the environment. Environments where entrepreneurs grow include space you are living in on a daily basis, for example a home, school, or a workplace. These spaces are the arena of interaction with a variety of people, such as parents, relatives, and friends. Many of the parents of entrepreneurs are business owners, self-employed, specialists, and administrative executives. Therefore, entrepreneurship can easily be fostered naturally within a family circle. In addition, they have the employee experience of small and medium-sized enterprises. The following factors are considered. Because of a concern over the future of the company, they aim to enhance their own capabilities while considering their career progression, They have a lot of direct opportunities to come into contact with company owners (existence of close role models), They can receive experience with a wide variety of occupations that might not be provided by large companies. According to Tada (2012), for local industrial regeneration, there are two forces "Export force" and "Circulation force" are significantly important. "Export force" is marketing ability. This is a force that exports products and services to other regions. "Export force" tries to sell products in large cities in order to attempt to obtain revenues from outside the region. "Circulation force" is an industry cluster. This force circulates revenues earned from outside the area in the region. It is important to circulate money earned from outside the region in the internal region. For regional economic autonomy, "Circulation force" is important.

### **2.2. Previous Related Research on Business-game-based Education**

This subsection gives an overview of previous researches regarding business-game-based education. With respect to business-game-based education, Shirai (2005) indicated that students would be able to practice business knowledge including marketing, accounting, and logistics through a virtual experience of managing

companies on computers by participating in business games as players. By doing so, they would be able to deepen their understanding of corporate management. Additionally, the purpose of Shirai (2005) was that each individual student would analyze corporate systems through development of business game programs.

In order to develop a business game program, the developer needs to model the targeted business. Through this modeling process, students would be able to analyze corporate systems specifically by sorting out major targeted business factors and defining the relationships among these factors. Additionally, the developed business game program could be evaluated or criticized when other players played the program. This process would enable the developer to learn other factors that were unknown to the developer. Furthermore, when multiple students played the completed business-game program as players, the management results could be compared and analyzed. Doing so could analyze the availability of operations in the relevant business model. Fukuda (2006) formed a hypothesis that only students who finished their study of economics would be able to understand the business model of store management handled in a game, while students who could not understand the business model would be poor at playing the business game program. However, this hypothesis was not necessarily supported in his study. In other words, there was no correlation observed between the game performance of the students and their understanding level of economics. For this reason, he said that the current economics taught in Japan actually does not have any educational effect regarding the qualities that entrepreneurs should possess.

Hishiyama and Nakajima (2015) introduces one of our active learning programs, the Croquette Factory Game, for understanding business interaction with uncertainty. We show that this program provides beneficial educational effects for students in understanding a business model with uncertainty.

### **2.3. Previous Related Research on Disruptive Innovation Ability**

In the following, it has been given an overview of previous researches regarding the ability of entrepreneurs.

A disruptive innovation is an innovation that creates a new market and new business resources and disrupts an existing market and business resources displacing established market leaders and alliances. With respect to disruptive innovation ability that is required for entrepreneurs, Christensen, Dyer, and Gregersen. (2011) indicated the importance of the following five skills: "Associating skill," "Questioning skill (to ask questions about objections to the actual conditions while being passionate to explore objects)," "Observing skill (to observe the surrounding world carefully in order to get insight or ideas that bring about new methods)," "Networking skill (to find out or attempt new ideas through a broad range of networks with others having diverse backgrounds and thoughts)," and "Experimenting skill (to challenge a new experience and attempt new ideas)." Figure 1 shows the model called "Innovator's DNA" in order for entrepreneurs to produce innovative ideas.

According to Gregersen (2009) of a six-year-long study into disruptive innovation involving some 3,500 executives, there are five skills that innovative and creative entrepreneurs need to develop. The five skills, Gregersen says, are 'a habit, a practice, a way of life' for innovators. Although Gregersen and his co-authors use the DNA metaphor, innovative entrepreneurs are actually made or developed, rather than born. "We each have unique, fixed physical DNA," says Gregersen, "but in terms of creativity, we each have a unique set of learnable skills that we rely on in order to get to the ideas that will give us some insight.

Since in this research, skills of Innovator's DNA are focused for confirming the Business Game educational effect. The next section verifies the effect of a business game by using the innovator's DNA model.

### **3. DISCUSSION**

#### **3.1. Bakery Game**

The School of Economics of Wakayama University utilized a business game program provided by the School of Management of the Yokohama National University, called the bakery game, in a database management class. In this bakery game, teams with players acted as bakery managers that determine the sales price of bread, the number of orders of bread dough, and the amount of bread baked. Ten teams competed in the game based on their business performance based on the final amount of retained earnings. Each team competed with other teams in the common market with regard to their performance based on surplus funds or profit. The purpose of this game is as follows: (1) to experience the essence of corporate management, (2) to experience the decision-making process as a group, (3) to understand the profit and loss structure and utilize its concepts. In this study, we conducted this game by dividing the students into 10 teams with 4 to 5 members each. Afterwards, we had them submit written descriptions of their impressions about this game. In the end, 24 students submitted their descriptions by e-mail. Giving consideration for proper handling of personal information, we combined these written descriptions while hiding information that could identify an individual student and then conducted text mining.

#### **3.2. Text-mining Technique**

Text mining is the analysis of data contained in natural language text. The application of text mining techniques to solve business problems is called text analytics. Text mining can help an organization derive potentially valuable business insights from text-based content such as word documents, email and postings on social media streams. Mining unstructured data with natural language processing, statistical modeling and machine learning techniques can be challenging, however, because natural language text is often inconsistent. It contains ambiguities caused by inconsistent syntax and semantics, including slang, language specific to vertical industries and age groups, double entendres and sarcasm. Text analytics software can help by transposing words and phrases in unstructured data into numerical values which can then be linked with structured data in a database and analyzed with traditional data mining techniques. In this research, KH coder was used as Text analytics software. KH Coder is free software for content analysis, text mining or corpus linguistics. It can handle Japanese, English, French, German, Italian, Portuguese and Spanish language data. Just input raw texts and you can utilize searching and statistical analysis functionalities like KWIC, Collocation Statistics, Co-occurrence networks, Self-organizing map, Multidimensional scaling, Cluster analysis and Correspondence analysis.

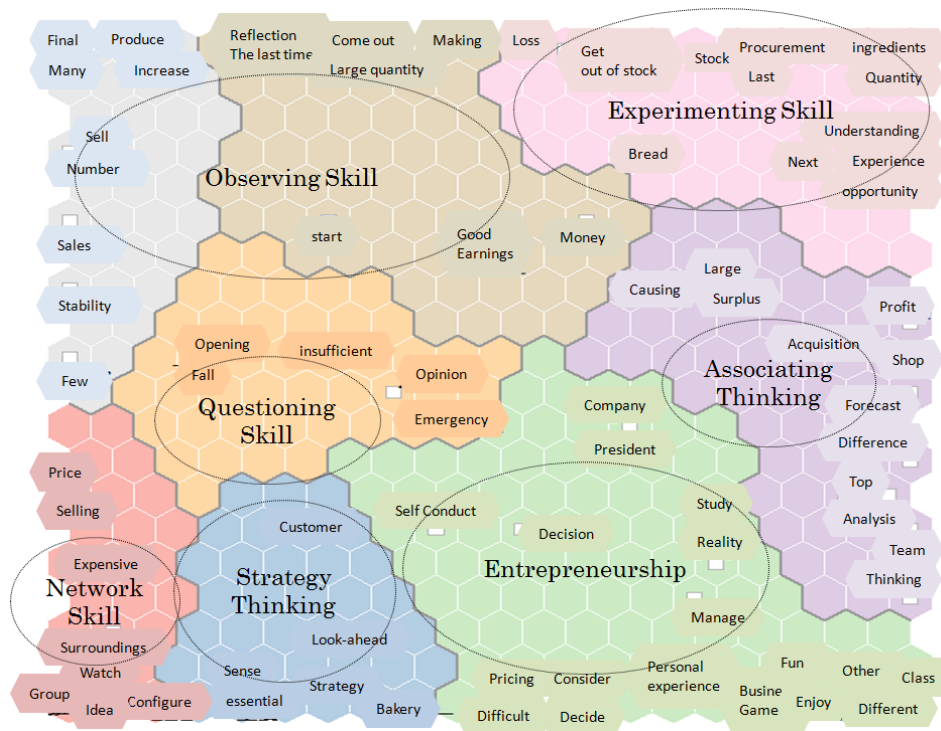
#### **3.3. Self-organizing Map**

The self-organizing map in Figure 1 shows the results. This self-organizing map is a neural network algorithm not including teachers. This is a data analysis method that maps high-dimensional data on a 2D plane non-linearly. In Figure 1, the Innovator's DNA skills proposed by Christensen et al. (2011), Entrepreneurship and the Strategy thinking are mapped. In Figure 1 "Associating skill", is mapped on the cluster including "Thinking",



"Team" and "Analysis". "Questioning skill" is mapped on the cluster including "Insufficient" and "Opinion". "Observing skill" is mapped on both of the cluster including "Reflection the last time" and the cluster including "Sales" and "Number". "Networking skill" is mapped on the cluster including "Surroundings" and "Group". "Experimenting skill" is mapped on the cluster including "Understanding" and "Experience". "Entrepreneurship" is mapped on the cluster including "President", "Personal experience" and "Self-conduct". "Strategy Thinking" is mapped on the cluster including "Strategy", "Sense", "Essential" and "Look-ahead". Figure 1 shows us that this business game corresponds to the five skills of innovation DNA as a research result. Moreover, it demonstrates that the participants can find excitement in joining in corporate management and developing strategic reasoning.

Figure 1. The Self-Organizing Map of Business game Impressions.



Additionally, this result implicates that the participants can enjoy such an experience that differs from any of the education programs offered by the School of Economics.

#### 4. CONCLUSION

In this research, we examined the educational effect of a business game on the perspective of entrepreneurship (spirit of entrepreneurs and entrepreneurs' activity) in order to clarify whether a business game would be effective for nurturing strategic entrepreneurs. As a theoretical framework, skills of Innovator's DNA are adopted for confirming the Business Game educational effect. And the text mining was conduct based on descriptions of their impressions about the business game. From the point of view of the five skills as

innovation DNA that Christensen et al. (2011) required of entrepreneurs, we were able to confirm that business game programs such as bakery game are actually essential for education of future entrepreneurs. Additionally, we also clarified that students would be able to experience virtual corporate management that cannot be explained in any subject offered in the School of Economics, while they could taste the enjoyment and a little difficulty related to business. The future issue of this study is to clarify the implementation methods of business game programs that can enhance the entrepreneurship progress effects in business games education. Half a century ago, Japan did produce a number of great entrepreneurs. They were the founders of Toyota, Sony and Honda who would be not afraid to try something different from existing for innovator's DNA skills. According to the education of business game playing, Japanese youths who would be unafraid to take risks of entrepreneurship. Business game education may be the best way to restart the Japanese economy rapidly.

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