



ATEE

Association for Teacher Education in Europe

HU HOGESCHOOL
UTRECHT

PROCEEDINGS
of the **ATEE**
WINTER
CONFERENCE
2018



**TECHNOLOGY AND
INNOVATIVE LEARNING**

Editors: Michiel Heijnen, Miranda de Hei en Stan van Ginkel
ISBN: 978-90-8928-129-6

Editors: Michiel Heijnen, Miranda de Hei en Stan van Ginkel.

Proofreading: Cecile van Hattem

Graphic design: Esther Bergé (Giraffic designs)

Publisher: Archimedes Institute, Utrecht University of Applied Sciences and Association of Teacher Education in Europe (ATEE)

ISBN: 978-90-8928-129-6

Contents

Introduction Michiel Heijnen	5
Attitudes of pre-service teachers towards the use of mobile devices in teaching-learning process in India Susmita Mondal	7
Facilitating self-regulated learning in online courses: implications for training Maureen Snow Andrade	14
Pre-service teachers' perceptions regarding the contribution of communal blog to their professional development Liat Biberman-Shalev	21
The impact on teacher's self-efficacy of TPACK in the Professional Development School Scheme (PDSS) Ming Yan TSUI Ida Ah Chee MOK	30
Exploring lesson study as a transformative learning approach for teacher educators' professional development in technology Maurice Schols	43
MEANING-ORIENTED teaching for French Foreign Language in secondary schools in Flanders: the relation between meaning oriented teaching, the programmes (curricula) in teacher training and the professional profile for teachers in Flanders Valeria Catalano	52
Migrant teachers' experiences with the use of digital technology and media during their placement period in Swedish schools Annika Käck Sirkku Männikkö Uno Fors	64
Professional development: an ecological perspective on special education teacher learning in mathematics Stella Long	73
Assessment of Innovation Dimension in a MOOC Course "New Media in Education" focused on PBL Plans Orly Melamed Rivka Wadmany	84

Underequipped skilled educators. The case of Southern Italian high school teachers for students with special educational needs

96

Anna Dipace
Fedela Feldia Loperfido
Jarmo Viteli
Katia Caposeno
Alessia Scarinci

How to Motivate New University Teachers for Student-centered Learning

104

Karolina Duschinská
Radka High

Development of Inquiry Didactics Sequences for Science Teaching in a Brazilian Pre-service Chemistry Teacher Course: promoting Entrepreneurship Education.

112

Aparecida de Fátima Andrade da Silva
José Gomes Thomaz
Rosiane Keila Santos Costa

Introduction

Michiel Heijnen

Archimedes Institute, The Netherlands

Archimedes Institute of Utrecht University of Applied Sciences was delighted to welcome and host the Association for Teacher Education in Europe (ATEE) Winter Conference 2018 in Utrecht, the Netherlands.

The 2018 ATEE Winter Conference had a strong focus on **technology and innovative learning**. Teachers and teacher educators are increasingly challenged to innovate their educational practices and align this with the learning needs of contemporary adolescents. Furthermore, educational researchers face the complex task to study the implementation and outcomes of the use of digital technology in innovative learning environments. The conference combined findings of empirical research with experiences from practice by sharing tools, hands-on examples and teaching methodology in order to increase and enhance both regular and refugee student learning experiences.

The conference subthemes are:

Teacher Education & Digital Technology

Digital technology increasingly becomes an essential component of the working practice of teachers and learners. Innovative tools, such as Video Games, Virtual Reality and Augmented Reality, represent a challenge to optimize existing educational design principles, to change teacher thinking, to apply new teaching methods and to support learning processes inside or outside traditional classrooms. We will focus on effectively integrating digital technology in teacher education. Moreover, we are very interested in how teacher educators perceive the value of such innovative technologies for their educational practice. Therefore, this sub-theme of the conference concentrates on conceptual, theoretical and empirical research related to digital technologies in (school) education, primarily through the spectrum of teacher education.

Professional Development of Teachers

Professional development of teachers fosters and provides support for teacher quality and in turn contributes to powerful school communities and strengthens educational quality. We will share findings or discussion topics that contribute to insights in various ways of professional development of teachers. We especially welcome contributions that relate to the use of technology and the creation of innovative learning environments. Some examples of research for professional development: outcomes of and experiences with professional learning communities or teacher learning networks, lesson study practices, on job coaching, school team development, and academic schools. Other examples of topics are related to, for example, management or school support for professional development and schools collaborating for professional development.

Refugee Education

Today, only 14% of young people in poor countries complete their studies up to higher education and this figure is down to 1% for refugee children and almost non-existent for girls. The situation is even more challenging in sub-Saharan Africa where 70% of countries face teacher shortages and 90% of them do not have enough secondary school teachers. To address this global challenge on education in emergencies, this conference theme on refugee education will bring necessary awareness as to how the role of teachers and teaching needs to evolve. We will share research papers and/or documented individual best practice experiences on refugee education to facilitate subsequent co-creation of innovative learning solutions for refugee education.

Proceedings of the conference

The conference itself provided the participants with an opportunity to share their research, their good practices and ideas in presentations and workshops. Next to the conference, this book of proceedings offers an opportunity for participants of the conference to share a bit more of the background of their research or good practice with others, through the publication of a full paper. The papers in the proceedings cover the three subthemes of the conference. The authors of the papers come from different countries (India, USA, Israel, Hong Kong, the Netherlands, Belgium, Brazil, Sweden, Ireland, Czech Republic and Italy), so also the international view on teacher educational issues is guaranteed.

On behalf of the reviewers and editors, we would like to stress that all accepted papers are published textually unchanged: the editors do not take responsibility for any (spelling, grammatical, content related etc.) errors which may remain in the papers received from the authors.

We would like to thanks the reviewers for their work:

Davide Parmigiani
Miranda de Hei
Inge Blauw
Stan van Ginkel

Attitudes of pre-service teachers towards the use of mobile devices in teaching-learning process in India

Susmita Mondal

Visva-Bharati University, India

Conference subtheme: Teacher Education and Digital Technology

Abstract

Digital technology enables self-paced learning through various tools and by using different digital tools, teaching learning enterprise has become more productive and meaningful. Nowadays Smartphones and tablets improved interaction and cooperation among students, and being able to search for information was useful for studying (Parmigiani D. and Giusto, M. 2015). In India Teacher training Colleges are facing with challenges of preparing a new generation of teachers to effectively use new learning tools in their teaching learning practices. The Study was designed to obtain pre-service teachers attitudes towards the use of mobile devices in teaching-learning process. The investigator used a self-made questionnaire as a tool and administered to 100 male and female pre-service teachers from rural and urban Teacher training Colleges of University of Calcutta (India). This study reveals that Indian pre-service teachers attitude towards the use of Mobile devices differs regarding their gender and locality. It also found that urban participants clearly had strong views on how mobile device be used to enhance teaching-learning process. From the result it can be suggested that Rural Pre-service teachers should be more focused on using of digital technology with national and global expertise. This study also suggests solutions to improve Indian teacher education programmes and the quality of teaching-learning process.

Keywords

Digital technology, Mobile Devices, Teacher Education, Pre-service teacher, Teaching Learning process.

1.0 Introduction

Digital technology are a major factor in shaping the new global economy and producing rapid changes in society. Within the past decade, the new Digital technology tools have fundamentally changed the way people communicate and do business. They have produced significant transformations in industry, agriculture, medicine, business, engineering and other fields. They also have the potential to transform the nature of education-where and how learning takes place and the roles of students and teachers in the learning process. Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change. For education to reap the full benefits of Digital technologies in learning, it is essential that pre-service and in-service teachers have basic ICT skills and competencies. Teacher education institutions and programmes must provide the leadership for pre-service and in-service teachers and model the new pedagogies and tools for learning. They must also provide leadership in determining how the new technologies can best be used in the context of the culture, needs, and economic conditions within their country. To accomplish these goals, teacher education institutions must work closely and effectively with K-12 teachers and administrators, national or state educational agencies, teacher unions, business and community organizations, politicians and other important stakeholders in the educational system. Teacher education institutions also need to develop strategies and plans to enhance the teaching-learning process within teacher education programmes and to assure that all future teachers are well prepared to use the new tools for learning.

As we become increasingly supported by technology, teaching and learning process will not be the same as before. We will have to make use of the rich and exciting opportunities offered by the new technologies in education to reach our training goal and mission. One of the objectives of the present

*Corresponding author

Email address: tosusmitamondal@gmail.com

paper is to provide better understanding and appreciation of the role of Mobile devices in teaching and learning system. Learning is not a transfer of knowledge, rather an active construction. This paradigm shifts give the learners a completely new role that was not earlier described in the transmission model of teaching. Technology and teacher professional development in its use are best introduced in the context of broader educational reform which embraces a shift away from teacher-centred, lecture oriented towards learner centred, interactive and constructive learning environment. Multimedia and Digital technology can play the role of catalyst for such educational reforms. Mobile devices can promote effective instruction that is more engaging; learner centred, interdisciplinary and more closely related to real life events and processes and adaptive to individual learning styles and needs. It also encourages higher order thinking skills and help to construct knowledge socially. Thus teacher professional development in the use of interactive technology should embody and model the forms of pedagogy that teacher can use themselves in their classroom.

This paper examines how Teacher education practices build confidence, capability and critical understanding in trainee teachers with respect to the use of Mobile devices to support young student's learning. The role of digital technologies in learning and teaching has evolved rapidly over the last decade from a comparatively marginal position to one where it is considered a core curriculum area. This is reflected by the challenges posed by school based placements as our student teachers are expected to demonstrate their capacity to meet standards in increasingly technology rich classroom environments. It is important therefore to provide our trainees with the opportunities to build confidence and competence, develop positive attitudes and mindful perspectives with regard to the use of this technology, and equip them with the means to embrace its potential to enhance learning.

2.0 Literature review

Technology integration refers to possessing technology-skills and effectively using them for teaching such that there is a complete merger between technology and pedagogy. The ultimate aim of technology integration in education is to use the technology in a continuous manner in academics so that it leads to the diversification and achievement of curriculum objectives and engages students in meaningful construction of their knowledge bases. Information Communications Technology (ICT) has great potential for enhancing teaching and learning outcomes. Among other factors, the teacher's own education is an important indicator of how successfully ICT can be applied in the classroom (Erdem, M., Akkoyunlu, B. and Yilmaz, A., 2008). In recent years, ICT also helps teachers, students and parents to come together. Continuous and Comprehensive Evaluation (CCE) helps students as well as teachers to use more technology for making teaching learning more attractive for the betterment of our future generation. Teachers must know the use of ICT in their subject areas to help the learners for learning more effectively (Bhattacharjee, B. and Deb, K., 2016). Information and Communication Technology (ICT) has influenced all aspects of life. Processing the knowledge of ICT is really the need of the hour. This paper describes the ICT awareness among teacher educators. The framework raises important questions of how teachers use technological devices in their teaching learning process in order to understand the concept in a better way. It also emphasizes teachers to integrate technology into the instruction in the 21st century (Philomina, M. J. and Amutha, S., 2016). Hattangdi and Ghosh (2008) contended that technology integrated education leads to democratization of education and effective use of ICT for the purpose of education has the potential to bridge the digital divide especially in developing countries like India. However though technology has tremendous potential to bring about radical changes in teaching learning process. In India efforts are being made to change the scenario at the school level, initiative taken by State Government, National Council of Educational Research and Training (NCERT) and State Council of Educational Research and Training (SCERT). All Government and Government-aided Secondary and Higher Secondary Schools are to be provided basic computer literacy courses through a computer lab with broadband internet connectivity. All Government and Government aided Secondary and Higher Secondary Schools will be covered through ICT and School project. To match step with these developments, the pre-service teachers made changes. The technological and pedagogical skills together impact the teaching learning process significantly. Four main factors depends on the Effective technology integration in education by the pre-service and the in-service teachers and their proficiency in using different technological applications for instructional activities, frequency of technology integration done by their faculty, their attitude towards the impact of technology integration on improving learning and the mutual relationship between these three (Singh, 2013).

In this context the following research questions emerged for investigation in the study : What is the status of Mobile devices usage in teacher education institutions and local schools? How use of Mobile devices ability of pre-service teachers related with their attitude towards integration of technology in teaching-learning?

3.0 Need of the study

Studies by Bhattacharjee, B. and Deb, K. (2016), Philomina, M. J. and Amutha, S., (2016), Singh, U. (2013), Ardron, K. (2009), Erdem, M., Akkoyunlu, B. and Yilmaz, A., (2008), showed that the Digital technology has influenced all aspects of teaching learning process. Review of earlier research studies on the attitude of pre-service teachers towards Digital technology in teaching learning processes in teacher education and contribution of different factors responsible for their status improvement is essential to formulate an appropriate perspective for any further study. Several studies, on the attitude of pre-service teachers towards use of Digital technology have been confined to one or two aspects and only to some regions of a State or a Country. As no study is held on the attitude of pre-service teachers towards use of Digital technology in West Bengal, India. In this paper, an attempt has been made on attitude of attitude of pre-service teachers towards use of Digital technology in West Bengal, India.

All the possibly available studies were reviewed and it has been observed that there are many researches, which are conducted especially on attitude of pre-service teachers towards use of Digital technology. In this context the study conducted by Philomina, M. J. and Amutha, S., (2016) forms the best line of direction so far as the components of the topic are concerned. Irrespective of her best effort, keeping in view the spelt rationale, the researcher wants to conduct the study titled : Attitudes of pre-service teachers towards the use of Mobile devices in teaching-learning process in India.

4.0 Objectives

- 1) To find out the attitudes of male and female pre-service teachers towards the use of Mobile devices in teaching-learning process in India.
- 2) To find out the attitudes of rural and urban pre-service teachers towards the use of Mobile devices in teaching-learning process in India.

5.0 Hypothesis

- 1) There is no significant difference between the attitudes of male and female pre-service teachers towards the use of Mobile devices in teaching-learning process in India.
- 2) There is no significant difference between the attitudes of rural and urban pre-service teachers towards the use of Mobile devices in teaching-learning process in India.

6.0 Delimitations of the study

1. The present study is delimited to the pre-service teachers of India.
2. The present study is delimited pre-service students of West Bengal, a State of India.

7.0 Methodology

Implementation of the descriptive method research design resulted in this study. The study is quantitative in nature and was conducted on a sample of pre-service teachers of West Bengal, a State of India. The Study was designed to obtain pre-service teachers attitudes towards the use of Mobile devices in teaching-learning process in India.

Instrument

Considering the nature of present study, the investigator used a self-made questionnaire as a tool. Pre-service Teachers' Attitudes towards using digital technology was measured through questionnaire. The questionnaire contains 20 closed-ended questions Five open ended questions allowing respondents a range of ways to reflect on their own experience. The participants were asked to rate their levels of agreement (from 1- strongly disagree to 5- strongly agree). In this study, researcher utilized a 5-point Likert scale format (1 for strongly disagree, 5 for strongly agree).

The research questions with mainly two dimensions:

- (A) Has the use of mobile devices affected the pre-service teachers' attitudes in teaching-learning process?
- (B) Has the use of mobile devices affected the main aspects of teaching-learning process in teacher education programme?

Samples

For collection of data, Attitudes towards using digital technology was administered to the 100 male and female pre-service teachers from rural and urban Teacher training institutions. A cluster sampling of 100 pre-service teachers comprising 50 males and 50 female, rural and urban pre-service teachers was selected from West Bengal, a State of India.

Technique

The main statistical technique used for the data analysis was 't' test for knowing the significance between the means of different comparative groups. The data was analyzed with the help of computer by using SPSS to get accurate results and also to save time.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 male pre-service teachers female pre-service teachers	68.400	50	1.63333	.23099
	73.000	50	1.55511	.21993

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 male pre-service teachers & female pre-service teachers	50	-.061	.674

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)			
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference							
				Lower	Upper						
Pair 1 male pre-service teachers - female pre-service teachers	-.46000	2.32300	.32852	-1.12019	.20019	-1.400	49	.168			

8.0 Results: Analysis and Discussion

Hypothesis: 1

There is no significant difference between the attitudes of male and female pre-service teachers towards the use of Mobile devices in teaching-learning process in India

From the above Tables it is evident that the t-value is 1.400, which is not significant at 0.05 levels. Thus, the null hypothesis that, there is no significant difference between the attitudes of male and female pre-service teachers towards the use of Mobile devices in teaching-learning process in India is accepted.

Mean of attitudes of male and female pre-service teachers towards the use of Mobile devices are 68.4 and 73.0 respectively. It means that as compared to male pre-service teachers, female pre-service teachers have more attitudes towards the use of Mobile devices.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Rural Pre-service teachers Urban Pre-service teachers	60	50	12.28904	1.73793
	72	50	12.50143	1.76797

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 Rural Pre-service teachers & Urban Pre-service teachers	50	.027	.855

Hypothesis: 2

There is no significant difference between the attitudes of rural and urban pre-service teachers towards the use of Mobile devices in teaching-learning process in India

		Paired Samples Test						t	df	Sig. (2-tailed)			
		Paired Differences				95% Confidence Interval of the Difference							
		Mean	Std. Deviation	Std. Error Mean		Lower	Upper						
Pair 1	Rural Pre-service teachers - Urban Pre-service teachers	-12.20000	17.29575	2.44599	-17.11540	-7.28460	-4.988	49		.000			

From the above Tables it is evident that the t-value is 4.988, which is significant at 0.05 levels. Thus, the null hypothesis that, there is no significant difference between the attitudes of rural and urban pre-service teachers towards the use of Mobile devices in teaching-learning process in India cannot be accepted. Mean of attitudes of rural and urban pre-service teachers towards the use of Mobile devices are 60 and 72 respectively. It means that as compared to rural pre-service teachers, urban pre-service teachers have more attitudes towards the use of Mobile devices.

9.0 Conclusions

Mobile devices has undoubtedly become a powerful tool that is breaking the traditional teaching methods of education. Mobile devices incorporated teaching learning process may lead the education system to be more productive and creative. The attitude of Mobile devices is necessary in the 21st century teacher educators since the conventional modes of teaching learning will not serve the purpose. There is no doubt that Mobile devices based teaching learning process will enhance the outcome of education. As they begin their training, teacher trainee has differing levels of competence and confidence with respect to their individual use of Mobile devices. Age on entry combined with their individual school experience appears to significantly influence these personal perspectives and is related to the recent and substantial impact of Mobile devices. Initial assumptions about the degree to which technology is present across all school placement settings seem to be challenged by some participant responses that suggest Mobile devices resources are often lacking or simply not used by school based staff. However, It also found that urban participants clearly had strong views on how digital technology should be used to enhance teaching and learning and have developed confidence and competence in their use of Mobile devices. This continues to be supported by their positive disposition to the challenges that Mobile devices presents, and a growing awareness of effective pedagogical approaches. From the above discussion it can be suggested that, Rural Pre-service teachers should be more oriented on Mobile devices integration with national and global expertise. Use of Mobile devices in teaching and learning should be included in the teacher education curriculum at all levels.

References

- Anandan, K. (2010). Instructional Technology in Teacher Education. New Delhi: A.P.H. Publishing Corporation. Pvt. Ltd.
- Ardron, K. (2009). How should information communications technology (ICT) be used to enhance teaching and learning in the early years? An investigation into the perceptions and attitudes of a group of early years trainee teachers. Finland : ETEN.
- Banu, N., Kamal, A.R. and Banu, T (April 2010). ICT in Higher Education - A Study. Canadian Journal on Data, Information and Knowledge Engineering, Vol. 1, No. 1, April, pp 12.
- Bhattacharjee, B. and Deb, K. (2016). Role of ICT in 21st Century's Teacher Education. International Journal of Education and Information Studies. ISSN 2277-3169 Volume 6, Number 1, pp 1-6.
- Chavan, K. (2009). Instructional System. Nashik: Insight Publications.
- Collis, B. (2002). Information technologies for education and Training. Berlin: Springer Verlag.
- Davis, N.E. et al. (1999). Showcase of the Telematics for Teacher Training project across Europe Retrieved from <http://telematics.ax.ac.uk/T3>.
- Developing research-based learning using ICT in higher education curricula: The role of research and evaluation retrieved from <http://knowledge.cta.int/en/content/view/full/12690>.
- Development using Information and Communication Technology retrieved from http://www.vvob.be/vietnam/files/SubmissionGlobalLearnJP_v2.pdf.
- Erdem, M., Akkoyunlu, B. and Yilmaz, A. (2008). The Use of Information Communications Technology in the Teaching and Learning Process and Teacher Training Programs in Turkey. Finland : ETEN.
- Global Perspectives on Higher Education and the Role of ICT retrieved from http://eprints.rclis.org/bitstream/10760/6716/1/Global_Perspective_on_Higher_Education_and_th_Role_of_ICT%E2%80%A6.pdf.
- Information and Communication Technology retrieved from http://www.unctad.org/en/docs//iteipc20031_en.pdf.
- International Society for Technology in Education Retrieved from <http://www.iste.org>.
- Juhitha, A. et al. (2011). ICT in Teaching Learning. New Delhi : APH Publishing.
- Multimedia Applications for Telematic Educational Networks Retrieved from <http://telematics.ex.ac.uk/MATEN>.
- National Policy on Information and Communication Technology (ICT) in School Education retrieved from <http://www.education.nic.in/secedu/ict.pdf>.
- Nooriafshar, M. (2008). The Role of Technology based Approaches in Globalizing Education. Hyderabad: Icfai University Press.
- Oliver, R. (2008). The Role of ICT in Higher Education for the 21st Century: ICT as a change agency for education. Hyderabad : Icfai University Press.
- Peeraer, J. & Petegem, P. V. Factors Influencing Integration of ICT in Higher Education in Vietnam retrieved from http://www.vvob.be/vietnam/files/SubmissionGlobalLearnJP_v2.pdf

People-ICT-Development retrieved from <http://www.google.co.in/search?q=People-ICT-Development&btG=Search&hl=en&sourece=hp>.

Philomina, M. J. and Amutha, S. (2016). Information and Communication Technology Awareness among Teacher Educators. International Journal of Information and Education Technology, Vol. 6, No. 8.

Resta, P. (Ed.). (2002). Information and Communication Technologies in Teacher Education: A Planning Guide. Paris: UNESCO.

Shukre, A. (2008). The Future of Online Education in India. Hyderabad : Icfai University Press.

Singh, U. (2013). Factors Relating To Technology Integration in Education by the Pre-Service and the In-Service Teachers. IOSR Journal of Humanities And Social Science (IOSR-JHSS) Volume 11, Issue 3 (May - Jun. 2013), pp 03-12.

Society for Information Technology and Teacher Education Retrieved from <http://www.aace.org>.

Varma, A. (2008). ICT in the Field of Education. Hyderabad : Icfai University Press.

Facilitating self-regulated learning in online courses: implications for training

Maureen Snow Andrade

Utah Valley University, U.S.A.

Conference subtheme: Professional Development of Teachers

Abstract

Online courses are a common and growing form of distance learning in higher education and a means of increasing access for individuals balancing multiple roles and responsibilities. To transition to this mode of teaching, however, instructors may need greater familiarity with related theories, course design possibilities, and pedagogies. This review explores the teacher role in online courses in relation to two theoretical foundations—the theories of transactional distance (Moore, 2007, 2013) and SRL (Dembo et al., 2006; Zimmerman & Risemberg, 1997; Zimmerman, 2002) with implications for related training. The larger aim of this exploration is to identify how institutions can support faculty members in facilitating learner success in an online context.

Keywords

Self-regulated learning, online learning, training.

1. Introduction

Online courses are a common and growing form of distance learning in higher education. Indeed, distance learning is often considered synonymous with online learning although the latter simply reflects a method of delivery (e.g., via the Internet) whereas the former includes multiple delivery methods (e.g., print or CD-Rom materials delivered via mail; broadcasting or teleconferencing via television, telephone, or Internet video). Distance learning is also characterized by the geographical and/or psychological separation of teacher and learner (Saba, 2016; Moore, 2007, 2013) whereas in some forms of online learning, the instructor and the student are co-located in the physical environment (e.g., blended or hybrid courses).

Flexible learning refers to offering students choice in "how, what, when and where they learn: the pace, place and mode of delivery" (Higher Education Academy [HEA], 2015, para 1). Designed to empower learners and provide educational choice in an economical and manageable way for both institution and student (HEA, 2015), flexible learning shares similarities with distance learning. Pace, for example, includes accelerated and part-time learning, a characteristic of distance learning, but also credit for prior learning; place includes classroom, home, and mobile learning, but also work-based and experiential learning; and mode refers to delivery through various technologies (Gordon, 2014). Flexible learning encompasses more aspects of learning but is based on the same premises as distance learning.

Both flexible and distance learning seek to expand educational access to a range of learners in higher education (Andrade, 2016), and particularly to those needing to balance study, work, and family (e.g., in the United States, 58% of students work while attending college and 26% are raising children; Lumina Foundation, n. d.). Choice—how, what, when, and where to learn—is reflected in the concept of autonomy, which has been extensively addressed in distance learning and reflects not only the freedom to choose, but also self-direction (Garrison, 2003; Holec, 1981; Hurd, 2005; Little, 1991; Oxford, 2008; White, 2005). Related to the latter, self-regulated learning (SRL) has been emphasized as the means through which distance learners can learn how to be effective by taking responsibility for the factors that impact their learning (Andrade & Bunker, 2009; Andrade, 2014a, 2014b; Dembo, Junge, & Lynch, 2006). The instructor role involves facilitating the development of SRL. In other words, rather than simply providing learning materials, the instructor must help manage the learning process for the student (Ryan & Tilbury,

*Corresponding author

Email address: maureen.andrade@uvu.edu

2013).

Changes in the higher educational landscape in terms of flexible and distance learning involve multiple stakeholders, of which faculty members are critical. Distance learning sees the learner as central in the educational process with the instructor facilitating learning (Saba, 2016). Consequently, not only must instructors adjust to institutional pressures to design and teach online courses, but also adopt a different role related to teaching and learning. This review explores the teacher role in online courses in relation to two theoretical foundations—the theories of transactional distance (Moore, 2007, 2013) and SRL (Dembo et al., 2006; Zimmerman & Risemberg, 1997; Zimmerman, 2002) with implications for related training. The larger aim of this exploration is to identify how institutions can support faculty members in facilitating learner success in an online context.

2. Theories

Distance learning delivered through technology enhanced learning environments provides a solution to the increasing global demand for higher education. These environments can aid the development of learner self-regulation, or the ability to control the conditions that affect learning, a prerequisite for success in distance education. Based on the theories of transactional distance (Moore, 2007, 2013) and SRL (Zimmerman & Risemberg, 1997; Zimmerman, 2002), the Model of Self-Regulated Distance Learning has been applied to online distance English language courses to increase learner self-regulation (Andrade & Bunker, 2009, 2011). Previous studies have explored the model's effectiveness by examining student learner journals, interviewing learners to determine retention of self-regulated learning (SRL) behaviors, and analyzing teacher feedback on SRL assignments (Andrade & Bunker, 2011; Andrade, 2014b).

The model posits that students enter an online course with certain levels of self-regulation. Through the structure and dialogue in the course, as facilitated by the instructor, they can develop a greater capacity for autonomy, and thus, greater likelihood of success in the online environment. Structure, dialogue, and autonomy are components of the theory of transactional distance (Moore, 2007, 2013). Transactional distance refers to the psychological distance between the learner and instructor. This distance is modulated through varying levels of structure, dialogue, and autonomy, and specifically the "quality and quantity of communication between the instructor and the learner" (Saba, 2016, p. 19).

Structure is represented by the objectives, content, teaching strategies, and assessment measures in a course. Dialogue refers to the communication between the learner and instructor in a variety of forms such as e-mail, announcements, and assignment feedback as well as peer-to-peer communication. Autonomy refers to what, how, and how much to learn, and consists of two types—instrumental and emotional (Saba, 2016). The former describes learners undertaking a task without help, and the latter to performing tasks without outside reassurance. When dialogue and structure are high, autonomy is low. SRL consists of six elements—motive, methods, time, social environment, physical environment, and performance. Strategies related to each of the components, such as identifying purpose for learning and setting goals (motive), implementing various learning and study approaches (methods), setting priorities and following a schedule (time), seeking help (social environment), choosing an appropriate location and time of day for study (physical environment), and monitoring outcomes and goal achievement (performance) are tools for developing greater autonomy, or the ability to be self-directed. Help-seeking in SRL theory is viewed positively and leads to greater achievement. Autonomous learning does not mean completely isolated or independent learning, but rather the ability to direct one's learning and make appropriate choices. However, as levels of autonomy increase, learners are likely to be able to do more tasks without help.

3. Training

Given that the goal of distance and flexible learning is to advance "the personal goals and professional aspirations of diverse learners" (Beaudoin, 2016, p. 11), and that higher education faculty members have typically not been trained to facilitate online learning, let alone the development of autonomy through self-regulation strategies, addressing this need is critical in order to enhance both the effectiveness of the instructor and the success of the student. It should be noted that most higher education faculty have not been trained in pedagogy at all, let alone online pedagogies (Xu & Morris, 2007). Most universities do, however, offer some type of internal training for teaching online although it may be in the form of informal mentoring (Allen & Seaman, 2011).

Institutions may also use a rubric to evaluate course effectiveness (Franker & James, 2016; Quality Matters, 2015), and track student success in online courses. Rubrics measuring quality focus on various aspects of online course design such as introduction, learning objectives, assessment measures,

materials, activities and interaction, technology, support, and accessibility (Quality Measures, 2015). Faculty members may have access to a professional instructional designer, who can help ensure these elements are present, and that assessments and activities are aligned with learning objectives. Faculty and the courses they develop benefit from both a formal course review process and informal mentoring (McLennan, 2011).

Faculty doubt the efficacy of online learning in terms of meaningful interaction, and believe that online courses are inferior to face-to-face, ineffective in helping at-risk students, and result in lower achievement of learning outcomes (Jaschik & Lederman, 2014). Only about one-third of faculty have taken an online course themselves or taught one, however (Jaschik & Lederman, 2014). It is unknown if training and quality assessment practices change faculty perspectives, but there is evidence that faculty at institutions with online offerings and those that offer both online and traditional degrees are more favorable and accepting of online education than those at institutions with no online degrees, based on the perceptions of chief academic officers (Allen & Seaman, 2011).

Training may occur at the institutional level through units responsible for supporting and enhancing teaching and learning, or at the department level, particularly when multiple sections of a course are offered and consistency is needed across instructors. Most universities operate on the principle of faculty autonomy, however, with faculty members having the freedom to teach their courses according to the methods and approaches they deem most effective; thus, online course development needs to allow for latitude with the faculty member being the key voice in decisions related to teaching and learning. In many cases, online course offerings are supported by a collaborative team with an instructional designer and the instructor serving as the subject matter expert (Xu & Morris, 2007).

Universities may offer incentives in the form of monetary rewards to encourage faculty members both to redesign their traditional courses for online delivery and to teach online. Help may also be offered through course specialists who support the faculty member and students with the technology needed to be successful, and through teaching assistants to aid with assignment grading, particularly in large enrollment sections. Encouragement may also occur in the form of rewards related to tenure and promotion or recognition by the institution in the form of awards and events for effective course design or online teaching strategies, depending on what the institution wants to emphasize.

Training programs may be required prior to faculty members being assigned or allowed to teach online or they may be optional (Lion & Stark, 2010). Sixty percent of institutions require some training prior to teaching online (Lion & Stark, 2010). Fifty percent of faculty, however, say that support in the form of training and instructional technology is too low (Jaschik & Lederman, 2014), suggesting that these practices are not sufficiently widespread.

Instructor training commonly mirrors the learning experience of the student and is delivered online using the same technology that students use and with many of the features of an online course, such as participating in discussion forums, uploading assignments, and taking quizzes online (Dimeo, 2017). Individualized and group trainings and formal and informal training are all options. Indeed, the types of training offered have expanded to meet growing needs and the time constraints of faculty (Dimeo, 2017). Support for faculty may occur in the form of posted FAQs, or through webcasts and workshops, informal gatherings, or annual conferences (Dimeo, 2017). Another component is to ensure faculty are conversant with the learning management system and technology options (McLennan, 2011).

Approaches may also include Q&A postings or refresher workshops (Dimeo, 2017).

Faculty development and training is the top priority related to online learning for higher education leaders (Frederickson, 2017). The academic discipline of business makes a good case study based on the extensiveness of online degrees offered and business school approaches to faculty training, particularly since many business education programs are governed by rigorous professional accreditation standards. Undergraduate and graduate business degrees are the most awarded degree in the U.S. (National Center for Education Statistics, 2017). Not surprisingly, online business degrees at both the undergraduate and graduate levels are the most in demand (Clinefelter & Aslanian, 2016), and among the most frequently offered online degrees in Canada, the U.S., and globally (Bates, Desbiens, Donovan, Martel, Mayer, Paul, Poulin, & Seaman, 2017; Hanover Research, 2011, 2014).

The Association to Advance Collegiate Schools of Business (AACSB) standards apply to all degrees, not only online degrees, and include "policies and processes to enhance the teaching effectiveness of faculty and professional staff involved with teaching across the range of its educational programs and delivery modes" (AACSB International, 2013, p. 34). Kunz and Cheek (2016) propose a series of questions to investigate the growth of online learning across business schools, including a focus on training related to the development of online degrees. Such questions explore if the training was offered when such programs were initially launched, and if it was formal or informal, internal or external, and

if it addressed technology and learning management systems and pedagogy and design. However, information about training content and effectiveness is not widely available.

4. SRL & Autonomy Focused Training

Topics for online teacher training might focus on instructor roles, quality standards, learner engagement, multimedia, group work facilitation, feedback options, student support, and many others. A framework for faculty training specifically designed on the theories of transactional distance and SRL, discussed earlier, with the aim of helping learners develop autonomy through the application of SRL strategies and be successful in the online environment, suggests beginning with identifying the needed skills and knowledge of the instructors and modeling the online training experience after the student course (Andrade, 2015). The identification of skills and knowledge can occur collaboratively with the instructors and be modified depending on their prior experience. By modelling the student course in the training course, instructors learn first-hand how to practice and apply SRL strategies and be prepared to facilitate SRL development with students.

For example, the content of the training course provides structure with content modules and due dates; dialogue occurs through the social environment as teachers share their goals and teaching experiences and build community. The SRL component of motive is practiced as teachers set goals such as redesigning a face-to-face activity for the online environment or practicing a particular response strategy. These activities and strategies involve applying the content provided and reflect the SRL component of method. Instructors also view student assignments and model responses and then write their own examples responses. Most of the training occurs concurrently while instructors are teaching online, enabling concepts to be applied and reflected on. This also makes instructor exchanges meaningful. Teachers seek help from each other through the discussion board, thereby utilizing the social environment. They monitor their performance, reflect on their goals, and report on them in the same way that students do. Goal achievement results in increased motivation and skill for both instructors and students. Instructors use the same technology that the students use. Teachers also evaluate each module upon completion and make suggestions. In this way, both students and instructors are able to increase their level of autonomy, encompassing both choice and self-direction. Evaluations of this approach have shown extensive improvements in the appropriateness and adequacy of the feedback teachers provide to students, and better facilitation of SRL (Andrade & Bunker, 2011; Andrade, 2014b).

While SRL and transactional distance are valuable theoretical lenses through which to view course design and support student success, they are certainly not the only approaches. Many courses build in some type of reflection on performance at a minimum. The six components of SRL provide a practical means of assisting students, have a long history of improving achievement (Dembo et al., 2005), and lend themselves well to an online environment.

5. Conclusion and practical implications

Training for the online environment will vary depending on purpose – is it to help faculty members design a course, or to teach a course, for example? Is the purpose to ensure consistency in sections across a single course? Is it focused on gaining familiarity with technology, or how to make activities engaging and interactive? Is the course based on particular theoretical underpinnings with which instructors must be familiar? Would an understanding of transactional distance and its components or SRL be advantageous to instructors? How can the training help instructors network and create community? These are all questions to be considered.

That distance learning is growing in the form of online courses is well-established as is the increasing demand for higher education and the need to provide access to a diverse range of learners. Institutions must provide support when implementing various forms of flexible learning and recognize that education is a “partnership between [higher education providers] and students with the goal of providing accessible yet manageable learning opportunities for a wide range of people” (Higher Education Academy, 2015, p. 4). As such, approaches to addressing faculty concerns over the quality and efficacy of online courses, and establishing training and tracking mechanisms are paramount.

References

- AACSB International. (2013). Eligibility procedures and accreditation standards for business accreditation. Tampa, FL: The Association to Advance Collegiate Schools of Business.
- Allen, I. E., & Seaman, J. (2011). Going the distance: Online education in the United States, 2011. Retrieved from <https://www.onlinelearningsurvey.com/reports/goingthedistance.pdf>
- Andrade, M. S. (2014a). Course embedded support for online English language learners. *Open Praxis*, 6(1), 65-73. Retrieved from <http://openpraxis.org/index.php/OpenPraxis/issue/view/7/showToc>. <http://dx.doi.org/10.5944/openpraxis.6.1.90>
- Andrade, M. S. (2014b). Dialogue and structure: Enabling learner self-regulation in technology enhanced learning environments. *European Journal of Educational Research* 13(5), 563-574. Retrieved from wwwwords.eu/eerj/content/pdfs/13/issue13_5.asp
- Andrade, M. S. (2016). Distance learning: Making connections through social networking. In C. Bernadas & D. Minchella (Ed.), *Proceedings of the 3rd Annual European Conference on Social Media* (pp. 9-18), Caen, France.
- Andrade, M. S., & Bunker, E. L. (2009). Language learning from a distance: A new model for success. *Distance Education*, 30(1), 47-61.
- Andrade, M. S., & Bunker, E. L. (2011). Developing self-regulated distance language learners: A promising practice. *Proceedings of the Fourth Annual Self-regulated Learning in Technology Enhanced Learning Environments conference sponsored by the Targeted Cooperative Network of European Institutions (STELLAR-TACONET)*, Barcelona, Spain (pp. 113-125).
- Bates, T., Desbiens, B., Donovan, T., Martel, E., Mayer, D., Paul, R., Poulin, R., & Seaman, J. (2017). Tracking online and distance education in Canadian universities and colleges: 2017. Vancouver, BC: The National Survey of Online and Distance Education in Canadian Post-Secondary Education. Retrieved from <https://www.newswire.com/files/e8/b0/f52d2613bf54ec6b35a454a344a0.pdf>
- Beaudoin, M. (2016). Issues in higher education—A primer for higher education decision makers. In B. O. Barefoot & J. L. Kinzie (Series Eds.), *New Directions For Higher Education*, & M. S. Andrade (Vol. Ed.), *Issues in Distance Education* (Vol. 173, pp. 9-19). San Francisco: Jossey-Bass. doi:10.1002/he
- Clinefelter, D. L. & Aslanian, C. B., (2016). *Online college students 2016: Comprehensive data on demands and preferences*. Louisville, KY: The Learning House, Inc.
- Dembo, M. H., Junge, L.G., & Lynch, R. (2006). Becoming a self-regulated learner: Implications for web-based education. In H. F. O'Neil, & R. S. Perez (Eds.), *Web-based learning: Theory, research, and practice* (pp. 185-202). Mahwah, N. J: Lawrence Erlbaum Associates.
- Dimeo, J. (2017, October 11). Teaching teachers to teach online. *Inside Digital Learning*. Retrieved from <https://www.insidehighered.com/digital-learning/article/2017/10/11/how-colleges-train-instructors-teach-online-courses>
- Franker, K., & Price, D. (2016). The course development plan: Macro-level decisions and micro-level processes. In B. O. Barefoot & J. L. Kinzie (Series Eds.), *New Directions For Higher Education*, & M. S. Andrade (Vol. Ed.), *Issues in Distance Education* (Vol. 173, pp. 43-53). San Francisco: Jossey-Bass. doi:10.1002/he
- Fredericksen, E. E. (2017). A national study of online learning leaders in US higher education. *Online Learning*, 21(2). doi: 10.24059/olj.v21i2.1164
- Garrison, R. D. (2003). Self-directed learning and distance education. In M. G. Moore, & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 161-168). Mahwah, NJ: Lawrence Erlbaum.

Gordon, N. (2014). Flexible pedagogies: Technology-enhanced learning. Higher Education Academy. Retrieved from https://www.heacademy.ac.uk/sites/default/files/resources/tel_report_0.pdf

Hanover Research. (2011). Trends in global distance learning. Washington, DC: Hanover Research.

Hanover Research. (2014, February 24). Online postsecondary education trends analyzed across 700 institutions – Hanover Research shares results. Retrieved from <http://www.hanoverresearch.com/2014/02/24/online-postsecondary-education-trends-analyzed-across-700-institutions-hanover-research-shares-results/>

Higher Education Academy. (2015). Flexible learning in higher education. Retrieved from https://www.heacademy.ac.uk/system/files/downloads/higher_education_academy_-_flexible_learning_framework_-_210416.pdf

Holec, H. (1981). Autonomy and foreign language learning: Council of Europe. Oxford: Pergamon Press.

Jaschik, S., & Lederman, D. (2014). The 2014 Inside Higher Ed survey of faculty attitudes on technology. Retrieved from <https://www.insidehighered.com/system/files/media/IHE-FacTechSurvey2014%20final.pdf>

Kunz, M. B., & Cheek, R. G. (2016). How AACSB-accredited business schools assure quality online education. Academy of Business Journal, 1(2), 105-115.

Lion, R., & Stark, G. (2010). A glance at institutional support for faculty teaching in an online learning environment. EDUCAUSE Quarterly, 33 (3). Retrieved from <http://www.educause.edu/ero/article/glance-institutionalsupport-faculty-teaching-online-learning-environment> Lumina Foundation. (n. d.). Today's reality. Retrieved from <https://www.luminafoundation.org/todays-student-statistics>

Little, D. (1991). Learner autonomy 1: Definitions, issues, and problems. Dublin, Authentik.

Hurd, S. (2005). Autonomy and the distance language learner. In B. Holmberg, M. Shelley, & C. White (Eds.), Distance education and languages: Evolution and change (pp. 1-19). Clevedon, U.K: Multilingual Matters Ltd.

McLennan, K. L. (2011). Tulane University School of Continuing Studies: Case study in online quality improvement. Continuing Higher Education Review, 75, 181-188.

Moore, M. G. (2007, 2013). The theory of transactional distance. In M. G. Moore (Ed.), Handbook of distance education (3rd ed., pp. 66-85). Mahwah, NJ: Lawrence Erlbaum.

National Center for Education Statistics. (2007). Fast facts. Most popular majors. Retrieved from <https://nces.ed.gov/fastfacts/display.asp?id=37>

Oxford, R. L. (2008). Hero with a thousand faces: Learning autonomy, learning strategies and learning tactics in independent language learning. In S. Hurd, & T. Lewis, Language learning strategies in independent settings (pp. 41-63). Bristol, England: Multilingual Matters.

Quality Matters. (2015). Standards from the QM higher education rubric, fifth edition. Retrieved from <http://www.elo.iastate.edu/files/2016/04/QM-Rubric.pdf>

Ryan, A. & Tilbury, D. (2013). Flexible pedagogies: new pedagogical ideas. Higher Education Academy. Retrieved from https://www.heacademy.ac.uk/sites/default/files/resources/npi_report.pdf

Ryerson University. (n. d.). Flexible learning. Retrieved from https://www.ryerson.ca/content/dam/lt/resources/handouts/Flexible_Learning_strategies.pdf

Saba, F. (2016). Theories of distance learning—Why they matter. In B. O. Barefoot & J. L. Kinzie (Series Eds.), *New Directions For Higher Education*, & M. S. Andrade (Vol. Ed.), *Issues in Distance Education* (Vol. 173, pp. 21-30). San Francisco: Jossey-Bass. doi:10.1002/he

White, C. (2005). Towards a learner-based theory of distance language learning: The concept of the learner-context interface. In B. Holmberg, M. Shelley, & C. White (Eds.) *Distance education and languages: Evolution and change* (pp. 55-71). Clevedon, U. K: Multilingual Matters Ltd.

Xu, H., & Morris, L. V. (2007). Collaborative course development for online courses. *Innovative Higher Education*, 32(1), 35-47.

Zimmerman, B. J., & Risemberg, R. (1997). Self-regulatory dimensions of academic learning and motivation. In G. D. Phye (Ed.), *Handbook of academic learning: Construction of knowledge* (pp. 105-125). San Diego, CA: Academic Press.

Zimmerman, B. J. (2002). Becoming a self-regulated learner. *Theory Into Practice*, 41(2), 64-70. http://dx.doi.org/10.1207/s15430421tip4102_2

Pre-service teachers' perceptions regarding the contribution of communal blog to their professional development

Liat Biberman-Shalev

Levinsky College of Education, Israël

Conference subtheme: Teacher Education & Digital Technology

Abstract

The contribution of technology platforms such as blogs in higher education is of ever-increasing interest. The blogs may be viewed as an evolved form of personal webpage or home page that includes different types of records or posts presented in chronological order. A communal blog is platform in which all students participating in the course publish their posts in one blog with the result that both the course instructor and all the course participants can read the posts and add comments. This study explores the integration of a communal blog in teacher education with the emphasis on exposing pre-service teachers' perceptions regarding this blog' contribution to their professional development. The study was based on a group of elementary-track pre-service teachers. The participants were asked to accompany their practical work with a communal blog. A qualitative analysis of interviews with all teacher students revealed the following themes: Instrumental platform, prompting memory, awareness, comparison and competition, reciprocity and sharing, change of perspective, communication, writing skills and prompting ICT skills. Conclusions and implications refer to ways to integrate blogs into teacher education.

Keywords

blogs, teacher education, pre-service students

1. Introduction

In recent years, there has been increasing evidence that the use of blogs in diverse academic contexts is becoming more and more commonplace, particularly in teacher education (Duarte, 2015; Kang, Bonk, & Kim, 2011; Powell, Jacob, & Chapman, 2012). In this context, the blog is seldom used as a study journal in which students document relevant information from college courses and practical work at the school, publish reflective records, voice their opinions regarding educational issues, and express their feelings and emotions vis-à-vis academic study. Moreover, since scholars have portrayed the blog as a space where discourse can occur among learners, between learners and instructors, as well as between learners and the larger internet community (Sim & Hew, 2010), it seems that teacher education may consider blogs to serve as platforms for encouraging both online and face-to-face communication and social interaction.

Right from the beginning of the training process, students are exposed to teachers' professional practices such as writing reflections on the basis of teacher-student discourse analysis, developing integrative thinking and professional language based on the connection between practical experience and various educational theories, and implementing 21st-century technologies. It is crucial for teacher educators to discover how their students perceive the contribution of the blog to the development of their professional practices since this will enable them to grasp the implications of using this technology for their trainees' professional development as well as for advancing and improving teacher education (Tondeur et al., 2012). Meanwhile, it enables teacher educators to determine whether and how they can become role models for their students with regard to the implementation of ICT (Lunenberg, Korthagen, & Swennen, 2007).

*Corresponding author

Email address: liat.shalev@levinsky.ac.il

2. Literature review

2.1 Blogs

The blogs may be viewed as an evolved form of personal webpage or home page that includes different types of records or posts presented in chronological order (Sim & Hew, 2010). Internet users can avail themselves of these records for the purpose of reading and writing comments (talkback). Blog owners are known as bloggers and the blogger community is dubbed the blogosphere. The blog is a platform for mass communication as it facilitates the introduction and publication of information on the web by means of chronologically-displayed records (from newest to oldest entry), thereby creating links to websites and other blogs and affording the blog readers an opportunity to respond to the information published in it (Blood, 2002; Williams & Jacobs, 2004).

It is customary to classify blogs according to four dimensions: (1) personal-individual (log network: personal online diary of one blogger), (2) private-public (group support: team of bloggers discussing personal matters), (3) topically-individual (column: a blogger's personal interpretation of a new theme with each entry), and (4) topically-public (shared content: community of bloggers writing about local and global social matters) (Krishnamurthy, 2002).

All blogs share the following characteristics: individual ownership (the blogger is responsible for publishing and editing content, determining readers' rights, and designing the blog), hyperlinked post structure (the blog permits the creation of links to external information), updates displayed in reverse chronological order and the creation of an internal blog information search according to different categories and tags).

2.2 Blogs in teacher education

For over two decades, the empirical educational research corpus has paid a great deal of attention to the advancement of teacher education that is tailored to the 21st century (Handler, 1993; Niess, 2015). However, research on the contribution of the blog platform to the advancement of teaching, learning, and assessment in academia is still in its early stages (Deng & Yuen, 2011). It seems that despite the availability and the user-friendly accessibility of the blog platform, its integration into teacher education is relatively limited (Fisher & Kim, 2013). Furthermore, there is only a vague understanding of how its implementation affects students' training (Tang, 2013). Evidence from empirical studies conducted around the world reveals that when teacher educators integrate blogs into their course requirements, it exerts a significant effect on their students' learning process (Tang & Lam, 2014; Top, Yukselturk, & Inan, 2010). For example, in a study conducted in Turkey, Okan and Taraf (2013) found that students who were specializing in foreign-language teaching and utilizing blogs in their learning process perceived the blog as a platform that supported professional preparation and advanced their ICT skills.

A broad overview of studies dealing with the integration of blogs into teacher education reveals that in general, the contribution of the blog is reflected in an improvement in student teachers' reading and writing skills as well as in their professional reflection (Harland & Wondra, 2011), critical thinking, and social interaction (Deng & Yuen, 2011; Yang, 2009).

Some studies have suggested that blogs contributes to flexibility of time and space in the learning processes while increasing the satisfaction derived from learning, academic achievement, a deeper understanding of the material studied, and sharing ideas and practical experience with faculty members and peers (Kirkwood & Price, 2014). Moreover, when a blog accompanied the practical work at school, it was considered to be a platform supporting the cognitive, social, and emotional dimension of learning (Chu, Chan, & Tiwari, 2012), and could encourage the creation of a community that had an impact on the student teacher's professional identity (Luehmann & Tinelli, 2008). In contrast, there are a few studies that indicate the relatively small contribution of blogging to the advancement of student teachers' professional development as concerns enhanced higher-order reflection (Jones & Ryan, 2014; Killeavy & Moloney, 2010; Xie, Ke, & Sharma, 2008).

One common way to use blogs in teacher education is by means of a communal blog in which all student teachers participating in the course publish their posts in one blog with the result that both the course instructor and all the course participants can read the posts and add comments. This signifies that communal blogging may be considered as tantamount to implementing sociocultural theories of learning and technology (Vygotsky, 1986) since the focus is on the interaction among the course participants as well as on their cooperation and sharing ideas while creating a collaborative learning community (Tang & Lam, 2014; Top, 2012).

The current study examines a main research question, as follows:

- What are the perceptions of pre-service student teachers with regard to the contribution of a communal blog to their professional development?

3. Methodology

3.1 Research context and procedure

The study was conducted at a large college of education located in a major city in the center of Israel. As part of the teacher education program, student teachers engage in a full school day of practical work once a week throughout the academic year (two semesters). Each student's practical work includes the following: (1) planning lesson encounters with one pupil or more, chosen to be taught by the student teacher in consultation with the teacher educator, (2) operating the encounters, (3) receiving feedback on their practice from both the pedagogy instructor and the other student teachers at the same school, (4) observing pupils, the teacher trainer, and other professionals in the classroom, (5) attending meetings with school officials (e.g., the school principal, the school counselor), and (6) activating unique educational initiatives at the school (e.g., creating special learning spaces, staging educational events). Various incidents that occurred during the practical work and the reflections derived from them are posted in a communal blog. These posts may be accompanied by photos, videos of the student's practice, and links to relevant sites. The blog is situated in course site on the MOODLE platform.

The current study extended over an academic year and included a group of 12 pre-service students training to be elementary-school teachers. Each student teacher who belonged to it was required to publish a reflective post dealing with her practical work on a communal blog at least once a week. Each week, the pedagogy instructor read and commented on all the students' posts in this blog. Thus, the pre-service student teachers' posts became public knowledge. At the end of each academic year, semi-structured interviews (Creswell, 2005) dealing with the contribution of the communal blog to both the learning process and professional development were conducted with the pre-service student teachers.

3.2 Communal blog participants

The communal blog was used by 12 pre-service teachers (11 female and one male). Their ages ranged from 21 to 28, and they were all training to becoming elementary-school teachers. The student teachers' fields of specialization varied: four specialized in science, three in math, three in Hebrew literature, and two in Bible studies. Only two participants claimed that this was their first encounter with a blog. All the others claimed that although they had never maintained a blog, they had read fashion and cookery blogs.

3.3 Method

The present study implemented a phenomenological approach to education research (Sohn, Greenberg, Thomas & Pollio, 2017). Semi-structured interviews (Creswell, 2005) were conducted with the student teachers at the end of the academic year. The interview questions related to aspects that may shed some light on the students' perceptions regarding the contribution of the blog to their training (e.g., Did the blog enhance what you learned during the practicum, and if so, how? Did the blog improve your writing skills, and if so, how? Will you use a blog as a teacher in your future class? Why and how?). The importance of interviewing the student teachers lay in the fact that the implementation of blogs in the practicum process was a new technology that had just been instituted at the college. Thus, it was very interesting to explore what they thought of the usefulness of these technological tools for their training process.

The present study was conducted inductively (Richards, 2009). The first phase included a preliminary exploratory analysis, namely, reading the complete interviews transcripts as a single unit in order to gain an initial impression, seeking themes and exploring possible ways to organize the data, and ascertaining whether there was any need to collect additional data. The second phase consisted of subjecting the interview transcripts to a coding process in order to identify subcategories (Agar, 1980; Creswell, 2005).

4. Results

The following sections list the segmentation of the main themes and categories they contain.

4.1 Instrumental platform, prompting memory, awareness, competition, reciprocity, sharing, and change of perspective

Instrumental platform. The perception of the communal blog as an instrumental platform was negligible. This may be attributable to the fact that the communal blog was perceived as a public space that did not belong solely to the student teacher but rather to the sum total of its participants. Therefore, the perception of it as a personal organization space was less relevant.

Prompting memory. The student teachers perceived memory as an important contribution of the

communal blog: 'The blog serves as a reminder of the process I underwent'; 'The blog allows me to remember behaviors or things I said and did during my practical work.'. In this regard, memory was not attributed to aspects of deep self-exploration, but rather to the fond recollection of past events.

Awareness. The student teachers perceived the communal blog as contributing to an increased awareness with regard to others: 'Looking at my blog, I realize that I put my pupils first'; 'The blog has taught me about myself that I'm a fairly patient person who knows how to accommodate other people's views.' Some of the students' awareness was also associated with tracking the advancement of their fellow participants:

"A blog is like a travelogue. I look and see the process that every student has undergone throughout the year. I think that in my case the change is positive. There could be students who started well and then declined; so it's possible to see a positive or negative development."

In addition, the students' increasing awareness was associated with their understanding that a situation can be interpreted from a variety of perspectives: 'I read what others posted about our meeting with the school principal and I noticed that one could see things that others didn't think about or notice.' Similar findings regarding the manner in which the communal blog contributed to the exposure to a wide range of perspectives were also reported in another study (Ellison & Wu, 2008).

Comparison and competition. The communal blog structure seemed to promote comparisons among the blog participants. These comparisons foregrounded aspects of competition among the student teachers and were primarily attributed to the beginning of the academic year. Comparison and competition are associated with student teachers' high level of motivation to succeed in their practical work. In fact, peer contribution to promoting academic achievement has been studied for a long time (Zimmerman, 2003). One student teacher described the competition as follows:

"In the blog, there is healthy competition. Consciously or not, everyone wants to be the best, so we read one another's lesson plans and reflections [...] seeing what my colleagues posted on the blog made me realize where I stand in relation to them."

Reciprocity and sharing. With the positioning of personal status inside and outside of the blog, the sense of competitiveness seems to diminish and make room for reciprocity and sharing, as one student teacher expressed it:

"In the blog, I could share my practical work experience, give them [the other participants] ideas for activities with their pupils, and help them if they were stuck for a direction or an idea for the next time."

Top (2012) also describes the communal blog as a space for an emotional and professional supportive community.

Change of perspective among student teachers who used the communal blog focused on aspects of sharing and peer learning:

"At first it was very difficult to share my thoughts and reflections on the blog because I didn't know them [the participants] all, but the blog has made me realize how much sharing is liberating and helpful for everyone."

These perceptions are likely to reinforce the importance of teacher educators serving as role models for student teachers when implementing teaching methods while integrating ICT (Lunenberg, Korthagen, & Swennen, 2007).

4.2 Participants as a source of support

The communication among the student teachers within the virtual space seemed to increase the communication among them outside of it as well:

"Because of the blog, we felt more comfortable when we participated in the college classroom discourse and shared and discussed the school experiences at school we posted."

The professional support among student teachers was found to depend mainly on exchanging ideas or giving advice based on personal experience: "I used a lot of the other participants' planning materials; I was exposed to ideas and activities that I implemented when meeting my pupils."

One of the difficulties experienced by the blog's participants involved commenting on one another's posts. Some student teachers admitted that their comments tended to be positive and encouraging because:

"[It is] not always easy to mention things we liked less or considered incorrect, so first we comment only on the posts we identify with more."

The findings also indicate the possibility that the participants' comments were perceived as a source of encouragement and personal support, thereby engendering a positive communicative climate.

4.3 Writing for sharing

Among student teachers who used the communal blog, quality of writing referred to three main aspects. The first aspect focused on the quality of writing insofar as it related to the responsibility of what was written in the post and how it was written:

"I used to think profoundly about what I wrote and how I wrote it, mainly because of the fact that many people might read my posts."

The second aspect related to sharing. The desire to share their experiences seemed to encourage the student teachers to write in a manner that would enable the readers to contribute:

"From the participants' comments, I could recognize what was clear to them, what they understood from the reflections I posted. I was able to understand what I needed to emphasize more or how I could write it more clearly the next time."

The third aspect referred to improving the quality of writing by comparing one's own post to those of the other student teachers: "Looking at the other participants' posts has helped me improve my writing and notice little things I hadn't spotted before."

Some student teachers found that posting deepened their reflective and integrative thinking: "Over time, I began to use words that had become part of my professional language. I think that posting reflections on the blog has deepened my knowledge of these terms."

4.4 Promoting ICT skills

Except for one participant who claimed that she was not familiar with blogs, all the participants in the communal blog group claimed that it had not enhanced their ICT skills. When asked whether they would integrate a communal blog into their future classrooms, they related to two aspects: (1) the social aspect (i.e., using a blog to encourage collaborative and social sharing, and (b) the pedagogical aspect (i.e., cooperative learning and teachers' as well as pupils' peer learning).

5. Conclusion and discussion

The present study sought to explore the perceptions of pre-service student teachers regarding the contribution of communal blogs to their training process and professional development. The findings revealed that the majority of student teachers who used the communal blog perceived it as a public space in which, on the one hand, they positioned their status on the basis of comparing posts. Thus, its participants became a kind of a "ratio index" for comparing personal progress (Zimmerman, 2003). On the other hand, the communal blog was perceived as a platform for sharing ideas and experiences in order to help all its participants. The communal blog may therefore be seen as a platform that corresponds with the social-constructivist approach (Vygotsky, 1986) to learning and technology. The findings also revealed that among the communal blog users, the importance of sharing and peer learning was perceived as part of the teaching practices. This perspective was supported by five interconnected processes that occurred in the communal blog space: competition, awareness, reciprocity, and sharing. These processes honed the participants' understanding of the significance of peer learning and the perception that this method is beneficial to both weak and advanced students. Perhaps the sense of solidarity and the importance of cooperation strengthened the communication among the participants and diminished the importance of the communication with the pedagogy instructor. In addition, for communal blog users, writing quality was associated with aspects of responsibility and sharing.

The findings revealed that the manner in which the student teachers perceived their intention to utilize blogs as part of their arsenal of teaching methods reflected their personal experience of using the platform. In other words, communal blog users described promoting socio-emotional support and pedagogical aspects such as peer learning.

Thus, one conclusion of this study states that the student teachers' personal experience of using blogs enabled them to understand the benefits of that technology for future implementation. This signifies that although teacher educators who act as role models for the integration of technology are essential to teacher education (Lunenberg, Korthagen, & Swennen, 2007), one should consider that the students' personal interpretation of using such technology may be a significant factor that affects their perception of its future integration.

Leaning on the sociology of education literature regarding the structural functionalism paradigm (Durkheim, 1956; Merton, 1968), one can conclude that the structural characteristics of the communal blog platform may shape the perceptions and behaviors of the student teachers who functioned in this virtual space. In this regard, the structural characteristics of the communal blog foreground features of social-constructivism and are likely to promote a sense of community support and mutual cooperation

among the blog's participants. The blog's contribution to promoting a sense of community support among pre-service students specializing in nutrition was also mentioned in a study conducted in the United States (Halic, Lee, Paulus, & Spence, 2010). Future studies should examine whether students operating in various disciplinary cultures (Becher, 1994) perceive the contribution of the blog differently from what is revealed in the findings disclosed in this study. For instance, a study conducted in Australia found no differences between local and international students as regards their perceptions of the blog as supporting their learning process (Jackling, Natoli, Siddique, & Sciulli, 2015). It should be emphasized that this study has several limitations that should be taken into account in future research. One limitation relates to the rather small number of the participants in this study. Future studies should also consider analyzing the contents of posts and comments in order to validate the findings of this study.

In conclusion, teacher educators who wish to use the communal blog as an accompaniment to their courses or to their students' practical work should examine the findings and conclusions of this study when advocating a particular educational approach (cognitive-constructivism, social-constructivism, etc.), the aim of their course (peer learning, self-inquiry), and the unique needs of the student teachers (self-exploration, peer support).

References

- Agar, M. H. (1980). *The professional stranger: An informal introduction to ethnography*. San Diego, CA: Academic Press.
- Becher, T. (1994). The significance of disciplinary differences. *Studies in Higher Education*, 19(2), 151-61.
- Blood, R. (2002). *The weblog handbook: Practical advice on creating and maintaining your blog*. Cambridge, MA: Perseus Publishing.
- Chu, S. K. W., Chan, C. K. K., & Tiwari, A. F. Y. (2012). Using blogs to support learning during internship. *Computers & Education*, 58(3), 989-1000.
- Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Merrill Prentice Hall.
- Deng, L., & Yuen, A. H. K., (2011). Towards a framework for educational affordances of blogs. *Computers & Education*, 56, 441-451.
- Duarte, P. (2015). The use of a group blog to actively support learning activities. *Active Learning in Higher Education*, 16(2), 103-117.
- Durkheim, E. (1956). *Education and sociology*. Glencoe, IL: Free Press.
- Ellison, N. B., & Wu, Y. (2008). Blogging in the classroom: A preliminary exploration of student attitudes and impact on comprehension. *Journal of Educational Multimedia and Hypermedia*, 17(1), 99-122.
- Fisher, L., & Kim, D. (2013). Two approaches to the use of blogs in pre-service foreign language teachers' professional development: A comparative study in the context of two universities in the UK and the US. *The Language Learning Journal*, 41(2), 142-160.
- Halic, O., Lee, D., Paulus, T., & Spence, M. (2010). To blog or not to blog: Student perceptions of blog effectiveness for learning in a college-level course. *The Internet and Higher Education*, 13, 206-213.
- Handler, M. G. (1993). Preparing new teachers to use computer technology: Perceptions and suggestions for teacher educators. *Computers & Education*, 20(2), 147-156.
- Harland, D. J., & Wondra, J. D. (2011). Preservice teachers' reflection on clinical experiences: A comparison of blog and final paper assignments. *Journal of Digital Learning in Teacher Education*, 27(4), 128-133.
- Jackling, B., Natoli, R., Siddique, S., & Sciulli, N. (2015). Student attitudes to blogs: A case study of reflective and collaborative learning. *Assessment & Evaluation in Higher Education*, 40(4), 542-556.
- Jones, M., & Ryan, J. (2014). Learning in the practicum: Engaging pre-service teachers in reflective practice in the online space. *Asia-Pacific Journal of Teacher Education*, 42(2), 132-146.
- Kang, I., Bonk, C. J., & Kim, M. C. (2011). A case study of blog-based learning in Korea: Technology becomes pedagogy. *The Internet and Higher Education*, 14(4), 227-235.
- Killeavy, M., & Moloney, A. (2010). Reflection in a social space: Can blogging support reflective practice for beginning teachers? *Teaching and Teacher Education*, 26(4), 1070-1076.
- Kirkwood, A., & Price, L. (2014). Technology-enhanced learning and teaching in higher education: What is 'enhanced' and how do we know? A critical literature review. *Learning, Media and Technology*, 39(1), 6-36.

- Krishnamurthy, S. (2002). The multidimensionality of blog conversations: The virtual Enactment of September 11. Paper presented at Internet Research 3.0. Maastricht, The Netherlands.
- Loughran, J. (2006). Developing a pedagogy of teacher education: Understanding teaching and learning about teaching. New York, NY: Routledge.
- Luehmann, A. L., & Tinelli, L. (2008). Teacher professional identity development with social networking technologies: Learning reform through blogging. *Educational Media International*, 45(4), 323-333.
- Lunenberg, M., Korthagen, F., & Swennen, A. (2007). The teacher educator as a role model. *Teaching and Teacher Education*, 23, 586-601.
- Merton, R. K. (1968). Social theory and social structure. New York, NY: The Free Press.
- Niess, M. L. (2015). Transforming teachers' knowledge: Learning trajectories for advancing teacher education for teaching with technology. In C. Angeli and N. Valanides, *Technological pedagogical content knowledge exploring, developing, and assessing TPCK* (pp. 19-37). New York: Springer.
- Okan, Z., & Taraf, H. U. (2013). The use of blogs in second language teacher education. *Procedia - Social and Behavioral Sciences*, 83, 282-289.
- Powell, D. A., Jacob, C. J., & Chapman, B. J. (2012). Using blogs and new media in academic practice: Potential roles in research, teaching, learning, and extension. *Innovative Higher Education*, 37(4), 271-282.
- Richards, L. (2009). Handling qualitative data: A practical guide (2nd ed.). London, UK: Sage.
- Sim, J. W. S., & Hew, K. F. (2010). The use of weblogs in higher education settings: A review of empirical research. *Educational Research Review*, 5, 151-163.
- Sohn, B. K., Thomas, S. P., Greenberg, K. H., & Pollio, H. R. (2017). Hearing the voices of students and teachers: A phenomenological approach to educational research. *Qualitative Research in Education*, 6(2), 121-148.
- Tang, E. (2013). The reflective journey of pre-service ESL teachers: An analysis of interactive blog entries. *Asia-Pacific Educational Research*, 22(4), 449-457.
- Tang, E., & Lam, C. (2014). Building an effective online learning community (OLC) in blog-based teaching portfolios. *The Internet and Higher Education*, 20, 79-85.
- Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisserand, P., & Ottenbreit-Leftwich, A. (2012). Preparing preservice teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, 59(1), 134-144.
- Top, E. (2012). Blogging as a social medium in undergraduate courses: Sense of community best predictor of perceived learning. *Computers & Education*, 15(1), 24-29.
- Top, E., Yukselturk, E., & Inan, F. A. (2010). Reconsidering usage of blogging in pre-service teacher education courses. *The Internet and Higher Education*, 13(4), 214-217.
- Vygotsky, L. S. (1986). *Thought and language* (trans. A. Kozulin). Cambridge, MA: MIT Press.
- Williams, J. B., & Jacobs, J. (2004). Exploring the use of blogs as learning spaces in the higher education sector. *Australasian Journal of Educational Technology*, 20(2), 232-247.
- Xie, Y., Ke, F., & Sharma, P. (2008). The effect of peer feedback for blogging on college students' reflective learning processes. *The Internet and Higher Education*, 11, 18-25.

Yang, S. H. (2009). Using blogs to enhance critical reflection and community of practice. *Educational Technology & Society*, 12(2), 11-21.

Zimmerman, D. J. (2003). Peer effects in academic outcomes: Evidence from a natural experiment. *Review of Economics and Statistics*, 85(1), 9-23.

The impact on teacher's self-efficacy of TPACK in the Professional Development School Scheme (PDSS)

Ming Yan TSUI & Ida Ah Chee MOK

The University of Hong Kong

Conference subtheme: Professional Development of Teachers

Abstract

The purpose of this study was to examine how the self-efficacy of a group of in-service teachers' Technological Pedagogical and Content Knowledge (TPACK) might be supported by a professional development scheme. The research was carried out with 12 in-service teachers from 6 different Hong Kong secondary schools in school year 2017-2018. In addition, all of them joined the Professional Development School Scheme (PDSS) (Stem Education- technology integration in teaching) organized by Education Bureau (EDB), the Government of Hong Kong Special Administrative Region. In stage 1, the teacher in-charge of PDSS shared his teaching materials, invited lesson observation and gave technical support to his team members in the first semester. After the semester, a questionnaire was given to each team member to determine their self-efficacy in different domains in (Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Content Knowledge (TCK), Pedagogical Content knowledge (PCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content knowledge (TPCK)) and their self-efficacy of e-learning in the learning community. In stage 2, peer observations (with the teachers' consent) were promoted. After stage 2, a second questionnaire was given to each team member to examine the teachers' self-efficacy after the peer observation of subject integration with technology under TPACK framework. At last, the two sets of data would be analysed to investigate the experience of different components of the PDSS on the teachers' self-efficacy in technology integration in their teaching.

Keywords

TPACK, Professional Development, Technology Integration

1. Introduction

Under the Support Scheme for E-learning in Secondary Schools in Hong Kong by Hong Kong Education Bureau (EDB), a great number of schools have enhanced Wi-Fi infrastructure. However, the teachers' readiness of promoting e-learning have not fully developed. A possible reason is that quite a big number of mathematics teachers are passive in integrating technology into their teaching and believe that technology is not essential in their teaching practice. However, e-learning can provide meaningful learning beyond drilling exercises and enhance students' motivation according to the multimedia approach. Hence, professional development for in-service teachers is indispensable. Based on the concept of 'learning communities', EDB implemented the Professional Development Schools Scheme (PDSS), in which the participating school played a leadership role in the teacher activities. Most studies on TPACK in literatures are about pre-service mathematics teachers and this study contributes to the research gap by targeting in-services teachers. Using PDSS in Hong Kong as an example of the government's effort for providing professional development for in-service teachers, and with the lens of TPACK, we discuss: How do PDSS with a learning community approach facilitate the integration of technology in the in-services teacher practice and their self-efficacy of TPACK? The paper will invite further reflection and discussion on the learning community approach for developing TPACK.

*Corresponding author

Email address: ivanmytsui@hku.hk

2. Literature review

2.1 The Technological Pedagogical and Content Knowledge

The Technological Pedagogical and Content Knowledge (TPACK) is an extension of Shulman's Pedagogical Content Knowledge (PCK) (Shulman 1986) with integration of technology. Angeli and Valanides (2009) stated that the effectiveness of technology integration should include the formulating by all components in the TPACK that are composed of technology, content and pedagogy (see figure 1). In this paper, the content refers to mathematics content. Efficient and effective integrated technology in teaching practice requires teachers' good understanding of mutual relationship in content, technology and pedagogy (Koehler, Mishra, & Yahya, 2007). Furthermore, the TPACK framework can act as a guideline for educators to analyse the teacher's teaching practice of technology integration (Baran, Canbazoglu Bilici, Albayrak Sari, & Tondeur, 2017). In addition, Sun, Strobel, and Newby (2017) pointed out that effective role models are crucial to motivate in-service teachers for their technology integration. In the TPACK framework, different instruments and methods were used to investigate the level of integration of technology into teaching practice (Jen, Yeh, Hsu, Wu, & Chen, 2016).

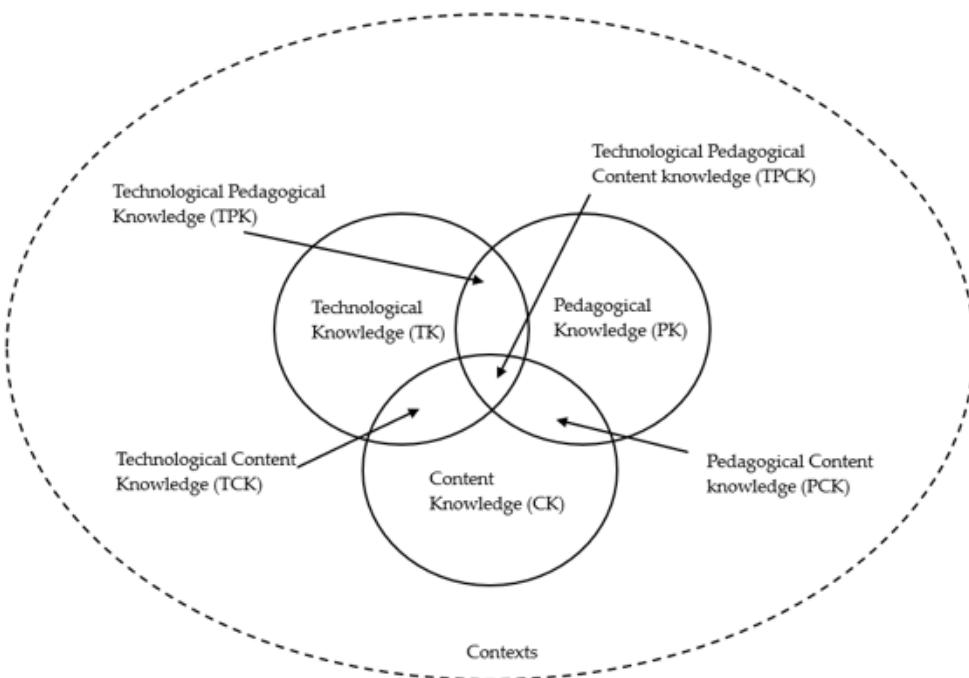


Figure 1. The components of Technological Pedagogical and Content Knowledge

TPACK includes seven domains which are Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Content Knowledge (TCK), Pedagogical Content knowledge (PCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content knowledge (TPCK).

Technological Knowledge (TK) - It is about both the operation skills of particular advanced technologies such as tablets, computer, software and apps, and also that of standard technologies, such as books, blackboard and chalk.

Content Knowledge (CK) - It is about the understanding of the subject matter in teaching such as concepts, facts and theories.

Pedagogical Knowledge (PK) - It is about teaching methods or teaching techniques in classroom, such as classroom management, lesson plan development, implementation and student learning.

Technological Content Knowledge (TCK) - It is about the subject matter taught and the subject content that can be represented by the use of technology.

Pedagogical Content knowledge (PCK) - It is about the transference of the subject matter to teachers' teaching.

Technological Pedagogical Knowledge (TPK) - It is about the use of suitable technology to fit teachers' teaching strategies, and the ability to manipulate those technologies, such as discussion boards, and chat room.

Technological Pedagogical Content knowledge (TPCK) - It is about the knowledge of integration of three domains (content, pedagogy, and the technology)

2.2 Blended learning

There are various definitions about blended learning. Singh and Reed (2001) define the blended learning as delivering the suitable skills or knowledge to the suitable person at the right time by using suitable learning technology with appropriated learning style for achieving the learning goals. Osguthorpe & Graham (2003) define that blended learning as integrating the advantages of web based learning into face-to-face to learning. Thorne (2003) defines the blended learning as education model which can integrate e-learning that improves in parallel with new technologic developments and traditional learning. Some researchers believe that blended learning mixed the traditional face-to-face instructions and online learning by student's own study progress (Bonk & Graham, 2006). Rossett (2002) defines that for the learning processes: Blended Learning combines the traditional face to face learning and e-learning or distance learning by using different kind learning tools on the same platform. Alonso, López, Manrique, and Viñes (2005) state that blended learning as dynamic, real time, collaborative, personalised, comprehensive and enabling the organisation are the properties of blended learning.

Garrison, Anderson, and Archer (1999) created a guideline for blended learning by using the Framework for Community of Inquiry (CoI) which is called the Garrison and Vaughan's inquiry-based framework. CoI framework was developed by constructivism. Therefore, the CoI framework includes inquiry and collaboration. Rather than individual level, a blended faculty community of inquiry is being used the community-based inquiry to represent the integration of pedagogy and technology. They also emphasized that the blended learning is merely used in educational technology to supplement traditional face to face instruction. Therefore, the blended learning model turned from technology to learning (Garrison & Vaughan, 2008).

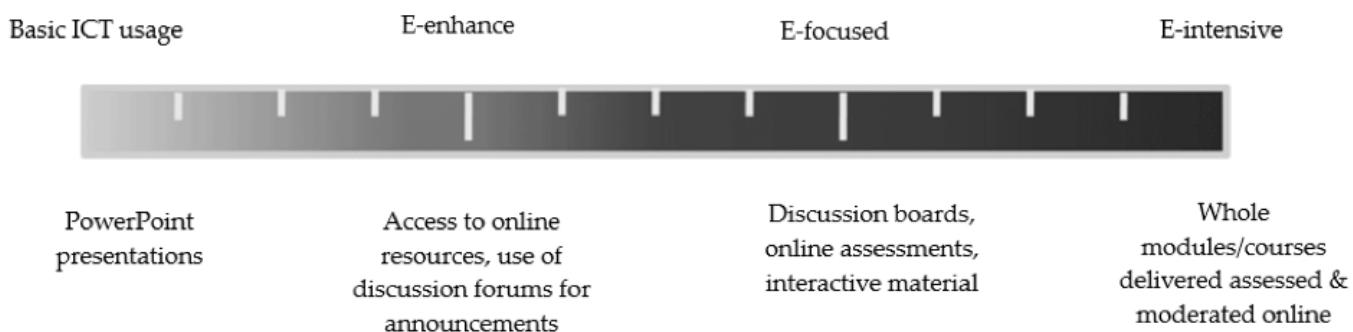


Figure 2. Continuum of Blended Learning

Blended learning was treated as one of top 10 trends for delivering knowledge by The American Society for Education and Development (Graham, 2006). There are many advantages of the blended learning. First, blended learning is flexible, comfortable and low cost for students to learn and also enhance students' interest in learning and interaction with others (Young, 2002). Second, students can get more inspiration through experimentation with a realistic simulation by compared to traditional teaching method (Mills, Middleton, Moran, Murray-Smith, & Pack, 1974). Third, students can explore in all mathematics topics such as algebra, geometry and measurement (NTCN, 2000). Lastly, students can learn anywhere at anytime. Some countries such as Australia, China and New Zealand use blended learning to improve the education of students' living in isolated or remote areas (Powell & Patrick, 2006). In Hong Kong, the traffic is convenient, and it is accessible for most teachers and students to go to schools. Therefore, in Hong Kong, the blended learning is mostly used to enhance the student-centre teaching or used as pre-lesson assignment at home.

Despite of the numerous advantages to use technology there are a number of drawback. First, teachers have to spend a lot of time to prepare the blended learning materials (Benson & Anderson, 2010).

Second, using technology in teaching is more challenging to teachers than to students. Students normally adapt to the technology very easily. However, not all teachers can master technology when they teach. Third, students are easily to be involved in problems of plagiarism and credibility because they can find online resources easily. They may just copy the answers from the internets. Forth, students require self-discipline in their learning. In Hong Kong, most teachers are facing the problem that students just use their mobile devices for leisure but not for learning, especially with poor parental support.

There are pros and cons in different educational models. Technology is an essential part of our daily life, and students should try to learn with technology. We should try to tackle the disadvantages in technology integration.

2.3 Mobile devices

Aguilar and Puga (2015) define the mobile devices as "Any personal and portable computer device that could be used in mathematics classroom. This includes devices such as calculators, laptops, smart phones and tablets". However, not many researchers give the definition to mobile devices. Yet, from their researches, they intend to regard tablets and smart phones as those access internet devices as mobile devices (Roberts & Vänskä, 2011; White & Martin, 2014). In Hong Kong secondary schools, most students buy their own calculators. Teachers are familiar to make use of the calculators in their teaching. Therefore, in this study, the mobile devices are referred to tablets only such as iPads or Android tablets.

2.4 Professional Development

Professional development (PD) is a training process for teachers' training in their work place to improve or increase their capabilities. PD for in-service teachers is indispensable (Guskey, 2002). It can include different approaches such as learning communities, coaching, lesson study, mentoring and so on (Buysse, Rous, & Winton, 2008). Besides, PD is an important training for in-service teachers to improve their teaching practice (T.R. Guskey, 2002). Besides, teachers can change their beliefs and attitudes about technology by PD (Shaunessy, 2005). Furthermore, Teachers can gain required knowledge and skills to integrate technology into their teaching practice (Fishman & Pinkard, 2001). Long term training, collaboration, school based activities, aiming at all students learning including the curricula that related to teachers' teaching are crucial for effective professional development (Elmore, 2004; Hiebert, Gallimore, & Stigler, 2002). There is much positive effect on student achievement when teachers attended professional development (Cohen & Hill, 2008). However, some scholars state most of professional development programmes are not effective (Wang, Frechtling, & Sanders, 1999). Thomas R Guskey (1986) suggests that there are two major factors affecting the failure of professional development programmes. First, it is the motivation of joining the programmes. Second, teachers change their beliefs or knowledge in the programmes.

Borko (2004) suggests that the PD system should include facilitators, PD program, teachers and context. They have relationship on each other (see figure 3).

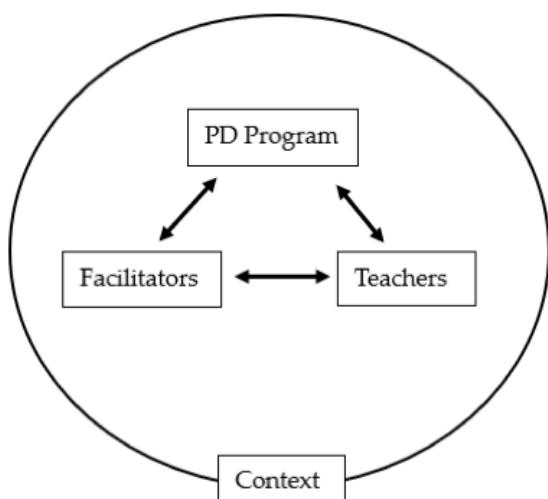


Figure 3. Elements of a professional development system.

The professional development programmes

The Teachers who are teacher's members in the scheme

The facilitator who is the teacher in-charge of the PDSS facilitates other teacher members to develop their BYOD for their own schools.

The context is how to develop their BYOD for their own schools.

3. Contextual background

3.1 Hong Kong education curriculum

Information Literacy is one of the seven learning goals of secondary schools. The appropriate use of information technology in mathematics learning is one of the directions in mathematics education. Therefore, technology integration is one of the main concerns in Hong Kong curriculum. However, there are two obstacles that hinder teachers to use technology in senior class mathematics teaching. First, the teaching time for senior classes in secondary schools is limited. Second, most teachers are very much concerned about students' public exam results. Therefore, most schools develop their technology integration in junior classes only. For the senior classes, teachers use technology only to drill multiple choice questions.

3.2 E-learning in Hong Kong

Hong Kong teachers are still at an initial stage on technology integration for their own teaching practice (So & Swatman, 2006). However, computers are ready in most Hong Kong classrooms and Wi-Fi is installed in many Hong Kong schools. Nevertheless, e-learning was not popular because there are three obstacles. First, teachers lack time to prepare the e-learning materials (Powell & Patrick, 2006). Second, there are insufficient online resources with relevant learning objects which fit for the existing Hong Kong curriculum (Means, Toyama, Murphy, Bakia, & Jones, 2009). Third, Teachers have not yet been equipped with enough specific technological knowledge and skills (Snoeyink & Ertmer, 2001). Therefore, the overall ranking of Hong Kong teachers' readiness of e-learning is 19th out of 60 countries by The Economist ranking (The Economist 2003). EDB is trying to encourage teachers to take part in different kinds of trainings such as workshops and seminars. The purpose is to promote e-learning in Hong Kong. However, EDB has not provided any guidelines or directions for technology integration for secondary schools (Powell & Patrick, 2006). Besides, the trend of e-learning in Hong Kong is that teachers prepare their own technology integration materials to fit their own teaching practice (Means et al., 2009). Therefore, in the early stage for the promotion of technology integration, EDB did support all schools to install computers. Although computers are available in Hong Kong secondary schools now, most computers are not fully utilized and merely installed in computer labs only. Therefore, it is not convenient for teachers and students to use them. Recently, EDB has suggested that schools use mobile devices to promote e-learning. However, Hong Kong teachers mostly present the materials verbally during the class (Leung, 2005). Recently, EDB is going to promote student-centred approach. Under this model, flipped classroom and self-regulated learning, which utilize technology in teaching, are being promoted in mathematics education. However, due to the low self-discipline of students, many schools have given up using those models for their teaching practice.

Borotis and Poulymenakou (2004) define e-learning readiness as teacher preparing mentally and physically for some technology integration experience or action. However, not all in-teachers are well-trained for technology integration in their teaching.

3.3 EDB training for promoting e-learning

EDB launched two 3-hour workshops and one 3-hour seminar to equip technology integration for in-service teachers in the school year 2017 - 2018. However, it is not sufficient to promote e-learning among secondary schools. Therefore, based on the concept of 'learning communities', EDB implemented the Professional Development Schools Scheme (PDSS). Palloff and Pratt (1999) define learning community as based on the people who share the same interests or common areas or topics from a group for knowledge exchange or transformation with it. The scheme includes one teacher the teacher in-charge of the PDSS of the scheme who is a very experienced mathematics teacher seconded by EDB and 12 Mathematics teachers from 6 different secondary schools. The purpose of the professional development school takes the leading role to share their practice and expertise to other secondary schools. "If teachers are to learn how to create a positive environment

that promotes collaborative problem solving, incorporates technology in a meaningful way, invites intellectual exploration, and supports student thinking, they themselves must experience learning in such an environment" (NCTM, 2007, P.119). Through different kinds of inter-school activities such as lesson planning, class observation, sharing of resources and joint-school professional development programmes, it makes the partner schools advance the technology integration into their teaching practice. In this study, all schools are interested to develop "Bring Your Own Device" (BYOD) for their own school even though they have different paces to promote BYOD. Education (2012) defines BYOD as "technology models where students bring a personally owned device to school for the purpose of learning".

The context of the study was the Professional Development School (PDS) Scheme (STEM education) organised by the EDB, which aimed to focus on technology integration (BYOD) in mathematics education in secondary schools. In stage 1 which lasted for one semester. The teacher in-charge of PDSS shared his teaching materials, invited lesson observation and gave technical support to his team members in the first semester. Stage 2 of the scheme took place in the following semester. During this period, the teacher members were encouraged to use technology in their teaching and peer lesson observation would be promoted.

Due to the limitation of time, we do not investigate Stage 2 in this paper. We will analyse those data in the future.

4. Methods

Based on the concept of 'learning communities' EDB implemented the Professional Development School Scheme (PDSS), in which the PD schools played a leadership role in the teacher activities. The purpose of this investigation is to examine the impacts of PDSS on the in-service teachers' TPACK and their self-efficacy of e-learning in the learning community and integration of technology in their teaching practice. Besides, we will also explore to what extent practical experience may be beneficial to the teachers' readiness of technology integration in their teaching.

PDSS consisted of two Stages: (1) sharing by the PD school, (2) Practice by the teacher members.

All the teachers in the PDS scheme were invited to complete a questionnaire after Stage 1 and another questionnaire after Stage 2. The scheme will last for one year. The analysis for Stage 2 will be done in the future.

4.1 The questionnaire

Most teachers are experienced in teaching. Besides, Hong Kong mathematics teachers are confident of teaching mathematics (Mullis, Martin, Foy, & Arora, 2012). Therefore, the technology-related domains (TK, TCK, TPK, and TPCK) were examined in this study. The questionnaire was modified from the instrument developed by M. J. Koehler and Mishra (2005) for the use of the local context. The questionnaire was divided into two parts. The first part was for demographic information. The second part consisted of different questions in each technology-related domain. The questionnaire in this study included 11 items. 4-point scale was used, ranging 1 (strongly disagree) to 4 (strongly agree). All teacher members were invited to complete the questionnaires in around 5 minutes.

4.2 Demographical data

We collected the data of the five different schools out of six. Eight male and two female teachers were invited to complete the questionnaire. Three teachers have got one to five years working experience. One teacher has six to ten years working experience. Four teachers have eleven to fourteen years working experience and two teachers have at least fifteen years work experience in teaching.

5. Results

5.1. The impact of PDSS on the teachers

5.1.1. Examples of how a teacher uses the blended learning model in his teaching

Teachers integrated the blended learning platform into their instruction. The teacher in-charge of PDSS mainly promoted the blended learning platform which was called "Demos". One teacher taught sequence in Grade 1. Students wrote the answers on an iPad and their answers showed up on the teacher's screen. All students could get instant feedback from their teacher because of the interface

of the platform. The teacher could also point out some common mistakes among students. In another example, one teacher used another blended learning platform which was called "Socarative". When students input the answer of multiple choice questions into the platform during the class, the platform showed the correct percentage for each question immediately, then teachers could choose which question to explain during the class based on the correct percentage. The teacher could adjust his teaching based on the students' abilities.

5.1.2. Examples of blended learning model on enhancing students' motivation

Using gamification to enhance students' motivation, the teacher used "Demos". There was a function called "card matching" which could enhance students' interests (see figure 4). The platform corrected the answer automatically, so the teachers could save time of checking answers with the students. In another example, a teacher used "demos" to create a game for students to a drill exercises when he was teaching equation of straight line. The teacher created a scene on the coordinate plane (see figure 5). Students had to input the correct equation of straight line for the aeroplane to land safely, which enhanced students' participation in class.

The screenshot shows a student screen preview of a card matching activity. At the top, it says 'STUDENT SCREEN PREVIEW' and '1 of 6'. Below that is the task: 'Classify angles into 6 different types according to their sizes.' The interface includes a grid of cards. Some cards show angle diagrams, while others show numerical values. Labels identify the angle types: Reflex angle, Right angle, Round angle, Straight angle, Obtuse angle, and Acute angle. The numerical values shown are 102°, 260°, 125°, 180°, 45°, 300°, 90°, 360°, 97°, and 32°.

Figure. 4

The screenshot shows a student screen preview of a math activity titled 'Get ready for takeoff.' It says '4 of 7' at the top. The task is to 'Write the equation of a line that safely lands the plane.' A coordinate plane is shown with a grid. An airplane is positioned at the origin (0,0). A runway is drawn on the grid, starting from approximately (10, -2) and ending at (15, 0). The text 'Press "Submit" to see if the plane lands safely.' is displayed next to a 'Submit to Teacher' button. A 'Tip for Teachers' button is located at the bottom right.

Figure. 5

5.1.3. Examples of how teacher share the ideas and e-learning teaching materials

Sharing e-learning teaching materials and ideas were promoted in the scheme. The teacher in-charge of PDSS organized a joint-school sharing session to share the tips for prompting e-learning and how they use e-learning in their teaching practices. Teachers had a discussion to exchange ideas for technology

integration in the sharing session. Besides, he also created a website collection all the online materials prepared in the scheme and shared the website to all participating schools. It created a platform for teachers to share online teaching material which fit the local context.

5.2. Data analysis

A 4-point rating scale, ranging from 1 (strongly disagree) to 4 (strongly agree), was used to assess teacher's opinions in different domains. Descriptive statistics were used in this paper. Item-specific mean, domain-specific mean and overall mean were calculated.

Item-specific mean (ISM) - the mean of teachers ranging in each item of the questionnaire.

Domain-specific mean (DSM) - the mean of item-specific mean in each domain.

Overall mean (OM) - the mean of item-specific mean of all items in questionnaire.

Table 1. Survey means of the questionnaire

Domain	Item	Question	Survey Means		
			ISM	DSM	OM
TK	1	I have more confidence in solving technical problems in information technology	3.1	3.1	3.1
	2	I can learn information technology more easily	3.1		
	3	I can renew my knowledge on information technology	3.2		
TPK	4	I can use different information technologies in teaching	3.2	3.1	3.1
	5	I learn different information technologies, and enhances my teaching efficiency	3		
	6	I believe information technology has positive effects in class	3.1		
	7	I can make accurate judgment on how to use information technology effectively in class	3.1		
	8	I can use different information technologies in different teaching activities	3.1		
TCK	9	I can use information technology to let student understand mathematical theorem and calculations	3.1	3.1	3.1
TPCK	10	I can integrate mathematical knowledge, information technology and pedagogy in my teaching effectively	3	2.9	2.9
	11	I have more confidence in helping colleagues integrate mathematical knowledge, information technology and pedagogy in their teaching	2.7		

(Strongly disagree = 1 to Strongly agree = 4)

In general, no teacher strongly disagreed to any item in the questionnaire. Furthermore, the overall mean is 3.1 indicating that at least seven out of ten teachers agreed all items in TK, TPK and TCK domain of TPACK with DSM score 3.1, 3.1 and 3.1 respectively (see table 1). Therefore, we conclude that the Professional Development Scheme has positive impacts for the in-service teachers' TPACK, except the TPCK domain. Besides, the Scheme enabled in-service teachers to have positive impacts on their self-efficacy of e-learning in the learning community and integrated the technology into their teaching.

Concerning the TK, the DSM is 3.1. Further analysis of items in the domain revealed that eight out of ten teachers (mean = 3.1) agreed that the Scheme enabled teachers to have more confidence in solving technical problems in information technology. Nine out of ten teachers (mean = 3.1) agreed that the Scheme enabled teachers to learn information technology more easily. Nine out of ten teachers (mean = 3.2) agreed that they could renew their knowledge on information technology. Therefore, we concluded that there were positive impacts on the in-service teachers' TK as well as their self-efficacy of e-learning in the learning community and the integration of technology in the teaching in this domain.

Secondly, concerning the TPK, the DSM is 3.1. Further analysis of items in the domain revealed that

all teachers (mean = 3.2) agreed that the Scheme enabled teachers to use different information technologies in teaching. Besides, eight out of ten teachers (mean = 3) learnt different kinds of information technologies in the Scheme and (mean = 3.1) enhances their teaching efficiency. All teachers (mean = 3.1) agreed that the Scheme enabled teachers to make accurate judgment on how to use information technology effectively in class. Eight out of ten teachers (mean = 3.1) agreed that they could use different kinds of information technologies in different teaching activities. Therefore, we concluded that there were positive impacts on the in-service teachers' TPK as well as their self-efficacy of e-learning in the learning community and the integration of technology in the teaching in this domain

As for TCK, the DSM is 3.1, Further analysis of items in the domain revealed that all the teachers (mean = 3.1) agreed that the Scheme enabled them to use information technology to let students understand mathematical theorem and calculations. Therefore, we concluded that there were positive impacts on the in-service teachers' TCK as well as their self-efficacy of e-learning in the learning community and the integration of technology in the teaching in this domain.

Last but not least, concerning the TPCK, the DSM is 3.1. Further analysis of items in the domain revealed that nine out of ten teachers (mean = 3) agreed that the Scheme facilitated teachers to integrate mathematical knowledge, informational technology and pedagogy into their teaching effectively. However, only six out of ten teachers (mean = 2.7) agreed that they have confidence in helping their colleagues integrate mathematical knowledge, informational technology and pedagogy into their colleagues' teaching effectively. We concluded that the Scheme did not have significant impacts on the in-teachers' TPCK. However, it had positive impacts concerning their self-efficacy of e-learning in the learning community and the integration of technology in their teaching in this domain.

6. Limitation

As only 12 mathematics teachers in Hong Kong were involved in the Scheme, we cannot make any conclusion to represent Hong Kong's phenomenon. However, it can be used for educators as a reference that PD with learning communities approach is beneficial to in-service teachers who can integrate technology into their teaching practice.

7. Discussion

PDSS has positive impacts on the in-service teachers in TPCK domain. Based on the informal interview with participating, teachers who believe that technology integration can enhance students' motivation and achievement is due to the fact that students were more engaged in the lesson after inserting gamification activities and students got better multiple-choice question examination results. Despite the evident benefits of PDSS, the lack of time for preparing is a concern in implementing the scheme (Cohen & Hill, 2008). In addition, not all the materials fit into Hong Kong curriculum (Benson & Anderson, 2010). The PD Scheme was to save time for them to find or prepare the teaching materials because the teacher in-charge of PDSS created the materials with them and provided a platform for them to share their teaching materials that fit the local context among participant schools in the scheme. Nevertheless, half of the teacher participants of the Scheme did not have sufficient confidence in helping their colleagues in technology integration. It may be due to the different learning levels of the teachers concerned. The Scheme can merely help teachers to apply the knowledge (application level) but not yet to create or to help others (synthesis level). If researchers can find out what factors that are affecting the learning levels of teachers in the Scheme, it can be a big help to education authorities to promote technology integration more successfully.

Thomas R Guskey (2003) suggested that the essentials for the professional development are promoting active learning, observing and belting observed and coherence. Teachers were interested in hands-on work (promoting active learning) such as how to create online materials, how to use online materials. Teachers were active in observing the PD-in charge's lesson (observing and being observed). The Scheme helped teachers in their daily teaching (coherence). Therefore, most teachers felt that the Scheme was helpful. It is coherent with Thomas and Guskey's suggestion. Those factors are important for the PD.

One important factor for PD is collaboration among teachers (Hiebert et al., 2002). From my observation, teachers felt useful for the joint-school sharing sessions on the promotion of e-learning in the Scheme. They asked the teacher in-charge of PDSS to organise another one in Stage 2. Besides, teachers felt that

it is useful to share e-learning teaching materials on the website. In short, it is worth analysing the factors that help enhance the collaboration among teachers in PD.

In addition to the above stated discussion, the current study gives light to the need to explore the following questions. First, how many professional development schemes PDSS with a learning community approach can facilitate the integration of technology in the in-service teacher practice and their self-efficacy of TPACK? Second, what is the role of a professional development school (PDS)? To what extent should the school's support be important in technology integration?

8. Conclusion

In the future, it should play a bigger role in transforming education than just being integrated into each subject. Therefore, most countries' education authorities are trying to promote technology integration among high schools. If the promotion is successful, the training for in-service teachers is deemed important. However, most studies in TPACK were for pre-service teachers. Therefore, this paper acts as a reference for education authorities to promote technology integration. Furthermore, to enhance students' motivation, how to use blended learning platform for teaching and teachers' cooperation are important to be investigated their relationship with PD in the future. Obviously, there are some advantages and disadvantages in any schemes. PD is one of the effective methods to promote technology integration for in-service teachers.

References

- Aguilar, M., & Puga, D. (2015). Mobile Help Seeking In Mathematics. *Mobile Learning and Mathematics*, 176.
- Alonso, F., López, G., Manrique, D., & Viñes, J. M. (2005). An instructional model for web-based e-learning education with a blended learning process approach. *British Journal of Educational Technology*, 36(2), 217-235. doi:10.1111/j.1467-8535.2005.00454.x
- Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, 52(1), 154-168. doi:<https://doi.org/10.1016/j.compedu.2008.07.006>
- Baran, E., Canbazoglu Bilici, S., Albayrak Sari, A., & Tondeur, J. (2017). Investigating the impact of teacher education strategies on preservice teachers' TPACK. *British Journal of Educational Technology*, n/a-n/a. doi:10.1111/bjet.12565
- Benson, V., & Anderson, D. (2010). Towards a strategic approach to the introduction of blended learning: Challenges faced and lessons learned. *British Journal of Educational Technology*, 41(6).
- Bonk, C., & Graham, C. (2006). Blended learning systems: definition, current trends, and future direction. *Handbook of blended learning: Global perspectives, local designs*, 1-21.
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational researcher*, 33(8), 3-15.
- Borotis, S., & Poulymenakou, A. (2004). E-learning readiness components: Key issues to consider before adopting e-learning interventions. Paper presented at the E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education.
- Buyssse, V., Rous, B., & Winton, P. (2008). What Do We Mean by Professional Development in the Early Childhood Field? National Professional Development Center on Inclusion.
- Cohen, D. K., & Hill, H. C. (2008). *Learning policy: When state education reform works*: Yale University Press.
- Education, A. (2012). Bring your own device: A guide for schools. Edmonton, AB: Alberta Education.
- Elmore, R. F. (2004). School reform from the inside out: Policy, practice, and performance: ERIC.
- Fishman, B. J., & Pinkard, N. (2001). Bringing urban schools into the information age: Planning for technology vs. technology planning. *Journal of Educational Computing Research*, 25(1), 63-80.
- Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The internet and higher education*, 2(2-3), 87-105.
- Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*: John Wiley & Sons.
- Graham, C. R. (2006). Blended learning systems. *The handbook of blended learning*, 3-21.
- Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational researcher*, 15(5), 5-12.
- Guskey, T. R. (2002). Evaluating professional development. Thousand Oaks, CA: Corwin Press.
- Guskey, T. R. (2003). What makes professional development effective? *Phi delta kappan*, 84(10), 748-750.

- Hiebert, J., Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: What would it look like and how can we get one? *Educational researcher*, 31(5), 3-15.
- Jen, T.-H., Yeh, Y.-F., Hsu, Y.-S., Wu, H.-K., & Chen, K.-M. (2016). Science teachers' TPACK-Practical: Standard-setting using an evidence-based approach. *Computers & Education*, 95, 45-62.
- Jones, N. (2006). E-college Wales, a case study of blended learning. *The handbook of blended learning: Global perspectives, local designs*, 182-194.
- Koehler, M. J., & Mishra, P. (2005). What Happens When Teachers Design Educational Technology? The Development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research*, 32(2), 131-152. doi:10.2190/0ew7-01wb-bkhl-qdyv
- Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers & Education*, 49(3), 740-762.
- Leung, F. K. S. (2005). Some characteristics of East Asian mathematics classrooms based on data from the TIMSS 1999 video study. *Educational Studies in Mathematics*, 60(2), 199-215.
- Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. US Department of Education.
- Mills, R., Middleton, S., Moran, F., Murray-Smith, D., & Pack, A. (1974). Simulation in the teaching of concepts of respiratory gas exchange. *International Journal of Mathematical Educational in Science and Technology*, 5(3-4), 381-387.
- Mullis, I. V., Martin, M. O., Foy, P., & Arora, A. (2012). TIMSS 2011 international results in mathematics: ERIC.
- National Council of Teachers of Mathematics. (2000). Principle and Standards for school mathematics Reston, VA.
- National Council of Teachers of Mathematics. (2007). Mathematics teaching today: Improving practice, improving student learning (2nd ed.). Reston, VA: Author.
- Palloff, R. M., & Pratt, K. (1999). Building learning communities in cyberspace (Vol. 12): San Francisco: Jossey-Bass.
- Powell, A., & Patrick, S. (2006). An International Perspective of K-12 Online Learning: A Summary of the 2006 NACOL International E-Learning Survey. North American Council for Online Learning.
- Roberts, N., & Vänskä, R. (2011). Challenging assumptions: Mobile learning for mathematics project in South Africa. *Distance Education*, 32(2), 243-259.
- Rossett, A. (2002). The ASTD e-learning handbook: Best practices, strategies, and case studies for an emerging field: McGraw-Hill Trade.
- Shaunessy, E. (2005). Assessing and Addressing: Teachers' Attitudes toward Information Technology in the Gifted Classroom. *Gifted Child Today*, 28(3), 45-53.
- Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2). 4-14.
- Singh, H., & Reed, C. (2001). A white paper: Achieving success with blended learning. *Centra software*, 1, 1-11.
- Snoeyink, R., & Ertmer, P. A. (2001). Thrust into technology: How veteran teachers respond. *Journal of educational technology systems*, 30(1), 85-111.

So, T., & Swatman, P. M. (2006). e-Learning readiness of Hong Kong teachers. Paper presented at the Hong Kong IT in education conference.

The Economist. (2003). The 2003 E-Learning Readiness Rankings: A white Paper from the Economist Intelligence Unit 2003. Retrieved on Dec.19,2004 for <http://www.eiu.com>

Thorne, K. (2003). Blended learning: how to integrate online & traditional learning: Kogan Page Publishers.

Wang, Y., Frechtling, J., & Sanders, W. (1999). Exploring linkages between professional development and student learning: A pilot study. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal.

White, T., & Martin, L. (2014). Mathematics and mobile learning. *TechTrends*, 58(1), 64-70.

Young, J. R. (2002). 'Hybrid' teaching seeks to end the divide between traditional and online instruction. *Chronicle of Higher Education*, 48(28), A33-A33.

Exploring lesson study as a transformative learning approach for teacher educators' professional development in technology

Maurice Schols

Fontys University of Applied Sciences, The Netherlands

Conference subtheme: Professional Development of Teachers

Abstract

Over the past two decades, teacher educators and policymakers have expressed their concerns about traditional technology professionalization programs. Learning to cope with emerging technologies and new pedagogies requires adequate professional development opportunities that meet educators' learning needs. As a result, there is a growing wish to move away from traditional approaches of professional learning. This pilot study sought to explore the Japanese lesson study approach as a method of transformative learning that contributes to teacher educators' technology professionalization. Data sources included semi-structured group interviews, participants' reflective reports and field notes. An analysis of the data was based on an interpretive approach of organising, coding and categorising the data. Preliminary findings indicate that teacher educators consider lesson study to be an encouraging method to improve their teaching practice based on collaborative lesson planning, lesson observation and evaluation. This paper also offers a number of implications for practitioners and suggestions for further study.

Keywords

lesson study, transformative learning, teacher educators, technology professional development.

1. Introduction

In a rapidly changing society in which emerging technologies have a great impact, for most teacher educators, learning to cope with new technologies is a complex and sometimes daunting process. Moreover, the constant demand from ministries of education, management boards and students to innovate education is encouraging educators to examine the potential pedagogical benefits of integrating information and communication technologies in their teaching practice. For teacher educators to meet the learning needs and wishes of their students in a 21st-century learning context, educators must know how their students conceptually process content in order to determine what adequate and innovative pedagogical steps are meaningful for their teaching practice (Cochran, DeRuiter, & King, 1993; Donovan & Bransford, 2005; Mishra & Koehler, 2006).

Traditionally, technology professionalization programs for teacher educators focus on improving instrumental skills that are mostly based on a one-size-fits-all approach and that are too often provided in 'scattershot initiatives' (Martin et al., 2014, p. 328). However, empirical research (Darling-Hammond, 1997; Martin et al., 2014; Murray & Zoul, 2015) has shown that professionalization opportunities should be facilitated and provided over a long period of time in order to foster meaningful learning among teachers. Moreover, an increasing amount of research shows that effective professionalization programs are based on the notion of learning as continuing, social and connected to practice (Garet et al., 2001; Darling-Hammond et al., 2009; Schols, 2015). Yet, teacher educators experience many professional development initiatives as being disconnected from their teaching practice. Accordingly, traditional developmental strategies need to be reconceptualised in both content and provision.

Research on professional learning has shown that effective professionalization programs are best supported when they are embedded in communities of learning (Lave & Wenger, 1991; Hord, 1997; Wenger, 1998; Andrews & Lewis, 2002; Vescio, Ross, & Adams, 2008; Schols, 2011; Harris et al.,

*Corresponding author

Email address: m.schols@fontys.nl

2018). Such situated professional learning communities can support teacher educators to engage in collaboratively working with others on teaching practice-related problems. Moreover, in a rapidly changing contemporary workplace context, teacher educators are urged to use more technologies in their teaching practice to cater to students' learning needs and wishes. Learning new pedagogical concepts and critically investigating the potential pedagogical benefits of using emerging technologies in their teaching context is essential for educators to create an educational change that contributes to students' learning.

Investigating lesson study as a method to encourage transformative learning (Mezirow, 1991) might contribute to a better understanding of teacher educators' technology learning in the workplace. In light of this, there are two major bodies of literature that provide a foundation for the present study: 1) lesson study as a method for professionalization, and 2) transformative learning. Bridging both bodies of literature as well as the findings in this research provides a substantial base to explore whether teacher educators experience lesson study as a transformative learning approach for developmental growth. This in turn might help professionalization facilitators to design and implement more adequate professionalization strategies and opportunities.

2. Literature review

Teacher educators are increasingly encouraged to professionalize, and they are expected to be independent, self-directed learners who are able to maintain their expertise in their discipline. Moreover, it is assumed that they initiate and implement new technologies in their teaching practice in order to provide their students, who are tomorrow's teachers, with adequate knowledge and skills. As educators are willing to learn and prefer to have autonomy over their own learning process (Darling-Hammond & Lieberman, 2012; Schols, 2015), engaging in critical reflection on process, interaction with peers and revising assumptions concerning their teaching practice are essential ingredients for transformative professional development opportunities (Schön, 1983; Cranton, 1996; Collins & Halverson, 2009).

In the adult education literature, transformative learning has sparked increased interest among educators, researchers and theorists since Mezirow's publication *Transformative Dimensions of Adult Learning* in 1991. Mezirow (1991, 2003) states that transformative learning can be summarised as a process in which adult learners construct new knowledge through critically examining their own assumptions, beliefs and values with regard to their teaching practice. This process begins 'whenever assumptions or premises are found to be distorting, inauthentic, or otherwise invalid' (Mezirow, 1991, p. 6). Further, it often begins with a 'disorienting dilemma' (Mezirow, 1991, 2000; Taylor, 2000).

[This disorienting dilemma] begins when we encounter experiences, often in an emotionally charged situation, that fail to fit our expectations and consequently lack meaning for us, or we encounter an anomaly that cannot be given coherence either by learning within existing schemes or by learning new schemes. (Mezirow, 1991, p. 94)

As is made clear in the mission statement of the targeted teacher education institution, fostering innovation in teaching and learning involves teacher educators in a process of perspective transformation with regard to their own teaching practice in order to cater to the learning needs of tomorrow's teachers. However, for most faculty staff, developing a curriculum in which new technologies are integrated based on a 'future-proof' pedagogical concept is a daunting process because it challenges them to reflect on their existing learning and teaching perspectives. Nonetheless, the opportunity to engage with peers in a critical dialogue of reflecting on existing assumptions, ideas and beliefs with regard to practice is key to change (Cranton, 1996; Wilhite, DeCosmo, & Lawler, 1996). In order to discover what is required to contribute to educators' professionalization experiences that open up new ways of reconsidering their teaching practice in a 21st-century learning context, examining the process of lesson study as a method of transformative learning may provide valuable insight.

Lesson study (*jugyou kenkyuu*) is a team-based teacher professionalization model that has been used in Japan for more than a century (Takahashi & McDougal, 2016); it became popular worldwide after Stigler and Hielbert's (1999) seminal publication *The Teaching Gap*. In recent years, this inquiry model has gained more attention in the Dutch higher educational community as a strategy for enhancing teacher and teacher educators' professionalization trajectories (Verhoef & Tall, 2011; de Vries et al., 2016; Schipper, Goei, de Vries, & van Veen, 2018). In most cases, lesson study involves a group of 5-7 teachers

who meet regularly to work together on the planning, implementation and evaluation of a research lesson. Through lesson study, teacher educators construct, organise, share and refine their knowledge of the taught research lesson with the intention to improve and examine their students' achievement. Although there are many variations of lesson study as a model of teacher professionalization, the three stages of planning, implementing and evaluating remain at the core of most adapted models. In the context of this research, lesson study provides an ideal professionalization platform for teacher educators' technology learning.

3. Pilot project description

Over the years, technology professionalization programs at the targeted teacher education institution have provided teacher educators with workshops and retreats with regard to the use of emerging technologies in the classroom that were isolated from the teacher educators' practice. In order to explore whether a different method of professionalization might contribute to educators' developmental growth, lesson study was introduced to a group of five teacher educators as a transformative learning approach.

The pilot study was conducted during the autumn term and lasted for seven weeks, from September until the end of October 2016. In the study reported in this paper, five teacher educators volunteered from one main interdisciplinary team within the teacher education institution. During the induction phase, the five teacher educators were given a half-day training session about the purpose of the pilot study and lesson study based on Dudley's (2011, 2015) principles of lesson study (see Table 1).

Table 1. Stages and Activities of a Lesson Study Cycle (Adapted from Dudley, 2011, 2015)

Stage of lesson study cycle	Activities conducted during a specific stage
Stage 1: General meeting and planning of the research lesson	Educators determine what to improve and plan first research lesson together
Stage 2: Conducting the research lesson	One educator teaches the research lesson whilst the others observe the lesson and collect data
Stage 3: Evaluating the research lesson	Educators reflect on and evaluate the research lesson using collected data and evidence
Stage 4: Initial planning of the next lesson	Educators set up an initial plan for the next research lesson

Due to the limited scope of the pilot study and the explorative purpose of the research to examine whether participants experience lesson study as a transformative learning approach for technology professionalization, the pilot study comprised only one lesson study cycle, as discussed by Dudley (2011, 2015). During Stage 1, participants met to discuss on which group of student teachers the lesson study would be conducted and what issues were involved concerning the use of new technologies to cater to the learning needs and wishes of the students. During Stage 2, one teacher educator taught the research lesson whilst the others observed the lesson. As indicated by Dudley (2011), 'the focus of the observers [was] less on the teacher and more on the learners' (p. 9). Following the research lesson, during Stage 3, the five teacher educators met and reflected on the research lesson, in which new technologies were used to provide students with different learning opportunities. The teacher educator who taught the lesson spoke first and evaluated what went well during the research lesson and what difficulties he or she encountered. The other group members exchanged their observation notes, which focused on what the student teachers experienced as meaningful learning. Discussion questions were used during this session. For example, 'Did the use of emerging technologies enhance students' teachers learning?' 'What aspects of the research lesson did not contribute to students' learning?' During Stage 4, the teacher educators met to discuss initial plans with regard to a second research lesson based on the outcomes of the first lesson study cycle.

4. Aim of the study and research question

The pilot study presented in this paper is part of a larger research project that is being carried out at a Dutch teacher education institution. The subject area of the research is, as the title suggests, teacher educators' technology professional development. The approach to technology learning that it promotes is situated against the background of a diverse teacher educator population and underpinned by a

commitment to fostering teacher educators' developmental growth in terms of learning to cope with emerging technologies and integrating new technologies in educational contexts.

The general aim of this pilot research was to explore whether the use of a lesson study approach as a method of transformative learning contributes to teacher educators' technology professionalization. Understanding the affordances of lesson study may also contribute to developing adequate technology professionalization programs for teacher educators, which might cater to student teachers' learning. As such, the following research question guided the study: Do teacher educators perceive lesson study as a transformative learning approach that contributes to their technology professionalization?

5. Methodology

Based on the investigative nature of the research question and the researchers' intent to gain a more profound understanding of lesson study as a transformative learning approach for teacher educators' professional development in technology, a qualitative design (Creswell, 1994) was selected because it was considered to be the most appropriate research approach.

5.1. Participants

Five teacher educators from three main interdisciplinary teams voluntarily participated in the study. Of this group of five educators, one participant was between the ages of 25-29, two participants were between the ages of 30-39 and two educators were between 40-49 years old. All five were full-time teacher educators, and two educators were additionally involved in research activities. With respect to age, teaching and research activities, the demographics are representative of the ages and academic functions of the interdisciplinary team of teacher educators from the targeted teacher education institution.

5.2. Data collection

The research participants were interviewed during the pilot study in three semi-structured group interviews that were then transcribed verbatim. One semi-structured interview took place during the induction phase of the pilot study, the second semi-structured interview took place after four weeks during the lesson study cycle and the third semi-structured interview was conducted two days after the lesson study cycle ended. The interview guide consisted of questions focusing on aspects concerning the use of lesson study as a method of learning as well as general questions on transformative aspects relating to teacher educators' teaching views, ideas and practice. The group interviews were semi-structured to allow participants to freely express their experiences with lesson study. Moreover, the five teacher educators were asked to write down their experiences with lesson study in self-reflective reports on a weekly basis. The advantage of using reflective reports is that they provide information about the educators' views and ideas with regard to the use of lesson study in the context of this research in a personal way (Schols, 2015). Additionally, field notes were taken in order to provide further information about research participants' technology professionalization issues during data coding and categorisation (Schols, 2015).

5.3. Data analysis

The transcripts from the semi-structured group interviews, statements from the self-reflective reports and field notes were coded using ATLAS.ti 7.5.6 software in order to analyse the qualitative data. The data were independently analysed by two different coders. Inter-rater agreement of 89% was reached among the two coders with regard to identical fragments from the semi-structured group interviews, reflective reports and field notes. Based on a content analysis approach (Flick, 2009, pp. 325-326), five main codes emerged from the data, resulting in two main categories (see Figure 1).

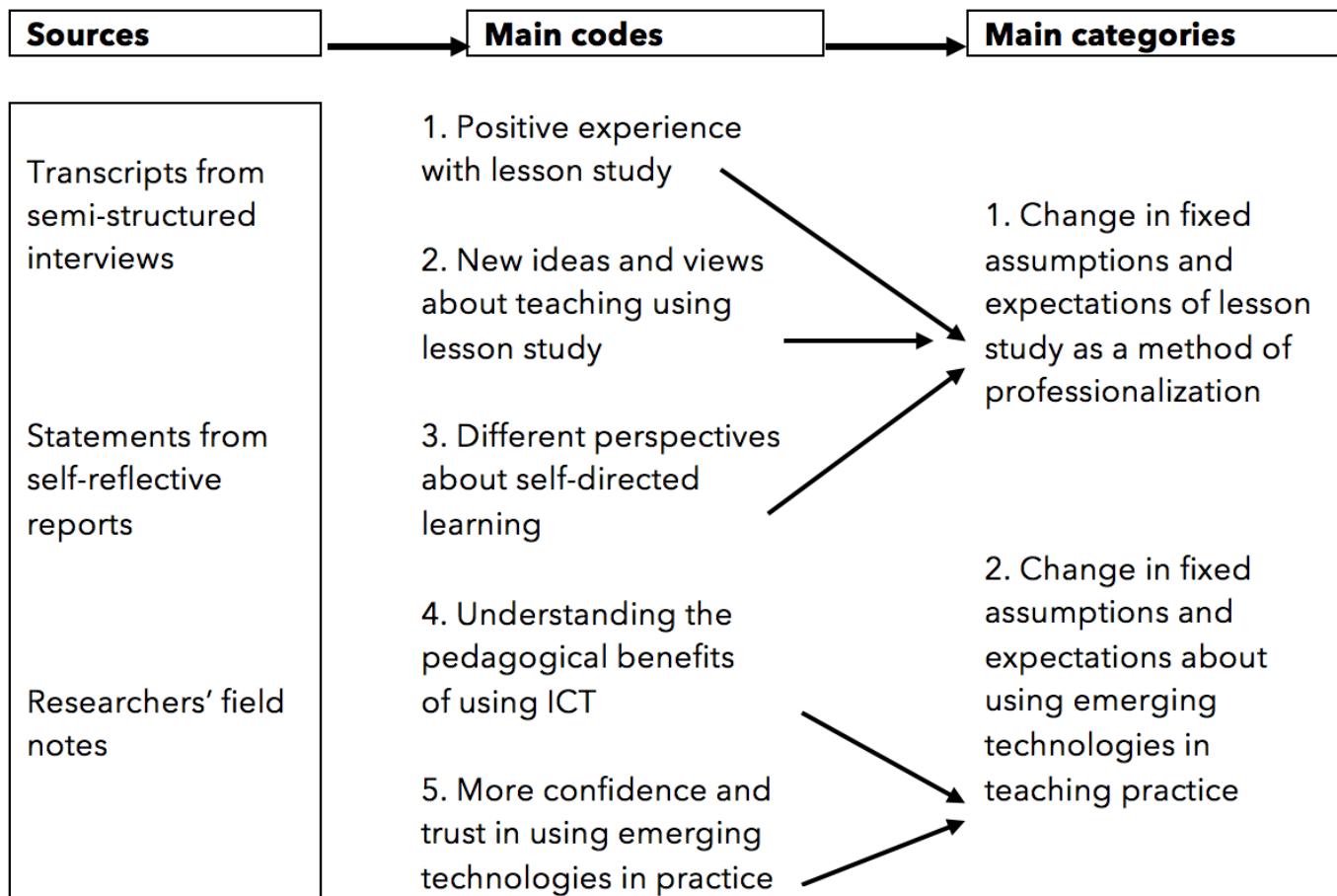


Figure 1. Overview of the content analysis process for the data pilot project.

6. Results

Analysis of the data from the semi-structured group interviews and the reflective reports revealed findings with regard to a change in research participants' assumptions and expectations of lesson study as a method for technology professionalization. Three out of the five teacher educators showed clear indications of change in their points of view concerning the use of lesson study as a method for technology professional development. The two other participants showed suggestive indications of change in points of view of using lesson study as an approach for professional growth. The findings of the pilot study will be discussed through the following two main categories that emerged from coding the data and that seemed congruent with the literature review:

1. Change in fixed assumptions and expectations of lesson study as a method of professionalization
2. Change in fixed assumptions and expectations with regard to using emerging technologies in teaching practice

6.1. Change in fixed assumptions and expectations of lesson study as a method of professionalization

During the inception phase of the pilot study, three out of the five participants indicated that they had doubts about using lesson study as a method for technology professional development. During the pre-semi-structured group interview, they explained that working in small groups with peers and critically reflecting on their teaching process could be a daunting experience. One teacher educator wrote in his or her reflective report, 'The idea of being critically observed by other colleagues . . . mostly more experienced . . . makes me feel uneasy . . . it feels as if I am stepping out of my comfort zone'. However, during the final semi-structured group interview, the same teacher educator indicated that lesson study as an approach of professionalization contributed to a change in his or her perspective:

At the beginning of this process, I really had some doubts [about] whether this would work for me or not. But now I realize that this method has helped me to critically reflect on my own teaching. To be honest, this is the first professionalization opportunity that worked for me. Working together with colleagues who are more experienced and more familiar with lesson study was . . . for me . . . very helpful. (Teacher educator INC)

Another teacher educator emphasised the positive effects of using lesson study in a learning community with peers as a method of professionalization. The following statement is from his or her reflective report:

Hmmm . . . I was not sure whether lesson study would work . . . and working together with other colleagues, I can only say that I have changed my mind a bit about professionalization programs. I really like this [lesson study] . . . as it helps me to analyse my own teaching together with other teachers and to see what I can use . . . or improve. (Teacher educator TLC)

A quote from another participant revealed that working together with other colleagues based on a lesson study approach enhanced his or her self-confidence while progressing through the seven-week cycle:

I really had the feeling that during this project . . . working together helped me to become more familiar with this professionalization method. Although I found it difficult to participate . . . in the beginning . . . since I did not know anything about lesson study, I felt more and more at ease and developed a sense of being in control of my own learning. (Teacher educator KBT)

Next to participants' accounts of a change in their fixed assumptions and expectations of professionalization opportunities, the following section presents transformative experiences of using ICT while participating in a lesson study community.

6.2. Change in fixed assumptions and expectations with regard to using emerging technologies in teaching practice

The semi-structured group interviews, participants' reflective report entries, the researchers' field notes and the analysis of the data revealed that teacher educators experienced a perspective change during the lesson study cycle with regard to their initial assumptions and ideas of using emerging technologies in their classroom. Several educators revealed that their initial 'fear' of using new technologies in practice was based on experiences such as not receiving adequate technology support or using poor technology. Another example they indicated as a barrier in using technologies for teaching and learning was that teacher educators did not have enough time to experiment with educational applications or discuss their experiences with other colleagues. However, several participants indicated that the use of lesson study contributed to the acquisition of new technology knowledge and skills that could be useful in their teaching practice. The following quote illustrates this experience:

During the lesson study cycle, we used an online platform to collaborate with students and colleagues. First, I thought this will not work, but as I talked about my ideas and views with other group members I gradually discovered that using the tool was easier than I thought it would be. Working together in a small group of colleagues really helped me to get more familiar with the tool and to critically examine in what way ICT can help my students and me to create a more interactive experience. (Teacher educator ADB)

At the same time that participants experienced and recognised that lesson study enabled them to experiment with new technologies, other educators stated how their ideas about their roles in teaching student teachers gradually changed while investigating the pedagogical potentials of new technologies in their classroom:

My view about how and what I need to teach has expanded during the lesson study project. Although I am still hesitant in using ICT in my lectures, I have experienced that students use new devices and applications on a daily basis . . . one cannot ignore this fact and should really examine how to incorporate devices and applications in the classroom . . . and . . . I do think . . . this should be done together with other colleagues . . . So, in what way one could and should use these new technologies in teaching and learning. (Teacher educator VAS)

The following section includes a brief discussion about the analysis of the data as presented in the previous two subsections. Additionally, a few suggestions for further research are discussed.

7. Discussion and conclusion

Do teacher educators perceive lesson study as a transformative learning approach that contributes to technology professionalization? Based on the theoretical review and analysis of the data in this pilot study, the preliminary findings suggest that lesson study's contribution to teacher educators' professional growth is twofold.

First, during the inception phase of the pilot study, the teacher educators stated that they had some doubts as to whether lesson study could be a useful method for professionalization. This possible misalignment of expectations was based on experiences with traditional professionalization opportunities such as workshops, off-campus training programs and instructional sessions. The fact that some educators had negative experiences with traditional professionalization programs created a general feeling of hesitation and an uneasiness to begin working in small groups with peers. However, two educators who were more familiar with lesson study as a positive method of professionalization were able to encourage the novice participants to take part in the study. During the seven weeks of collaboration, analysis of the collected data from the semi-structured interviews, self-reflective reports and field notes revealed that initial expectations changed gradually as the novice participants progressed through the pilot study. This process of reframing expectations became most apparent in the teacher educators' personal reflective reports. The data showed that collaborating with expert peers in a lesson study cycle contributed to a change in perspective with regard to the use of lesson study as a method of professionalization. An implication for practice could therefore be that lesson study groups should consist of several expert participants who can share their experiences with lesson study in order to support novice participants. This is in line with Lave and Wenger (1991) and Wenger (1998), who state that more experienced members of the group may help less experienced members based on 'a process of modelling, coaching and fading' (Squire & Johnson, 2000, p. 25).

Second, another area of change perspective revealed from the analysis of the data was teacher educators' use of new technologies in their teaching practice while progressing through the pilot study. Although the data showed mainly suggestive indications of change, participants' accounts indicated that using lesson study contributed to being more receptive to critically examining the potential pedagogical benefits of incorporating ICT in their teaching and in their students' learning processes. Exploring what works for their students and themselves together with other colleagues helped the participants to gain more confidence in using emerging technologies. Collaborating in a lesson study community enabled the research participants to verbalise their own dilemmas, ideas and views with regard to their use of ICT in practice.

In conclusion, the findings in this explorative study confirm the researchers' view that lesson study as a transformative learning approach facilitates teacher educators to critically examine their teaching practice together with a small group of peers. Although the researchers recognise that the findings suggest the need for further research with regard to educators' use of lesson study as a transformative learning approach that contributes to professional growth, the study provides insight into lesson study that could function as a platform for building a professional learning community.

References

- Andrews, D., & Lewis, M. (2002). The experience of a professional community: Teachers developing a new image of themselves and their workplace. *Educational Research*, 44(3), 237-254.
- Cochran, K. F., DeRuiter, J. A., & King, R. A. (1993). Pedagogical content knowing: An integrative model for teacher preparation. *Journal of Teacher Education*, 44, 263-272.
- Collins, A., & Halverson, R. (2009). Rethinking education in the age of technology: The digital revolution and schooling in America. New York: Teachers College Press.
- Cranton, P. (1996). Professional development as perspective transformation. San Francisco: Jossey-Bass, 1996.
- Creswell, J. (1994). Research design: Qualitative and quantitative approaches. Thousand Oaks, CA: Sage.
- Darling-Hammond, L. (1997). Doing What Matters Most: Investing in Quality Teaching. New York: The National Commission on Teaching and America's Future.
- Darling-Hammond, L., Chung Wei, R., Andree, A., Richardson, N., & Orphanos, S. (2009). A status report on teacher development in the United States and abroad. Stanford: National Staff Development Council and the School Redesign Network at Stanford University.
- Darling-Hammond, L., & Lieberman, A. (Eds.). (2012). Teacher education around the world: Changing policies and practices. New York, NY: Routledge.
- de Vries, S., Verhoef, N., & Goei, S. (2016). Lesson study: Een praktische gids voor het onderwijs. Antwerpen-Apeldoorn: Garant.
- Donovan, M., & Bransford, J. (2005). How students learn: Science in the classroom. Committee on How People Learn: A Targeted Report for Teachers. National Research Council. Washington, DC: The National Academies Press.
- Dudley, P. (2011). Lesson study: A handbook. Retrieved from lessonstudy.co.uk. (accessed 15 March 2018)
- Dudley, P. (2015). Lesson study: Professional learning for our time. London: Routledge.
- Flick, U. (2009). An introduction to qualitative research (4th ed). Thousand Oaks, CA: Sage.
- Garet, M., Porter, A., Desimone, L., Birman, B., & Yoon, K. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, 38, 915-945.
- Harris, A., Jones, M., & Huffman, J. (2018). Teachers leading educational reform: The power of professional learning communities. New York: Routledge.
- Hord, S. (1997). Professional learning communities: Communities of continuous inquiry and improvement. Austin, TX: Southwest Educational Development Laboratory.
- Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press.
- Martin, L., Kragler, S., Quattroche, D., & Bauserman, K. (2014). Handbook of professional development in education: Successful models and practices, PreK-12. The Guildford Press: New York.
- Mezirow, J. (1991). Transformative dimensions of adult learning. San Francisco: Jossey-Bass.

- Mezirow, J. (2000). Learning as transformation. San Francisco: Jossey-Bass.
- Mezirow, J. (2003). Transformative learning as discourse. *Journal of Transformative Education*, 1(1), 58-63.
- Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.
- Murray, T., & Zoul, J. (2015). Leading professional learning: Tools to connect and empower teachers. Corwin Press.
- Schipper, T., Goei, S., de Vries, S., & van Veen, K. (2018). Developing teachers' self-efficacy and adaptive teaching behaviour through lesson study. *International Journal of Educational Research*, 88, 109-120.
- Schols, M. (2011). Communities of practice: Pedagogy and internet-based technologies to support educators' continuing technology professional development in higher education. Proceedings of the International Conference of Education, Research and Innovation (pp. 5276-5285). Madrid, Spain, 14-16 November: IATED.
- Schols, M. (2015). Continuing technology professional development: A technology learning preferences instrument to support teacher educators' workplace learning (Doctoral dissertation). Roehampton University, London. Retrieved from Roehampton Research Explorer. (ID: 420516)
- Stigler, J., & Hiebert, J. (1999). The teaching gap: Best ideas from the world's teachers for improving education in the classroom. New York: The Free Press.
- Squire, K., & Johnson, B. (2000). Supporting distributed communities of practice with interactive television. *Educational Technology, Research and Development*, 48(1), 23-43.
- Takahashi, A., & McDougal, T. (2016). Collaborative lesson research. *ZDM Mathematics Education*, 48(4), 513-526.
- Taylor, E. (2000). Analyzing research on transformative learning theory. In J. Mezirow & Associates (Eds.), *Learning as transformation* (pp. 285-328). San Francisco, CA: Jossey-Bass.
- Verhoef, N. C., & Tall, D. O. (2011). Teacher's professional development through lesson study: Effects on mathematical knowledge for teaching. Proceedings of the 35th Conference of the International Group for the Psychology of Mathematics Education, Vol. 4 (pp. 297-304). Ankara, Turkey.
- Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education*, 24(1), 80-91.
- Wenger, E. (1998). Communities of practice: Learning, meaning, and identity. Cambridge, England: Cambridge University Press.
- Wilhite, S., DeCosmo, A., & Lawler, P. (1996). Faculty as adult learners: Implications for faculty development initiatives. Proceedings of The Eastern Adult, Continuing and Distance Education Research Conference. Pennsylvania State University, University Park, PA, October (CD-ROM).

MEANING-ORIENTED teaching for French Foreign Language in secondary schools in Flanders: the relation between meaning oriented teaching, the programmes (curricula) in teacher training and the professional profile for teachers in Flanders

Valeria Catalano
Hogeschool PXL, Belgium

Conference subtheme: Professional Development of Teachers

Abstract:

This pilot research has focused on the relation between meaning - oriented teaching in classroom practice, the curriculum and the professional profile for teacher training in Flanders. The case was specifically analysed for French Foreign Language as a subject in secondary schools. Since, too often, there is a lack of focus on participation and involvement in classroom practice as well as deep learning of pupils we moved to redefine MOT. This new definition led to the development of an observation tool which was tried out with 38 students during a two year teaching practice period in order to find the relation between complex skills, the teacher training programme and the particular professional profile for teachers in Flanders, Belgium. Therefore, 7 experts in education, responsible staff members and 14 students were extensively interviewed. Furthermore, the observation tool was presented to two focus groups of secondary school teachers, 40 teachers were questioned and 38 students (104 lessons) observed. The level of processing learning contents and learning materials was determined with a group of 26 students. Conclusively 10 teacher-training programmes for French Foreign Language in Flanders were compared. The data gathered in the pilot study suggests a consensus on curriculum development for teacher training is mandatory, in which the focus should be on meaning oriented learning contents and learning materials, training of higher levels of processing, intensive coaching of MOT within the programme of teacher training.

Keywords: meaning-oriented teaching, teacher-training programme.

1. Introduction

French Foreign Language (FFL) as a school subject is often seen as a problem in that sense that participation, motivation and results are an issue in secondary schools (in Flanders). Observations of classroom practice in a period over more than 20 years (1000 observations), contact with teachers in service, the intake group in teacher training departments, surveys organised by the authorities, education programmes organised especially for teachers, indicate the reasons for this situation are complex. The case of FFL is not an isolated one. Research in classroom practice and education in general inform us there is a problem what involvement and participation of learners in many school subjects is concerned.

The first overall question for this study is: "How can we create more involvement and participation of

*Corresponding author
Email address: valeria.catalano@pxl.be

learners, more specifically for French Foreign Language in secondary schools in Flanders?". In this study we chose to focus on the teaching practice in the classroom.

Are teachers constructing meaning? Do they give meaning to the learning materials, the goals of their teaching practice? Do they make this visible for learners? We reformulate the research question:

- What is meaning-oriented teaching? (MOT)
- How can we observe this skill?
- Is there a relation between MOT within the pre-service teaching practice, the programme (curriculum) of teacher training and the professional profile for teachers in Flanders?

2. Methodology

To answer the research questions we applied a mix approach of methods.

We interviewed 7 staff members and experts in education and asked questions based on our study of official documents. We were interested in the way they interpreted the professional profile for teachers. We organised an experiment with 31 students in a period of 2 years: we tried to have an insight in the levels of processing learning materials by these future teachers. The idea was to analyse whether or not there is a relation with the level of MOT within classroom practice. Do teacher-training programmes provide enough input of referential framework in general and training in higher levels of processing learning materials in particular?

We redefined the concept "MOT" and translated that definition into an observation tool for classroom practice. The tool was presented to two focus groups of teachers.

We observed more than 100 lessons taught by 26 future teachers and interviewed 7 of them (those with a master degree), organised a focus group with 9 others (professional bachelor degree). Conclusively we compared 10 teacher-training programmes of 10 College Universities in Flanders.

3. Literature review

3.1 Meaning: structuralism and sign

In order to learn more about "MOT", we decided to concentrate first on the concept of meaning. What is "meaning"? Since structuralism and more particularly post-structuralism and semiotics give us a way to conceptualise our study object, we based our understanding of meaning on the structural linguistics of Ferdinand de Saussure (2005) and of his disciples who founded the different schools of linguistics. Consequently, we focused on the distinction between Langue and Parole and on the two faces of the *Sign*, being the *Signified* (le signifié) and the *Signifier* (le signifiant). In Saussurean analysis the distinction between *Signifier* and *Signified* is crucial. The *Signifier* is the image used to stand for something else, while the *Signified* is what it stands for.

Roland Barthes is one of the leading theorists of semiotics, the study of signs. As all signs depend on the entire system of signs, none of them have meaning aside from the system. He defines "meaning" as the process that connects the mental concept (le *Signifié*) and the physical realisation of that mental concept (le *Signifiant*). The product of that connection is the sign¹. (Barthes, 1964).

In structuralism and post-structuralism "meaning" of non-linguistic realities is analysed in the same way as in language. The language system being the fundamental tool of "meaning" we understand its importance within the educational context. The teacher has the difficult job to "transform" the learning material into a "language" that pupils can understand. He will, to do so, use language and the signs within the language (text), but also the signs outside the verbal language (mimes, gestures, images, sounds, etc.) and more complex signs as music, film, architecture, events etc.

Didactics in foreign language acquisition can use the insights we derive from semiotics. It is in fact interesting to ask ourselves how we can translate the knowledge we acquire in this field into didactic approaches (Fontanille, 2015; Thür, 2009; Yakhbabjelmalek, 2008).

We understand, in the first place, that "meaning" is inextricably related to "communication" (Eco, 1988). The communication between the teacher and his public is realised through all the signs we mentioned.

¹La signification peut être conçue comme un procès; c'est l'acte qui unit le signifiant et le signifié, acte dont le produit est le signe» (Barthes, 1964)

Focussing on meaning in the teaching practice is giving specific importance to discourse, documents (text, images, audio, film, ...) and non-verbal communication. What do we say and how do we say it? What documents do we use and how do we use them? How do we look, move, change our mimics, make gestures in the classroom?

For the foreign language teacher all of this takes a particular importance in the sense that the signs of the language are simultaneously the learning material. Giving meaning to a sound is visualising the sound, making associations, connotations etc. (Eco, 1988). If the teacher wants to involve his students he will have to give a meaning to all the signs he uses or wants to teach. If he doesn't, students will not know what they are learning nor will they be inspired.

The last decades the teaching of foreign language is situated in a communicative and task-oriented approach (Bourguignon, 2006; CEFR, 2001; Puren, 2009). The idea of these approaches is precisely to create more contexts and give meaning to the purely formal dimension of language (*la Langue*). In semiotics we would say it is visualising the connection between the Signifier and the Signified. It is and was a reaction to what was applied in education before the communicative approach: while during the sixties the behaviouristic approach was meant to fix oral productions, out of any context (focus on *la Langue*), the traditional method of the beginning of the 20th century and the end of the 19th century focused on traditional literary analyse, grammar and spelling (*la Langue*). The gap with the real use of language (*la Parole*) was very large. Academic content and grammatical and lexical accuracy in written productions were key. Foreign language teaching and learning was transformed from a purely analytical approach of written language into a purely formal approach of oral language into an approach that aimed a communicative and participative dimension. We can say that this last evolution moved the teaching and learning of the foreign language from *la Langue* to *la Parole*.

3.2 Meaning-oriented learning

In his article, *Diepte - en Oppervlak leren*, Kaldewey (2006) opposes a reproductive learning style to a more "meaning - oriented" learning style. The two concepts were introduced in the Netherlands by J. Vermunt (Kaldewey, 2004; Stijnen, 2013) but were picked-up in other countries. We are interested by the fact that "meaning - oriented" is used to talk about learning styles. Even if we do all agree that this learning style is to prefer, Kaldewey is not convinced by its superiority. Research with Chinese students reveals that memorizing study information can happen with or without "meaning" (Kaldewey, 2006). Here the term "meaning" is used to talk about insight and understanding.

The concept of "learning-styles" was a study object in the eighties. Kolb and Vermunt (Kaldewey 2004, Stijnen 2013) were predominant in this study field. Today's research however teaches us there is no validation of the concept (Dembo & Howard, 2007; Kirschner, 2017). We will, therefore, not talk about learning styles in this project but about learning attitude and learning profile. More than relating "meaning" to a learning result, we will link it to involvement, participation and inspiration. The role of the teacher becomes major consequently.

As we said before, the task - oriented approach was implemented to stimulate participation, involvement and to give more "meaning" to education (Bourguignon, 2006). It is important to connect this meaning to the task students have to execute. Therefore, it is paramount to take into consideration the interest of the students (Hustinx et al., 2017). The teacher can present choices, pick in the existing interests of students or, better, enlarge those interests by inspiring them. The MOOC (Hustinx et al., 2017) taught us that documents can play a decisive role in this. The Internet gives the teacher a considerable amount of data and choices to make. To make a good and fast selection the teacher needs to have a large referential (cultural, social, anthropological, historical) framework. Furthermore, he needs to take into consideration the "learning profiles/ attitudes" of his students. If he is not interested himself in the subject or the documents he can use to enrich and support the MOT he wants to apply, he will not succeed.

Philippe Meirieu (2017) puts it differently. He insists on the fact that talking about "interest" is not the discourse we should have when we want to involve students during classroom practice. The child and the adolescent are not naturally "curious". Meirieu pretends we mix two concepts here: the will to know and the will to learn. Children and adolescents prefer knowing to learning. Therefore, it is difficult to talk about interest. Meirieu proposes to think and organise this differently: let's not talk about motivation from the start of the learning process, let's try to create conditions that stimulate the will to know and

to learn, to acquire knowledge that can help to experience success in school life, in professional life and in social life. More than motivate the student at the beginning of the learning process, it is better to "mobilise" him.

What the profile of the student is concerned literature teaches us that differentiation in work format, instruction and feedback (Struyven K. et al., 2015) is essential. In this project we will try to stimulate the meaning-oriented aspect of these work formats, instructions and feedback. If the student doesn't see the meaning of what he is learning the teacher will fail. The task of the teacher is, consequently, to make this visible. It is not by differentiating that he will succeed. It is by giving a meaning to this differentiation that he will. This is what we mean by the distinction between apply procedures and teaching in a meaning-oriented way.

In conclusion to this chapter on meaning-oriented learning we want to refer to the text of Kris Van den Branden (2015)² : "If students can give a personal meaning to what they learn or have to learn, if they believe that the new knowledge can make a positive difference in their lives, if they expect that participation to the learning process can make a difference, if they can identify with the goals education is formulating, they will put more energy in the learning activity."

3.3 Meaning-oriented teaching

In literature there is a large consensus about "transforming" learning materials (Freed, 2009; Van Den Branden, 2015) or about what they call the "meaning-making classroom" (Ancess, 2004; Molina, 2010). The "task-oriented" approach (Bourguignon, 2006; CERF, 2001; Pure, 2006) focuses on mobilising the student and making him a co-actor of a (social) construction. All those theories illustrate thought on a way to involve and mobilise more students in classrooms.

It is nevertheless remarkable to see that within literature on this issue, there is a blind spot concerning the relationship between learning content and the practice of the teacher (Schneuwly, 2000). Many studies are concentrating on classroom practice, but are creating abstraction of the learning contents instantaneous. One could conclude these contents are secondary, that they have no influence on interaction. Missing in literature on classroom practice are the reflection and analyse of the effects of learning contents on the practice of the teacher (Robichaud, Tardif & Perlaza, 2014). What tools does he use and which tools are specific for which content?

In his article, «*Les outils de l'enseignant. Un essai didactique.* » (Schneuwly, 2000), the author focuses on the tools of the teacher. He refers to the very large study of Tardif & Laserre (Schneuwly, 2000, p.20)³ who stipulate the "work" of the teacher is on one side codified by the organisation of the school (school-culture, class groups, goals, time sheets, work forms), on the other side quite "vague". The interactions of the teacher and his transforming activities are at the centre of what we call "meaning-oriented teaching." The authors insist on the fact that there is not much research in this field. Very few researchers are studying the relationship between curriculum (programmes), learning content and the practice of the teacher. Schneuwly focuses on the specifics of the tools the teacher uses and bases his reflections on the theory of Vygotsky (Schneuwly, 2000, p.21) who insists on the artificial guiding by "tools" of the natural developmental processes of children and adolescents. Those tools are psychological instruments the teacher uses to transform the learning content in function of the learning profile of the child/adolescent and the goals that were predetermined. The "Sign", as defined previously, being part of the semiotic system, is that psychological instrument. Which signs do the teacher use? How is he constructing "meaning" in the classroom practice? The learning materials as well as the guiding modalities (the discourse) meant to focus the attention related to the specific learning contents are, in fact, not doing this in contemporary educational practice.

If we want to find out about MOT we will have to observe which tools are needed for a specific school subject (French Foreign Language in this case). For this project, this meant we had to do very focused

² "Als leerlingen persoonlijke betekenis en zin kunnen geven aan wat ze moeten leren of doen, als ze geloven dat het nieuwe een positief verschil in hun leven kan maken, als ze verwachten dat het leren of participeren er op een of andere manier toe doet, als ze de doelen van het onderwijs tot hun doelen kunnen maken, dan zullen ze geneigd zijn om meer energie te investeren in de activiteit."(Van den Branden, K. 2015)

³"Assez étrangement, peu d'études ont été consacrées à la question du rapport entre les curriculums, les matières enseignées et la tâche de l'enseignant." (Schneuwly, 2000, P.20)

observations of specific and successful tools used and applied by the teacher in the classroom practice. Béatrice Fracchiolla's (2005) research is also very consistent with the main idea of this project. In « *Tabou et temporalité: la dimension interculturelle du temps* » she describes in a very sharp way contemporary education. She emphasises on the cultural diversity teachers have to deal with in classroom practice today. The teacher has to react to all the different cultural identities and profiles of the students and adapt the tools he uses to the varied public he is working with. She insists and talks about learning contents and documents that vanished in today's school context. She especially focuses on the absence of literary reading in contemporary secondary education. Literature is banned from many school programmes because of the strange taboo that lies on literary texts. Is the teacher using the correct tools to make literature accessible? Can literature offer a response to the very diverse identities of today's school public?

We based our new definition of "meaning-oriented teaching" on the insights we gathered in our literary review. This definition was "translated" into an observation document we used to do our observations of classroom practice

4. Results

4.1 Interviews

We interviewed 7 experts and responsible staff members of teacher training departments. Every one of them is in a very specific way involved in the organisation, the execution and the evaluation of the programmes.

We did half structured interviews of 90 minutes with these 7 experts and responsible staff members and asked them questions based on the lecture of two official governmental documents: the professional profile for teachers in Flanders and a government evaluation of the teacher training programmes in Flanders (Aelterman et al., 2008 ; Beleidsevaluatie, 2013).

The different parts of the interview were a brief introduction in which they presented their function, their perception on and evaluation of the current teacher-training programme. We then asked questions and presented affirmations they had to comment on. Those questions and affirmations were directly related to the two official documents we read. They were meant to find out about their reactions on the critical observations a research group formulated what the teacher-training programme is concerned, and more specifically the lack of expertise of teachers in school subjects. In the second document a research group was mandated by the Flemish government to evaluate the impact of the reform of teacher training programmes (2007) on the actual programmes. Conclusively we asked them how they evaluated the problems that teacher trainers of specific school subjects communicate to the responsible staff members.

We asked them what they knew about the specific situation of FFL in Flanders. Finally we tried to find out from which background they observed those problems and made their evaluations.

4.1.1. Background

In 2006 a new official document was elaborated and ratified in 2007 by the Flemish parliament: the one and only professional profile for teachers in Flanders. This professional profile focuses on 10 functions the teacher has to accomplish. No distinction or specification is made for teachers in nursery school, in primary school or in secondary school. No specification for the school subject either.

The teacher is a facilitator and his job consists of the execution of the following functions: he is a guide of developmental processes, an educator, an expert of the school subject, an organiser, an innovator and researcher, a partner of parents and tutors, a member of a team, a partner of external stakeholders, a member of a school community, a cultural participant. It is important to observe that only "generic" skills can be aimed in the programme.

We focus on the part that explains the dimensions of the specific knowledge and skills in the school subject and learn that there is no education without content. Teaching methods without content are "meaningless". The teacher has to facilitate the access to culture. This means that teachers need to have well-developed cultural framework and language skills.

This paragraph was the fundamental idea of this research project. We focused on content and on cultural framework within the teacher-training programme. We do, on the other hand, insist on the minimal conditions teacher-training programmes organise for such a solid cultural framework and the training of

advanced language skills.

In the official report of 2013 of the Commission for governmental evaluation of the teacher-training departments (Beleidsevaluatie), the researchers and authors of this report focused on one main question: did the teacher-training reform of 2006 have an influence on the actual programmes of the teacher-training departments in Flanders?

The authors of the report suggest to choose priorities since it is impossible to train all the skills stipulated in the professional profile within the 180 study points of the teacher-training programme for bachelors. They mention the fact no specifications are added in the professional profile concerning the expertise of the school subject. Another very important remark is the fact that thinking in terms of skills reduces the job of the teacher to a purely technical dimension and can lead us to train teachers more than educate them. They suggest teacher-training departments try to achieve a consensus on contents and more specifically content related to the school subject.

4.1.2 Conclusion interviews

The experts, staff members, head of departments of teacher training programmes, teacher trainers and teacher guides we interviewed don't perceive teacher-training programmes quite in the same way. They all agree on the following: the expertise of the teacher and the passion he has for his school subject are indispensable. When we talk about the foreign language teacher the perceptions of what is priority are varied: advanced language skills, knowledge of the culture, witness of the language and the culture, expert in the knowledge of the language system and of the teaching methods in foreign language education on one side; feasibility of the programme in the actual social, political and educational contexts on the other side. Today's school context asks more than a school subject expertise of the teacher: care expansion, dialogue with colleges, staff and parents are very important skills mentioned in the professional profile for teachers. The challenge today seems to be able to integrate all these skills, though all do agree this is arduous to achieve within a programme of 180 credits.

In conclusion of these interviews we can say three major stakeholders are involved in the evaluation and/or decision-making of the teacher-training programmes: the "managers", the "educational experts" and the experts of the school subjects. The "managers" are the responsible staff members and heads of department who are mostly concerned about the survival and the continuation of the educational flow, the profile of the University College and the arrival of new students. The "educational experts" are mostly preoccupied by the list of divers skills today's teachers must achieve. Finally, the experts of the school subjects and the educational researchers are mostly working on innovation and content. Their aim is to professionalise the teachers and make them better experts of education and school subjects.

In today's University College landscape, the "managers" and "educational experts" are the decision makers. The experts in school subjects and innovators have more and more difficulties to be involved in the decision-making where curriculum design is concerned.

4.2 Experiment

During a period of two academic years (2015-2017) we experimented with 31 students in French Foreign Language of the teacher-training department on a weekly basis. 13 documents (narrative, literary and argumentative texts, images from strips or artistic paintings, video clips of short films and interviews, classical music) were presented to 8 groups of students. We evaluated and analysed the level of processing the information that was contained in the documents. The attainment levels for secondary schools formulated by the Flemish authorities (1997, 2002) talk about four levels on which students can process the information: they are able to copy, to describe, to structure or to interpret. We based the activities and questions we presented to the students on these levels but also on the semiotic analysis of Roland Barthes (1966, 1970, 2007), Umberto Eco (1992) and D.S. Miail (2006) and tried to find out what the level of interpretation was, how students decode and give connotation to the information. The idea was to find out whether there is a relation between the level of processing these documents and the level of exploiting documents and learning materials in the classroom.

What were the obstacles we could observe? Do we learn something about the nature of our curriculum in the teacher-training department or about the intake of students in this department? We could isolate the following obstacles: referential framework; language skills and knowledge of language registers; discursive elements of texts; intertextuality; decoding images and giving connotations of images;

structure; interpretation.

All of the documents contained more levels of meaning. For each experiment we wrote down a scenario (title of the document, date, number of students, questions and answers, reactions and analysis).

Apart from four students with a higher educational background, and two French native speakers with literary background (*lycée français*), we could observe a structural lack of referential framework (social, cultural, anthropological, historical, literary, artistic). French native students that didn't have that background had the same problems as the not French native speaking students even if the language was an obstacle for most of the not French native speakers. But more than the lack of lexical knowledge, the lack of conceptual knowledge was a fundamental problem. When there was an image, that image was rarely decoded or given any connotation. It is in fact remarkable that images are rarely exploited within the analysis of a document. This means that "meaning" is very strongly associated with text and language. If we take the global analysis of the 13 documents by the 31 students in consideration, we conclude that only 15% of the students were able to structure and interpret the information. 85% was processing on the copying and descriptive level. We have to say that for the musical documents (classical music they didn't know or recognized) the processing level is quite parallel, but the emotional, affective dimension plays an important role in the appreciation by the students. They perceive beauty in a very direct way when it comes to music.

These observations are important since they inform us on the processing levels of students in second and third year of the bachelor programme of our teacher-training department. Are they connecting the two faces of *Sign*: the *Signifier* and the *Signified*? In other words, do they connect the conceptual aspect to the formal one? Are these documents treated in a meaning-oriented way?

A first hypothesis we will formulate is that the lack of MOT in classroom practice (which we observed during our classroom observations) can be related to the difficulties these students have to process documents that contain different levels of meaning. We suggest that teacher-training programmes focus more on the development of a referential framework (knowledge of the world, historical, anthropological, social, literary and artistic background) and commit on the deep training of advanced levels of processing information contained in all kinds of documents.

4.3 From definition to a observation tool for classroom practice

So we formulated a definition of MOT. We based that definition on our literary review.

"Meaning-oriented teaching is a complex skill: it is the capacity to have a permanent, varied, adapted and authentic communication with students. To do so, the teacher uses tools that can be material (teaching material, documents) or not material. The not material tools refer to *verbal signs* (discourse), *non-verbal signs* (expression, mimics, gestures, ...) and *actions* (what is the teacher doing)."

We give further explanation of the underlined terms:

- permanent communication: the interaction between the teacher and the student is continuous and refer on the connection they have. This means the teacher is very interested in the profile of the student (Hustinx et al., 2017). The teacher is emphatic;
- varied communication: the teacher communicates in different ways (Schneuwly, 2000): he focuses on speech as well as on non-verbal communication; Therefore he has well developed linguistic skills and he is expressive;
- adapted communication: based on the knowledge of the different learning profiles (Hustinx et al., 2017) and the diverse cultural identities (Molina 2009, 2010). He is an expert in the school subject (Robichaud, Tardif & Perlaza, 2014), a world citizen and a strong didactician;
- authentic communication: the teacher's communication is part of his personality as it is of his identification with his subject (Molina 2010).

We developed an observation tool that contained the elements of the definition and enabled us to focus our observations on the fundamental characteristics of meaning-oriented teaching. The document focuses on different forms of communication that can support the structure of the lesson, the learning contents and the documents. The structure of the lesson is key because it illustrates the goals and the trajectory of the lesson. The learning contents are central in our document since they are rarely named or visualised. This is a problem in the sense that often, neither the teacher nor the student know what

they are teaching/learning. Our experiment illustrated that documents are not exploited in a meaning-oriented way in 85% of the tested group.

This document (Fig.1) focused on the level of activation and implementation of relevant documents. If we implement this on the long term a more durable education can be offered and students will be able to construct an interesting referential framework that will enable them to participate more and better to social construction and create responsible world citizens.

Observation document classroom practice: meaning-oriented teaching

Meaning oriented teaching	Verbal - communication	Verbal communication	Non verbal communication	Material support/Teaching methods
<u>Structure</u> <u>Learning content</u> <u>Documents</u>	Content S/LC/D are made visible and are activated (in mother tongue or in the foreign language): why are we learning this? Where are we going? What came first? What comes next? o Learner understands goal of learning building blocks o Participation of the learner is central o Learner becomes progressively autonomous user	Foreign language: written & spoken What is the content? How is it activated? (instruction, repetition, interaction, ...) What is the selection of documents (learning materials)	Expression- prosody - enthusiasm - mime - silences S/LC/D are supported by non verbal communication (gesture - silences - emphasis - enthusiasm)	Blackboard - Projection - Smartboard - Tablets - Differentiation - ...
-- - + ++	-- - + ++	-- - + ++	-- - + ++	-- - + ++
FEEDBACK:				

Fig. 1

We observed 26 students in their pre-service classroom practice in 104 lessons during 4 semesters (between October 2015 and April 2017). Each of them was observed between three and six times. After each lesson we discussed the document and completed it together. In the first semester the structure, the learning contents and the documents were not (or poorly) activated, visualised, named or selected on a relevant basis. The lack of visualising the structure seemed to be related to the incapacity of naming the learning contents. The role of the textbook is very important in this matter, as is the lack of a genuine analysis of the learning content by the future teacher. We noticed that the student/future teacher was in a majority of the observations an executor of the textbook. If the textbook doesn't explicitly mention the name of the content the teacher doesn't recognise the real content. He is focused on the activities the textbook suggests. This means that he cannot transfer this content to his public. But if students in secondary schools don't know what they are exactly learning and why, they lose overview. We can say that in this case (75% of the observations in the first semester) the activation and identification of the learning contents is sacrificed to the organisation of communicative activities. The result is that the lesson is not perceived as a bad lesson, because the plan was executed and the students did the activities. However, the future teacher doesn't know or understand that the impact of the learning process is very low. It is on the longer term he notices that his students are not generating new language productions in other contexts, are not applying learning strategies, are not making associations between documents or between documents and other realities. We conclude that these lessons are "meaningless". They don't involve, nor inspire students and therefore they don't contribute to a durable learning process. The main reason for this is the lack of expertise of the future teacher what the subject is concerned but also what his complex skills are concerned.

What the communication (verbal and non-verbal) concerns we can say the styles of communication were very varied (evaluation was given by feedback). All of them tried to work on the non-verbal communication with unequal outcome. The use of the target language is a very consisting problem as a majority (60%) of the students are encouraged by the mentor to use the native language or the school language. This makes it rather difficult to communicate in the target language. Their communication skills varied in function of the language they used. The nature of the contact, but also of the content, was very different in French and in Dutch. The more they could freely use the language the more they gave meaning to what they thought. Nevertheless, a consistent part of them (25%) compensated progressively by non-verbal communication, by visualising the structure and by the use of strong documents.

Another recurring problem we observed was the nature of the communication and more specifically what we called the "adapted communication". Wrong answers were in a majority of the observed lessons not analysed by the teacher because of their apparent secondary and less important nature (forms, grammar structures). No meaning was given to the pillars of the language systems. No attention was given to the different ways students react on activities and exercises (learning profiles).

The third problem we observed was the identification of the learning contents. When students/future teachers are developing themselves learning material, they do mostly starting from the description of an activity or a task, as suggested by the task-oriented approach textbooks are applying. This means it becomes more and more difficult, for teachers as for students, to identify the actual learning content. Furthermore, learning contents with social, historical, cultural, artistic, literary content are rarely named. Aspects of these contents are occasionally presented but they are never at the centre of a lesson. The danger of the task-oriented approach is that rich learning contents and documents are not part of the programme, the focus of the teaching and learning lying on the functional and the practical dimension of a language activity. What we see in our observations are students of secondary school that are not involved and do not participate in a strong and convinced way.

We discussed all this with our own student group and slowly, very progressively, a minority (30%) integrated more and more relevant documents and tried to isolate learning contents through the activities and tasks they organised.

We also observed a control group of students with a master degree and a specific education in teacher training. They didn't know about the observation document and we didn't coach them. As this group was too limited (7 students) our observations can only give an indication.

4.4 Comparison teacher-training programmes in Flanders

We compared teacher-training programmes of 10 College Universities in Flanders and Brussels. The differences in weight of study points (Fig.2), content and organisation (blended learning- distant learning - contact hours and teaching methods) are impressive. This means that certification of teachers for secondary schools with a bachelor degree can be questioned. We cannot compare these programmes in any way. As the one and only professional profile for teachers gives a large autonomy to the College Universities, we can talk about a curricular patchwork. This situation is extensively described in other parts of western world (Hattie⁴, 2009; Robichaud, Tardif & Perlaza, 2015). The pragmatic and technical approaches of the profession overshadow content and cultural enrichment.

⁴ "Arthur Levin (2006, P.109) described teacher education as "the Dodge City of the education world. Like the fabled Wild West town, it is unruly and disordered." (...) There is no set of essential experiences that must be taught, let alone a "correct" order for teaching students to become teachers. (...) Spending three to four years in training seems to lead to teachers who are reproducers, teachers who teach like the teacher they liked most when they were at school, and teachers who too often see little value in other than practice-based learning on the job." (Hattie, 2009, pp. 109-110)

Study points (34-57 out of 180 for the entire teacher-training programme) for French Foreign Language (subject - methodology - practice) in 8 different teacher-training programmes (H1-H8) in Flanders

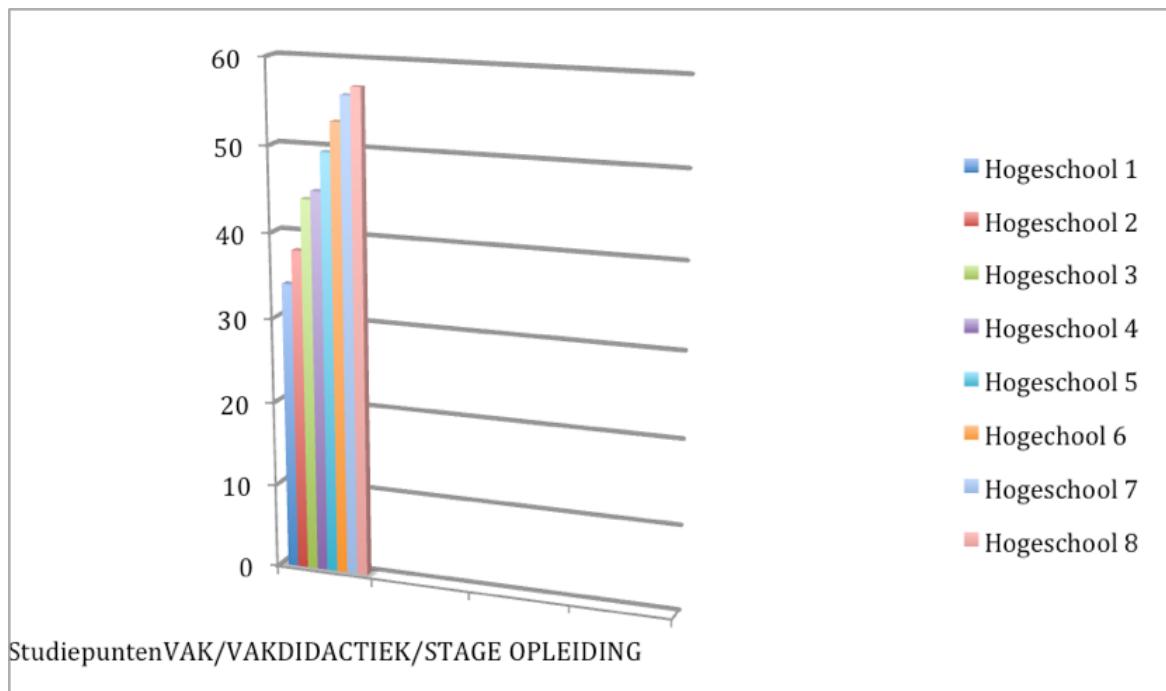


Fig. 2

5. Conclusion

This project proved MOT is a very complex skill that the future teacher can only achieve if he has a sufficiently large socio-cultural, artistic and literary framework and if he can select, integrate and transform content and documents he is able to treat in a structural and interpretative way. In the actual teacher-training programme for professional bachelors this skill is rarely achieved. There seems to be a need for training of higher levels of processing information and for intensive coaching of students in classroom practice. We saw that intensive coaching and feedback could make a difference for the bachelor students.

In the actual programmes of all College Universities there is a lack of investment in this kind of training and coaching. The control group with the 7 master degree students illustrates that these students (except one) had the same problems within the classroom. Even if their profile was different (they had an academic master degree), they didn't implement the visualising of the structure, they had difficulties to name the learning content and they mostly didn't use durable documents. We observed for a majority (five out of seven) of these students, a problem with communication, language skills, insight in the language system and in didactics: poor non-verbal communication, lack of authenticity and adapted communication, little variety in communication and absence of strong or durable documents.

We conclude that we have to think about a teacher-training programme that includes more specific didactics and invest in an intensive coaching of MOT in classroom practice. We need more consensuses about the nature and the specific goals and content of these programmes. Today's teacher-training programmes give a very large space to a dependence attitude of teachers toward textbooks and existing school culture. The reason for this is the lack of providing enough input what the specificity and expertise of the school subject is concerned, nor what the development of a large referential framework is concerned. The test group of masters is however too small to generalise this conclusion for their particular programme.

References

- Aelterman, A., Meysman, H., Troch, F., Vanlaer, O., Verkens, A. (2008). Een nieuw profiel voor de leraren secundair. Hoe worden leraren daartoe gevormd ? (informatiebrochure)
- Ancess, J. (2004). Snapshots of Meaning Making Classrooms, Volume 62 | Number 1 Teaching for Meaning Pages 36-41
- Barthes, R. (1964). Éléments de sémiologie. In: Communications, 4, Recherches sémiologiques. pp. 91-135; < URL: http://www.persee.fr/doc/comm_0588-8018_1964_num_4_1_1029
- Barthes, R. (2007). (herziene druk). L'empire des signes. Paris: Editions du Seuil.
- Beleidsevaluatie lerarenopleidingen (2013). Rapport van de Commissie Beleidsevaluatie Lerarenopleidingen
- Bourguignon, C. (2007). Apprendre et enseigner les langues dans la perspective actionnelle : le scénario d'apprentissage-action. APLV-Langues Modernes: < URL: http://www.aplqlanguesmodernes.org/spip.php?page=plan&tri=par_rubrique
- Bourguignon, C. (2006). De l'approche communicative à « l'approche communic-actionnelle » : une rupture épistémologique en didactique des langues-cultures : ». Synergie Europe, n° 1, p. 58-73.
- council of europe (2001). Common European framework of reference for languages.
- Cambridge University Press
- Dembo, M.H. (2007). Advice about the use of learning styles: a major myth in education. Journal of College Reading and Learning, 37 (2): 101-109
- Desmet, P. (z.j.). Frans gewikt en gewogen. Van uitstroom SO tot instroom academisch HO.(presentatie). Leuven: KUL
- Eco, U. (1992). Les limites de l'interprétation. Paris: Editions Grasset.
- Eco, U. (1988). Le Signe. Bruxelles: Editions Labor.
- Fontanille, J. (2015). La sémiotique face aux grands défis sociétaux du XXIe siècle., ACTES SÉMIOTIQUES n° 118.
- Fracchiolla, B. (2006). Tabou et temporalité: la dimension interculturelle du temps. Colloque Quelle didactique de l'interculturel dans les nouveaux contextes d'enseignement-apprentissage du FLE/S ?, Jan 2005, Louvain, Belgique. Cortil-Wodon: E.M.E., pp.155-168, 2006. <halshs-00944298>
- Freed, M. (2009). A Multiperspectival Conceptual Model of Transformative Meaning Making. ProQuest LLC, Ph.D. Dissertation, Saybrook Graduate School and Research Center. 277 pp.
- Hattie, J. (2009). Visible learning, A synthesis of over 800 meta-analyses relating to achievement : Taylor & Francis Ltd.
- Hustinx, Wassink, Rosius, Vandenhoudt. (2017). Gepersonaliseerd leren met tablets. MOOC. Hogeschool PXL.
- Kaldewey, J. (2006). Diepte - en oppervlakteleren. Velon 27(1)
- Kaldewey, J. (2004). Leerstijlen: een poging tot synthese. Tijdschrift voor Hoger Onderwijs, volume 22, issue 1, pp. 26 - 37
- Kirscher, P.A. (2017). Stop propagating the learning styles myth : Computers & Education, Volume 106: 166-171

Lotman, M. (2003). Peirce, Saussure and the foundation of semiotics. Sun Yat-sen Journal of Humanities. Number 16 (Summer 2003): 77-88

Meirieu, P. (2015). Peut-on susciter le désir d'apprendre?, Sciences Humaines, n° 268, < URL: https://www.scienceshumaines.com/peut-on-susciter-le-desir-d-apprendre_fr_33995.html

MIALL, D.S. (2006, 2007). Literary Reading. Empirical & Theoretical Studies. Peter Lang: New York

Molina,S.C. (2010). Examining the role of Meaning Making and Cultural Competence in How Teachers Understand and Approach their Work with Cultural and Linguistically Divers Students. ProQuest LLC, Ed.D. Dissertation, University of San Diego

Molina, S.C. (2013). The Value of Meaning Making and Cultural Knowledge for Teachers Working in Cultural and Linguistically Diverse Contexts. Journal of Teaching and Teacher Education.

onderwijs vlaanderen.(1997, 2002). Eindtermen moderne vreemde talen,< URL: <http://eindtermen.vlaanderen.be/secundair-onderwijs/index.htm>

Robichaud, A., Tardif, M., & Perlaza Morales, A. (2015). Sciences sociales et théories critiques dans la formation des enseignants, Laval : PUL

Saussure, F. (2005 herziene druk) Cours de linguistique générale. Paris :Payot.

Schneuwly B. (2000). Les outils de l'enseignant. Un essai didactique, Repères : recherches en didactique du français langue maternelle, no. 22, p. 19-38

Stijnen, J. (2013). Reflecteren over leer- en onderwijsstijlen. Madrigaal. Adem: Driemaandelijks Tijdschrift voor Muziek: 74-79

STRUYVEN,K., COUBERGS, C., GHEYSESENS, E. & ENGELS, N.(2015). Ieders leer-kracht. Binnenklasdifferentiatie in de praktijk: Acco: Leuven

Thür, D.(2009). Du dessin au signe, du signe au sens : la représentation schématique comme outil sémiotique au sein du dispositif didactique "cercle de lecture". Université de Genève. Maîtrise: <https://archive-ouverte.unige.ch/unige:3375>

Van den Branden, K. (2013). Duurzaam onderwijs: van theorie naar praktijk. Impuls, jg. 44, nr. 1

PROOFREAD by Patrizio Prata, Hogeschool PXL, Teacher-Training Department (English).

Migrant teachers' experiences with the use of digital technology and media during their placement period in Swedish schools

Annika Käck, Sirkku Männikkö Barbutiu & Uno Fors
Stockholm University, Sweden

Conference subtheme: Professional Development of Teachers

Abstract:

Professional development directed towards migrant teachers is provided at six Swedish Universities. These teachers study 1-2 years to become eligible to teach in Swedish schools. Part of this training is the placement period, where they become familiar with the Swedish school environment while guided by a placement supervisor. In this study, we examine migrant teachers' experiences with digital technology and media during their placement period, using the theoretical concept of "unfamiliar ways of thinking and practising". Data in this qualitative study was collected from a total of 34 migrant teachers through five focus groups and nine individual interviews. The migrant teachers' former teacher education was completed in twenty different countries. A qualitative content analysis was conducted. The results indicate that the placement supervisor is of great importance for the improvement of migrant teachers' digital competence, as it is defined in the Swedish context. As a role model, the placement supervisor can be a motivator and an inspirational force for migrant teachers. Findings also show that migrant teachers express unfamiliar ways of thinking and practising concerning the curricula, pedagogical methods and in their role as teachers, which has implications for how digital technology and media is used pedagogically.

Keywords: migrant teachers, placement period, digital technology and media.

1. Introduction

Swedish higher education offers a specific program during which migrant teachers have the possibility to study at institutions which offer teacher education to become eligible to teach in the Swedish school system. Courses in subject studies, subject didactics, and educational science are offered. Furthermore, they participate in everyday work at a school/preschool/day-care centre during their placement period. The aim of the placement period is to give migrant teachers the opportunity to reflect on teaching beliefs, attitudes and skills, which is seen as part of migrant teachers' professional development.

Migrant teachers are fully educated teachers but at the same time preservice teachers, learning ways of thinking and practising (WTP) in areas suited for Swedish education. Professional development is about change in teaching beliefs and practices, which challenges these trained teachers in questioning and reconstructing their teacher identity. Their former and new beliefs, attitudes and skills are to be blended which is immensely complex. In this paper, migrant teachers' experiences with digital technology and media during their placement periods was analysed. Through the lens of unfamiliar WTP, the use of digital technology and media was investigated.

2. Extended background

2.1. Professional development

Teaching beliefs and attitudes are a teacher's professional foundation. In Swedish curricula: Curriculum for the upper secondary school (The National Agency for Education. Lgy 11, 2017); Curriculum for the compulsory school, preschool class and the recreation centre (The National Agency for Education. Lgr 11, 2017); Curriculum for preschool (The National Agency for Education. Lpfö 98, 2016) fundamental values as democratic values, individual freedom and integrity, the equal value of all people, should be part of the teaching and learning. The school must encourage all students to discover their uniqueness,

Corresponding author
Email address: annika.kack@su.se

and furthermore, to develop understanding and empathy for others. Discrimination of gender, ethnic affiliation, religion or other belief systems, sexual orientation etc. must be combated at school. Teachers must be open to students' ideas and emphasise students' personal standpoints. All of this is written in the curricula mentioned above. The statement has implications for teachers' professional belief systems and their practice. The National Agency for Education works with development programmes and in-service staff, with the help of national schools (The Swedish National Agency for Education, 2018). The goal of professional development is to alter teachers' beliefs and practices, leading to improved student results. According to Guskey (2002), this must be considered when professional development is constructed. A significant change in teachers' beliefs and attitudes occurs after they see evidence of enhanced student learning, or discover new learning strategies that help students to learn (Guskey, 2002). Teachers develop a personal interpretative framework during their study and work, a lens, which guides the interpretations of and influences their teaching practice. Within this framework, teachers have a conception of themselves as teachers. The framework itself is modified through meaningful interaction. (Kelchtermans G., 2009). A reflection framework for teacher development consists of the environment, behaviour, competencies, beliefs, identity and mission. Through this framework, reflections can be made for example how teachers' identities influence their belief about teaching and teaching activities (Korthage, 2013). In order to develop understanding about teaching and self-as-a-teacher, it is important to identify and coordinate ones past, present and future selves. Becoming a teacher is an ongoing journey through life (Lee & Schallert, 2016). Reflecting and coordinating the past and present into the future is of great value for migrant teachers and reflection over intercultural competence is part of the process. Byram (1997) sees intercultural competence as constituted by knowledge of others; social processes; knowledge of self; critical cultural awareness; skills to interact, interpret and relate; discovery and interaction; intercultural attitudes as relativizing self; and valuing others' beliefs and behaviours.

2.2. Developing digital competence

Teachers' integration of digital competence is strongly related to their behavioral beliefs, the value of digital competence for developing students' future skills and engagement. Even so, normative beliefs are important in meeting the expectations of people connected to them in their teacher role. Lastly, integration of digital competence is related to a teacher's control belief and how easy it is to integrate due to technology, professional development, and curriculum resources (Sadaf & Johnson, 2017).

Most professional development activities struggle with the issues of teacher change and enhancement. Elevated attitudes and confidence in the use of technology are strongly tied to teacher's understanding of pedagogy and must be of interest when designing activities (Lawless & Pellegrino, 2007). Ertmer (2005) asked herself if teachers' pedagogical beliefs are the final frontier for integration of digital technology. She focused on teachers' educational, pedagogical beliefs about teaching and learning and how technology translated them into practice. Implications to think about in professional development were found to be the following: personal experiences change beliefs; vicarious experiences have the power to build confidence and competence; and socio-cultural influences and beliefs are continually changed by ongoing experiences.

2.3. Theory - Unfamiliar ways of thinking and practising

In teaching and learning, there is a concept referred to as "ways of thinking and practising" (WTP) (Kreber, 2009). Within a culture, discipline etc., teachers teach and choose learning activities according to the way they learned which can be hard for students to grasp (Hounsell & Anderson, 2009) and there are certain thresholds that can be found within these WTP (Meyer & Land, 2003). These thresholds can be somewhat hard to specify since there is core content connected to a threshold; for example, they entail a shift in learner subjectivity. In this study, the concept "unfamiliar WTP" is used instead of thresholds. The definition of "unfamiliar WTP" we use in this study is: "Something that is experienced as alien, not familiar, in teaching and learning or in what constitutes being a teacher." By using this definition, it will be possible to identify what challenges and difficulties are found in a new teaching environment. Since students put a lot of effort into interpreting what is experienced as unfamiliar, it is of pedagogical importance to help them understand this (Meyer, Land, & Baillie, 2010; Meyer & Land, 2003; Meyer & Land, 2005).

2.4. The context of the study

Today, migrant teachers come to Sweden for various reasons, and many have the desire to continue their teaching career. Therefore, additional training for teachers with a teaching degree in another country started as a government mandate in 2007. This programme is called "Further education for foreign

teachers” [Utländska Lärares Vidareutbildning]. Graduates from 90 countries have since then attended the programme. An individual study plan is created, ranging from 1-2 years of study. The programme starts with a course about being a teacher in Sweden which lasts for one semester. Later, the migrant teachers take courses together with Swedish teaching students, including school placement as an essential part. During their study, migrant teachers have the opportunity to identify competencies they already possess, modifications that are required in a new environment, as well as added skills specific for being a teacher in Sweden. Six Swedish universities participate in the training programme. In this study, four of them are represented.

Digital technology and media is specified in the Swedish educational system through ordinance and national curricula. The Higher Education Ordinance states: A teacher-to-be must show digital competence and be able to use it critically in teaching and learning as well as consider the role of the digital environment in the pedagogical occupation. Ensuring that all students have access to the same high-quality standard of education and activities in secure environments is a task for The Swedish National Agency for Education. It is via this agency one finds the national curricula: Curriculum for the upper secondary school (The National Agency for Education. Lgy 11, 2017); Curriculum for the compulsory school, preschool class and the recreation centre (The National Agency for Education. Lgr 11, 2017); and Curriculum for preschool (The National Agency for Education. Lpfö 98, 2016). Digital competence is part of the curricula for several reasons. One is that we live in a dynamic, complex, digitised society and students must be educated about how digitalisation might impact it, and what risks and possibilities come with a digital society. Furthermore, education in each school form should be equivalent regardless of where in the country it is provided. Everyone must be able to use and understand digital technology and media, being critical and independent students with personal responsibility. The overflow of information develops skills such as being able to evaluate and critically review the reliability of sources. Based on ethical aspects, the approach of being responsible and treating others with respect is essential. Improving students' digital competence by allowing them to test and practice different methods through a creative problem-solving approach is one aspect of how education can develop students' abilities to become independent members of society. Digitalisation is of significance for students' knowledge development. In the curricula, one can read that the internationalisation of Swedish society and the improvement of cross-border mobility leads to increased cultural diversity which demands that one appreciates one's own values and the cultural origins and diversity of others. The school is considered a cultural and social place to meet with a responsibility to develop intercultural awareness as well as other competencies.

The literature framework is intended to support reasoning about professional development related to digital competence while examining how migrant teachers experience the use of digital technology and media during the placement period. This study aims to identify unfamiliar WTP concerning digital technology and media that migrant teachers meet during their professional development at their school placement. This is of particular interest since digital competence is part of Swedish teacher education, schools and society and there is a lack of studies within this area.

3. Methodology

3.1. Research design

This study aimed to investigate which unfamiliar WTP related to the use of digital technology and media migrant teachers experienced during their placement period. To capture this aim, a qualitative study was conducted, using focus groups and individual interviews.

Research question:

- Which unfamiliar ways of thinking and practising, related to the use of digital technology and media, do migrant teachers experience during their placement period?

3.2. Population

The population of the study consisted in total of 34 migrant teachers. Twenty-five teachers participated in the focus groups, and nine in the individual interviews. The current study is part of a larger convergent mixed methods design, and migrant teachers were asked via a web survey if they were willing to participate in an interview. They could answer yes via the web survey or send an email to the first author. The migrant teachers that agreed to be interviewed held teaching degrees from 20 different countries. The respondents studied at four Swedish institutions for teacher education.

3.3. Ethics

According to The Swedish Research Council (Hermerén, 2017), there are main concepts of ethical concern to consider in social research; professional secrecy (a researcher is not allowed to discuss individual respondents with unauthorised people), anonymising or de-identifying respondents (eliminating the connection between collected data and a specific person's identity so that neither unauthorised persons nor the research group can re-establish it), and confidentiality (a general obligation not to communicate information given in confidence). All of these conditions are met in this study. Bryman (2012) expresses it as: no harm to participants, lack of informed consent, invasion of privacy or deception is accepted. In this study, each of these was considered. Before the data collection, information was given about the study's purpose, representation and the voluntary nature of participation. The participants were also guaranteed confidentiality and integrity; their names, countries or other aspects such as religion would not be exposed from an individual point of view. They were also informed that the participation would not affect their grades and that they could withdraw from the study at any time.

3.4. Data collection

Two data collection methods were used: individual interviews and focus groups, each of them supplemented by digital recording. These different data sources were chosen to complement each other. The method of using focus groups is suitable to capture experiences in which the participants can share and compare during interaction with each other. A more in-depth insight was gained through individual interviews. (Cousin 2009). Nine individual interviews and five focus group interviews were conducted with a total of 34 individuals, see Table 1.

Table 1. Summary of all the data collection activities

All interviews were semi-structured and explored the migrant teachers' experience with unfamiliar WTP connected to digital technology and media and revealed what was helpful in their development during their placement period. The interviews were conducted at the participants' universities, in rooms that were familiar to them and lasted between 40 to 70 minutes. Before each interview, as an introduction, the interview themes were shown to them. The first author conducted all the interviews during which it was expressed to the migrant teachers that there were no right or wrong answers and that it was important to reveal their own experiences. They were also told that the interviewer would ask clarifying questions if necessary.

Data collection	Participating Universities	Former teacher education in:
Individual interviews Total 9: male n=3 and female n=6	Stockholm University n=2 University of Gothenburg n=4 Örebro University n=1 Linköping University n= 2	Hungary, Latvia, Canada, Nicaragua, Palestine, Philippines, Russia, Serbia, South Africa
Focus groups Total 5 groups: 25 teachers male n=4 and female n=21	Stockholm University n=3 University of Gothenburg n=1 Örebro University n=1	Belarus, Bulgaria, China, Estonia, Hungary, India, Iraq, Iran, Latvia, Mongolia, Peru, Poland, Philippines, Russia, Ukraine

3.5. Data analysis

The interviews and focus group interviews were digitally recorded and transcribed verbatim in Swedish. The Word documents were transferred into MAXQDA, a qualitative data analysis software, where a thematic content analysis was conducted. All material was read several times to obtain an overall understanding, and emerging categories were noted based on the research question. Units of meaning for similarities and differences were identified, grouped and labelled. The segments were coded into main categories. Subcategories, with what was unfamiliar in the use of digital technology and media, were identified later. The relationships between the categories provided a fuller explanation of the unfamiliarity of the use of digital technology and media for the migrant teachers. The citations were chosen based on their representativeness to the categories.

4. Results

4.1 Demographic profile of the respondents

The 25 migrant teachers from the five focus groups, four males, and 21 females held teaching degrees from 15 countries. Among the individual interview respondents, three male teachers and six female teachers participated, who held their teaching degrees from nine countries. The respondents from the qualitative data collections were educated as teachers with specialisations in upper secondary school, secondary school, middle school, primary school, preschool and special education. Subject areas represented in the study were a social science, nature science, special education, gymnastics, sports and health, languages, literature, mathematics, art, music, computers and technology, psychology and other more country-specific subject areas.

4.2 Overall view of the results

Three main categories evolved from the qualitative data material regarding migrant teachers experiences with digital technology and media during their placement period. The first category is connected to society and its impact on digital technology and media through the curriculum, which was found unfamiliar for some migrant teachers. The second category has to do with the placement supervisors' use of digital technology and the role of being a teacher in Sweden. The last main category describes teaching and learning, and the unfamiliarity with new WTP in teaching and learning. Within these results, the focus is on what was experienced as unfamiliar, see Table 2.

Table 2. Summary of qualitative categories

Migrant teachers are not a homogenous group; there is a huge variation in levels of digital competence. Quotations like these represent the variation: "I am digital illiterate. They did not have the technology in my home country. The technology was a big obstacle for me in the beginning!" "I was a teacher in digital technology and media in my former country."

4.3 Society and digital competence

Unfamiliar WTP: Curricula and digital competence

WTP - Category	Unfamiliar WTP - Subcategory
Society and digital competence	Curricula and digital competence
The role of a teacher and the placement supervisor	To be a teacher in a new country The placement supervisors use of digital technology and media
Teaching and learning	New ways of teaching, pedagogical methods Use of digital, blended environments Use of group environments, settings, rooms

For certain migrant teachers, digital technology and media were not demanded in society for various reasons. In their interviews, migrant teachers stated deep problematic reasons for this. For some, the state controlled the use of digital technology and media: "We didn't have digital technology and media or cell phones because it was forbidden." For others, it was a lack of infrastructure and money: "We didn't have the resources for using digital technology and media."; "I come from a poor family, and I understood at the time that in my former country, there were universities that used advanced technology, but that was only for the rich people." Other causes include how digital technology and media was viewed and the teachers' beliefs, attitudes and practices connected to it: "We never used digital technology and media (in country X) since it was more important to write by hand and you learned more. The students lose concentration when digital technology and media are used and do not listen to the teacher's introduction."

4.4 The role of a teacher and the placement supervisor

Unfamiliar WTP: How to be a teacher in a new country and the placement supervisors' use of digital technology

In several of the transcripts migrant teachers expressed that being a teacher in a new country can be

frightening, especially if the environment is unfamiliar. "The fear -How am I going to feel like a teacher in a school in another culture, another country?" This response shows a lack of confidence in intercultural skills, being a teacher in a new country. However, questions raised about how to be a teacher were, to some extent, answered during the placement period. "The teaching role (in Sweden) is completely different, so now when I have done all the placement, it is easier for me to adapt my whole situation to how things are in Sweden. Now I work the way I was taught at the placement." The placement teacher can act as a mediator and helpful guide, bridging the old and new. "I had such an amazing supervisor. She understood how everything worked, how to talk to colleagues, how to talk to students, how to behave around colleagues and students, how to look... she was perfect." The results indicate that the placement supervisor is important as a role model, inspiring migrant teachers in their understanding of the potential of digital technology in teaching and learning. "I have been very inspired by digital technology and media during my placement... You see it at work, and it varies at the schools." The placement supervisor challenges migrant teachers in their understanding of the potential of digital technology in teaching and learning. "When I did my placement, my supervisor used digital technology and media in nearly all lessons. Placement supervisor, it gave me a role model for life, as a teacher and as a person." The placement supervisor is of great importance if migrant teachers' understanding of digital technology and media is to improve during their professional development. On the other hand, failure of further development can result from a unmotivated placement supervisor or one with little digital competence. "My supervisor was old fashioned, very sympathetic, but not interested in digital technology and media." In this category, migrant teachers want more education; without scaffolding, the migrant teachers struggle on their own: "There should be more knowledge in general on how to use digital technology and media in teaching. It is difficult to learn on your own. I try to find digital tools, and I found Evernote and searching for a program that a teacher can use for tests and presentations. I have an Ipad and a computer."

4.5 Teaching and learning

Unfamiliar WTP: New ways of teaching and new environments

This category emerged because migrant teachers wanted to talk about how to teach in a Swedish context. Unfamiliar WTP related to digital competence varied. For some, it was the pedagogical methods in use and for others, the digital technology itself. The unfamiliarity was expressed as follows: "We never used digital technology and media (in country X). When we worked as teachers, we only used literature in teaching and learning." "We used the traditional way of teaching and learning. The teacher explains, and the student listens." Migrant teachers discovered new and variated ways of teaching as they portrayed what they saw during their placement period. "The teaching is different (in Sweden)." "I had the opportunity to see digital technology at work in my placement. It gives the option to vary the teaching." This response illustrates how the variated teaching was something interesting. Being able to see digital technology and media used by their placement supervisor changed some migrant teachers' beliefs and attitudes. "Sometimes I think - Oh, if they (in the former country) could use digital technology as they do in Sweden, being able to use computers, PowerPoints, different digital technology and media programs. Digital technology makes teaching and learning more interesting." Not everyone was impressed, however. On the contrary, opposite attitudes were expressed. "You are exaggerating the use of digital technology and media in Sweden." This view shows how migrant teachers feel the need to negotiate with themselves if this way of teaching and learning is something for them; is it something they want to integrate into their teaching beliefs? During the placement period, migrant teachers have the opportunity to develop their digital competence in authentic learning environments, which is useful since this can be new for some of them. "The teaching and learning environments are different in Sweden; a lot of technology is used which I am not used to." "Pedagogical films and the development of computers were new to me." "There are whiteboards; the students have laptops, digital technology is used in different ways." Findings also show that migrant teachers find some of the WTP in Swedish schools unfamiliar, which has implications for how digital technology is used. "Here (in Sweden) digital technology and media are used for pedagogical work and for learning, which means a practical use." Pedagogical methods, for example working in groups and using group environments, enable a different kind of teaching and learning. One example is to be able to turn from teacher-centred to student-centred teaching. This implies using digital technology and media as well since there is a strong focus on social learning using digital blended environments. This can be experienced as unfamiliar and not easily accepted by some migrant teachers. "The teacher walks in, writes something on the board, and lets the pupils work in groups on their own. What kind of education is that? As a teacher, you are a well of knowledge to students. You have to fill them up..." The use of digital technology and media is a

common part of being a teacher in Sweden according to migrant teachers. "The teachers (in Sweden) do everything using digital technology and media: results, grades, assignments, lessons, explanations, contact with parents, etc." Several migrant teachers expressed that more education in digital technology and media is needed. Developing digital competence was viewed as something important but hard to accomplish oneself. "I would like more support in how to use digital technology and media, learn more about it. To discuss, find solutions, Ipads, recordings in language, there is a lot to use." "We need to gain more knowledge of digital technology and media in relation to teaching." Some of the migrant teachers expressed that their former education in digital technology was different. "In my former country, we read, theoretical, about digital technology and media. In Sweden, we have more practice."

5. Discussion

The results of this study help us to understand the complexity of migrant teachers' further professional development during the school placement when digital technology and media is used. Professional development has the aim to improve teachers' practices and beliefs which is even more complex for teachers coming from another country since there are new WTP to reflect on. It is not only about the digital technology and media; it concerns the belief systems, attitudes, skills within digital competence, intercultural competence and teaching beliefs, which all have an impact on migrant teachers' use of digital technology and media. According to Lee & Schallert (2016), teachers can develop their understanding of themselves as self-as-a-teacher and their practices through self-reflection on how past selves influence their present selves in teaching situations. Furthermore, how their present teacher selves influence their projected future possible selves. In our results, migrant teachers express the unfamiliarity and sometimes fear, of being a teacher in a new country. The unfamiliarity has its foundation in what expectations a new society has on teachers, for example via the curriculum and its content. Some migrant teachers may not have had the opportunity to work with digital technology and media in their previous home countries. To build confidence as a teacher in a new country there must be an opportunity to work with the competencies the migrant teachers already possess, make modifications that are required in a new environment, as well as add skills specific for being a teacher in Sweden. Furthermore, the ability to communicate and interact across cultural boundaries is a competency needed by both the migrant teacher and the placement supervisor. For migrant teachers, the placement period can be of uttermost importance in reflecting, identifying and challenging their past, present and future selves as teachers and their teaching beliefs, which can sometimes be opposite to Swedish teaching beliefs. Migrant teachers' interaction with the placement supervisor can be helpful when sorting out the old and new, the familiar and the unfamiliar. It is important for their professional development that they have a chance to see how a sometimes unfamiliar WTP can enhance students' learning. As Guskey (2002) infers, otherwise the professional program will fail in its task to mediate the pedagogical belief system that the curriculum is based on. Ertmer (2005) emphasised that pedagogical beliefs are a frontier for integration of digital technology since that has an impact on how technology translates into practice. Lawless & Pellegrino (2007) and Sadaf & Johnson (2017) correlate teachers' fundamental beliefs to the integration of digital competence. Even so, the attitudes to use digital technology were tied to teachers understanding of pedagogy. During their professional development, migrant teachers will meet new "WTP". Evidence from this study shows that migrant teachers sometimes struggle with blended environments, group-work etc. Some migrant teachers are used to a teacher-centred pedagogy, which makes both the student-centred and blended learning environments something they have to reflect over and process in relation to their beliefs and attitudes. Since the professional development of migrant teachers is immensely complex, the lens of unfamiliar WTP seem to be fruitful in identifying some aspects of the use of digital technology and media. The placement supervisor serves an important role when reflecting and teaching together and carrying out the duties of a teacher jointly with the migrant teacher during the placement period. They can reflect on beliefs, attitudes and skills connected to teaching competence, intercultural competence and digital competence. Both will benefit from these joint reflections, learning from each other while reflecting on past and present, and imagining the future. This study has been analysing a Swedish teacher education program. The culture-specific issues may not be transferrable into other cultural contexts but the notion of unfamiliarity is applicable and helpful in the further development of intercultural teacher education. The method of identifying unfamiliar WTP is applicable at other institutions as well. The identifying process is ongoing since education in society is always changing.

6. Conclusion

We may regard migrant teachers as a valuable resource. Their further education in ways that recognise their past education and teaching experiences is vital. During their placement period, it is important that they get the opportunity to reflect on their present teacher selves, looking backwards and while also imagining the future, when processing the often new way of teaching and learning. In this process, the placement supervisor is of utmost importance as a role model and a reflective partner helping to verbalise the unfamiliar, explaining the new and supporting in building a new professional identity. Further development of the placement supervisor in intercultural education and digital competence is recommended. If the unfamiliarity can be identified it will be possible to adapt educational settings to accommodate migrant teachers' needs.

References

- Bryman, A. (2012). Social research methods (4. ed. ed.). Oxford: Oxford University Press.
- Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, (4), 25.
- Guskey, T. R. (2002). Professional development and teacher change. Great Britain: CARFAX PUBLISHING.
- Hermerén, G. (2017). Good research practice. Stockholm: The Swedish Research Council.
- Hounsell, D., & Anderson, C. (2009). Ways of thinking and practicicing in biology and history: Disciplinary aspects of teaching and learning environments. In C. Kreber (Ed.), *The university and its disciplines : Teaching and learning within and beyond disciplinary boundaries* (pp. 71). New York: Routledge.
- Kelchtermans G. (2009). Career stories as gateway to understanding teacher development. . In Bayer M., Brinkkjær U., Plauborg H., Rolls S. (Ed.), *Teachers' career trajectories and work lives. professional learning and development in schools and higher education.* (vol 3 ed.,). Dordrecht: Springer.
- Korthage, F. A. J. (2013). Chapter 12 in search of the essence of a good teacher: Toward a more holistic approach in teacher education Elsevier.
- Kreber, C. (Ed.). (2009). *The university and its disciplines : Teaching and learning within and beyond disciplinary boundaries.* New York: Routledge.
- Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, 77(4), 575-614.
- Lee, S., & Schallert, D. L. (2016). Becoming a teacher: Coordinating past, present, and future selves with perspectival understandings about teaching. *Teaching and Teacher Education*, 56, 72-83. 10.1016/j.tate.2016.02.004
- Meyer, J., Land, R., & Baillie, C. (Eds.). (2010). Threshold concepts and transformational learning. . Rotterdam: Sense Publishers.
- Meyer, J., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. (*Occasional, Enhancing Teaching-Learning Environments in Undergraduate Course Project No. 4*). Edinburgh: University of Edinburgh.
- Meyer, J., & Land, R. (2005). Threshold concepts and troublesome knowledge (2): Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education*, 49(3), 373-388. 10.1007/s10734-004-6779-5
- Sadaf, A., & Johnson, B. L. (2017). Teachers' beliefs about integrating digital literacy into classroom practice: An investigation based on the theory of planned behavior. *Journal of Digital Learning in Teacher Education*, 33(4), 129-137.
- The National Agency for Education. Lgr 11. (2017). *Läroplan för grundskolan, förskoleklassen och fritidshemmet 2011: Reviderad 2017.* [curriculum for the compulsory school, preschool class and the recreation centre]. Stockholm: Skolverket.
- The National Agency for Education. Lgy 11. (2017). *Läroplan för gymnasieskolan: Lgy 11.* [curriculum for the upper secondary school]. Stockholm: Skolverket.
- The National Agency for Education. Lpfö 98. (2016). *Läroplan för förskolan: Lpfö 98* [curriculum for pre school]. Stockholm: Skolverket.
- The Swedish National Agency for Education. (2018). Retrieved 2018-03-23.

Professional development: an ecological perspective on special education teacher learning in mathematics

Stella Long

Mary Immaculate College, Limerick, Ireland

Conference subtheme: Professional Development of Teachers

Abstract:

This study focused on a Professional Development (PD) programme, a Post Graduate Diploma in Special Educational Needs (PGDSEN) for Special Education Teachers (SETs) in a Higher Education Institute (HEI) in Ireland. The study sought to understand the factors influencing Special Education Teacher (SET) learning in mathematics. It identified the perceptions and experiences of the participants, SETs, of the influence of the mathematics input on the PGDSEN programme on their acquisition of knowledge and skills. The study examined the perceptions of the SETs of the transfer of their learning to practice. The conclusions of the study aim to inform future policy, provision and research initiatives to further support and enhance the teaching of mathematics in inclusive and special education settings.

The participants were the primary/special school teacher cohort ($n=32$) of a PGDSEN programme. Set within a constructivist paradigm, this study adopted a case study design. Conducted in four phases over a 30 month period, the methodology adopted a mixed methods approach. Bronfenbrenner's (1979) ecological theory provided a framework to identify, organise and understand the complexity and interaction of factors influencing SET learning in mathematics.

The application of Bronfenbrenner's (1979) ecological theory to the findings suggested that the learning of the SETs was nestled within a series of inter-related systems (microsystem, mesosystem, exosystem, macrosystem). The interactions between and within the systems influenced SET learning and the transfer of their new learning to practice. Successful outcomes were dependent on the interplay of factors at each of the four layers in Bronfenbrenner's (1979) model.

Keywords: Professional development, teacher learning, inclusive and special education

1. Introduction

Similar to other jurisdictions, the development of inclusive educational provision in the Republic of Ireland has been shaped by national and international policy directives (Government of Ireland, 2004; UNESCO, 1994; Winter & O'Raw, 2010). Inclusive educational provision for pupils with Special Educational Needs (SEN) continues to change and evolve (Winter & O'Raw, 2010). The inclusive process is complex and is dependent on factors both within and external to the school (Mittler, 2000). The key role of teachers in creating inclusive practices in schools is noted in the literature (Rouse, 2008; Shevlin, Winter, & Flynn, 2013). Inclusive practices involves changes in pedagogical practices for teachers. Special Education Teachers (SETs) require a "sophisticated knowledge base that extends beyond that of general education teachers" (Brownell, Sindelar, Kiely, & Danielson, 2010, p. 371). Some teachers have expressed their concerns with regard to their ability to teach pupils with SEN (Ring & Travers, 2005) and stated that they do not have the necessary skills and knowledge required (Black-Hawkins, 2014). Practising teachers who feel that their Initial Teacher Education (ITE) has left them unprepared for this task perceive Professional Development (PD) as a means of acquiring the skills and knowledge for teaching in inclusive contexts (Ware, Butler, Robertson, O'Donnell, & Gould, 2011).

Higher attainment levels in mathematics are demanded of all pupils, including those with SEN (Bryant &

Corresponding author

Email address: stella.long@mic.ul.ie

Bryant, 2008; Government of Ireland, 2018). However, some pupils find it difficult to learn mathematics (Geary, 2011). The critical influence of the teacher on pupil achievement in mathematics is recognised (Hill, Rowan, & Lowenberg Ball, 2005). Special Education Teachers require a knowledge of mathematics, its' associated pedagogy and an understanding of the learning strengths and needs of the pupil (Chinn & Ashcroft, 2017; van Garderen, Thomas, Stormont, & Lembke, 2013). PD for SETs is vital to support them with the specific challenges of teaching mathematics to pupils with SEN (Maccini & Gagnon, 2006).

This paper focuses on a Professional Development programme for Special Education Teachers in Ireland. Funded by the Department of Education and Skills (Department of Education and Skills, 2012a, 2018b) the programme is designed to support the capacity of schools in special education. The purpose of the research study was to understand special education teacher learning, in relation to the teaching of mathematics to pupils with SEN. The study also sought to understand the perspectives of the participants of the transfer of their learning to practice. The findings will be presented in the context of Bronfenbrenner's (1979) ecological systems theory.

2. Literature review

Inclusive education in the Irish context has been defined by Winter and O'Raw (2010) as the process of

- Addressing and responding to the diversity of needs of learners through enabling participation in learning, cultures and communities
- Removing barriers to education through the accommodation and provision of appropriate structures and arrangements, to enable each learner to achieve the maximum benefit from his/her attendance at school. (p. 39)

In practice, Ireland has adopted a "flexible continuum of provision" ranging from inclusion in mainstream schools, special classes in mainstream schools or in special schools (Department of Education and Skills, 2007; Westwood, 2013, p. 2). Typical features of inclusion in the literature include positive teacher attitudes, a whole-school culture or community of practice to inclusive education (Ainscow & Sandell, 2010), the provision of Professional Development (PD) for teachers in inclusive practices (Forlin, 2010; Smith & Tyler, 2011) and effective leadership for inclusion (Winter & O'Raw, 2010).

Ainscow's (2007, 2014) assertion that teachers form the nucleus of inclusive education practices is widely acknowledged in the literature (Shevlin et al., 2013; Smith & Tyler, 2011). The development of effective inclusive practice relies on "teacher knowledge, skills, understanding, capacity and attitudes" (Shevlin et al., 2013, p. 1119). Teacher quality influences pupil achievement (Rice, 2003). Research indicates that some teachers perceive that they do not have the required expertise to teach pupils with SEN (Banks et al., 2016; Florian & Black-Hawkins, 2010; Rix, Sheehy, Fletcher-Campbell, Crisp, & Harper, 2013)).

Despite inputs during the Initial Teacher Education (ITE) process, many newly qualified teachers continue to express their lack of preparedness in special education (Forlin, 2012). Research in special education contexts indicates that teachers require upskilling in key areas of special education such as assessment, planning, intervention strategies and mathematics (O'Gorman & Drudy, 2010; Rose, Shevlin, Winter, & O'Raw, 2015; Travers et al., 2010). Developing teacher expertise in special education within a process of inclusion which is fluid requires ongoing opportunities to partake in professional development (Mittler, 2000; Pugach & Blanton, 2014). Professional development for teachers is acknowledged as a medium for increasing pupil achievement levels by enhancing and developing the quality of teaching (McLeskey & Waldron, 2002; Opfer & Pedder, 2011).

The Post Graduate Diploma in Special Education programme of professional development (Department of Education and Skills, 2012a) is a fully funded programme for special education teachers. The purpose of the PD programme is to support schools to meet the needs of pupils requiring additional support.

The modules and the accompanying assignments ensure that the participants acquire a knowledge of special education theory and the practical expertise to apply it in their own classroom settings. Participating teachers (SETS) are released from school for an eight week period over the course of one academic year. The PGDSEN programme is a Level 9 programme on the National Framework Qualifications scale (60 ECTs) and is offered at a number of Higher Education Institutions (HEI) in Ireland on an annual basis. Banks et al. (2016) noted that special class teachers felt more confident about their teaching role following the opportunity to engage in PD in SEN. The influence of professional development on the teaching practices of special education teachers was found to be positive in the Project Iris research study (Rose et al., 2015). On the other hand, the absence of PD for teachers involved in SEN is viewed as a barrier to the development of inclusive schools (Rouse & Florian, 2009).

The opportunities pupils have to learn mathematics is one aspect of increasing pupil attainment levels in mathematics (Chinn & Ashcroft, 2007; van Garderen et al., 2013). Pupils with learning difficulties in mathematics require teachers who have a knowledge of the content matter, the pedagogy and the specific learning strengths and needs of the pupil (Mastropieri, Scruggs, & Mills, 2011; van Garderen et al., 2013). In Ireland, the Continuum of Support framework provides a "graduated approach to identification and programme planning" (NEPS, 2007a) for pupils requiring additional support. Implementing the Continuum of Support framework involves collaboration between the class teacher, special education teacher and external professionals. In line with best practices internationally, each step of the continuum involves assessment, planning and intervention and review of progress to date (NEPS, 2007b; Riccomini & Witzel, 2010).

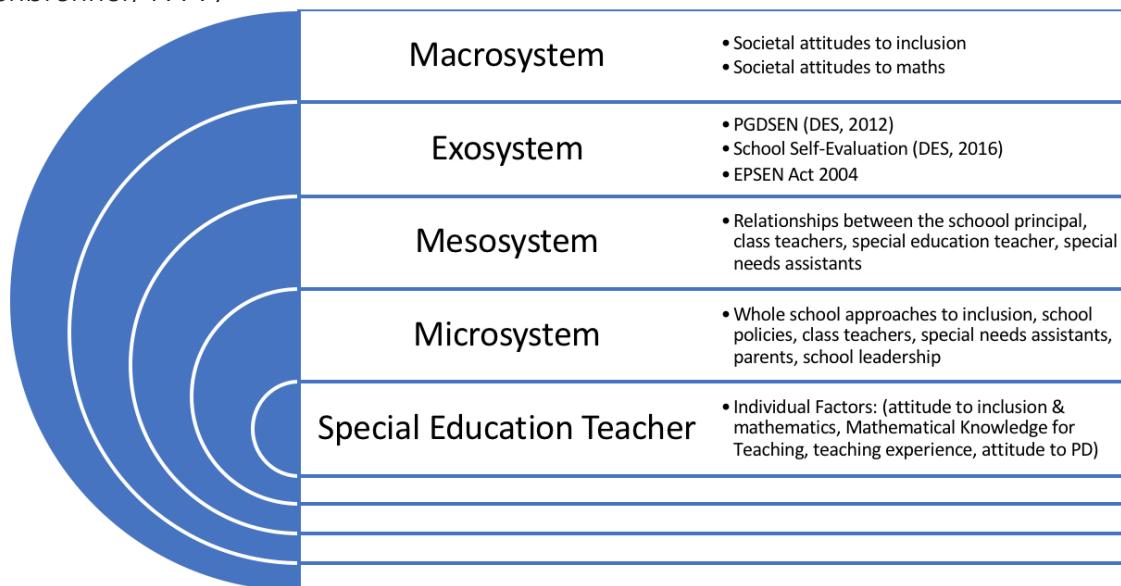
3. Theoretical Framework

This research study was embedded within a social constructivist paradigm. This enabled an understanding of the phenomena from the perspectives of the participants, SETs (Creswell, 2009). Bronfenbrenner's (1979) ecological theory provided the theoretical framework to underpin the study (Grant & Osanloo, 2014; Schunk, 2014).

Urie Bronfenbrenner's studies in psychology led him to develop an interest in the many facets of human development. He had a particular interest in developing his understanding of human development such that it would serve to inform "policy, practice and research" (Hayes, O'Toole, & Halpenny, 2017, p. 2). Bronfenbrenner (1979) envisioned individual human development in the context of the wider ecological systems framework influencing the learner (Odom & Diamond, 1998; Odom et al., 2004). Bronfenbrenner (1979) defined development as "the person's evolving conception of the ecological environment, and his relation to it, as well as the person's growing capacity to discover, sustain, or alter its' properties" (p. 9). It occurred within a series of interrelated or nested environmental systems identified by Bronfenbrenner (1979) as the microsystem, mesosystem, exosystem and macrosystem (Hayes et al., 2017). Bronfenbrenner's ecological theory proposes that the process of the development of the learner is influenced by occurrences within each nested ecological system and the interactions (bidirectional) between them in the context of the broader setting of the systems (Greene & Moane, 2000; Rosa & Tudge, 2013). Generally presented visually as a series of concentric rings, systems which are closest to the learner have the greatest influence on the learner (see Figure 1) (McTernan & Godfrey, 2006). Systems which are further from the learner are considered to have lesser but yet important influences on development (Mc Guckin & Minton, 2014).

Bronfenbrenner's (1979) theoretical perspective on human development is recognised internationally as a validated framework for research in educational settings (Brownell & Smith, 1993; Chau-Ying Leu, 2008; Greene & Moane, 2000; Lewthwaite, 2011; Mc Guckin & Minton, 2014). It provided a relevant framework to "consider, reconcile and respond to the factors" associated with Special Education Teacher Learning in Mathematics in the context of "practice, policy and planning" for the purposes of this paper (Christensen, 2010; Hayes et al., 2017, p. 6).

Figure 1. An Ecological Perspective on Special Education Teacher Learning (adapted from Bronfenbrenner, 1979)



4. Methodology

Set within a constructivist paradigm, a case study design proved to be an appropriate means of gaining an in-depth insight into the phenomenon, *special education teacher learning in mathematics* following the completion of a Post Graduate programme of Professional Development in Special Educational Needs (PGDSEN) by the participants, Special Education Teachers (SETs).

The study was conducted in four phases, over a 30 month period. The methodology adopted a mixed methods approach. The data collection methods included questionnaires, quantitative measures, interviews, document analysis and reflective diaries. Individual interviews took place in the SETs school settings at two points, 12 months and 18 months, following their participation in the professional development programme. Quantitative measures provided baseline data and included:

- The Sentiments, Attitudes, and Concerns about Inclusive Education Revised (SACIE-R) scale (Forlin, Earle, Loreman, & Sharma, 2011)
- The Diagnostic Teacher Assessment in Mathematics and Science (DTAMS) measure (CRIMSTeD, 2016)
- The Mathematics Anxiety Scale (Hunt, Clark-Carter, & Sheffield, 2011)
- The Mathematics Teaching Efficacy Beliefs Instrument (Enochs, Smith, & Huinker, 2000).

Creswell's (2012) Six Step Framework for analysing and interpreting qualitative guided guided the analytic process. The computer software, NVivo, supported the transcription and coding of the data. Adopting a deductive approach to coding, the theoretical framework and the research question guided the development of predetermined codes (Braun & Clarke, 2012; Miles & Huberman, 1994). In addition, the application of an inductive approach to coding ensured that codes were developed which were representative of the views of the participants (Braun & Clarke, 2012; Stake, 1995). All codes were defined and recorded. Themes were developed through a process of code merging and the elimination of redundant codes (Marshall & Rossman, 2011). Three themes were identified which were validated by evidence from a number of sources in the data (Creswell, 2009). Data analysis was conducted thematically.

4. Findings

The findings are presented in the context of Bronfenbrenner's (1979) ecological model of human development (see Figure 1).

The participants were a diverse group of SETs with differing levels of experience in general and special education settings. All held special education teaching positions in either primary or special schools in Ireland. The participants were positively disposed towards the concept of inclusion and inclusive practices. They viewed PD as a means of upskilling in terms of the knowledge and skills required to teach mathematics in inclusive settings.

Bronfenbrenner's (1979) systems theory suggests that the development of the learner is strongly influenced by his immediate environment, his *microsystem* (see Figure 1). The knowledge and skills acquired by the participants were implemented at this level of the system (Neal & Neal, 2013). The participants' schools varied in terms of size, gender, location, socio-economic status and the diversity of their pupils. Schools varied in terms of their models of support for teaching mathematics to pupils with SEN. In some schools, pupils were supported in their mainstream class while in others, support was provided individually or in small groups outside of the classroom. In some instances, SETs had the support of Special Needs Assistants (SNAs) when teaching mathematics. Access to relevant resources and assessment measures in maths was limited in some schools. Whole school approaches to inclusion, leadership styles, teacher expertise in SEN, teacher attitudes to inclusion and attainment levels in mathematics differed in the participants' schools.

The ability of the participants to implement adapted or changed practices following their participation in the programme of professional development was dependent on the relationships and social interactions between the variables in their microsystems (schools, class teachers, principals, school policies etc.). The relationships or links between the variables are elements of the *mesosystem* layer of Bronfenbrenner's (1979) model (Christensen, 2010). His model suggests that at this level, connecting with the variables in the microsystem, strengthens the position of the participants to be influential in terms of their ability to implement adapted or changed practices. Collaborative relationships between class teachers and

special education teachers represent a core element of inclusive practice (Shevlin, Kenny, & Loxley, 2008).

In the current study, the nature of this relationship varied both between and in schools. It proved to be significant in the transfer of adapted or changed practices. Collaborative relationships between SETs and class teachers were complex. Firstly, finding time to collaborate was challenging. Collaboration was facilitated by school leaders, principal teachers in a few schools in this study through the allocation of dedicated meeting time. However, in most schools, meetings between SETs and class teachers were of an informal nature occurring spontaneously in school corridors or staff rooms. Consequently, some SETs were denied the opportunity to meaningfully collaborate with their colleagues, class teachers. There was evidence to suggest that in some instances, SETs were planning and implementing intervention programmes in mathematics independently of the class teacher. Such practice were examples of missed opportunities for collaboration and exchange of new ideas.

Secondly, the attitudes and perspectives of class teachers towards the teaching of mathematics to pupils with SEN impacted on the opportunities for some SETs in this study to implement adapted practices. Positive teacher attitudes to inclusion are a factor in developing inclusive schools (Westwood, 2013). Although most of the participants reported of the positive attitudes of class teachers to inclusive practices in maths, there was clear evidence in a few schools of class teachers who were not willing to embrace new approaches in mathematics.

The practice of co-teaching is advocated in policy directives issued by the Department of Education and Skills (Department of Education and Skills, 2005) was evident in all schools (excepting the special school). In these classes, SETs collaborated with their colleagues to share their knowledge and expertise in maths - *"It worked really well. We could do a sum on the board and I would see one way of doing it and she would see another way of doing it. We would link in together"*. Other participants had less positive experiences with co-teaching with a participant stating that the process still needed to be tightened up. While co-teaching was generally viewed positively by the participants in this study, it is clearly evident that it is an evolving collaborative process. It is imperative that school leaders facilitate collaboration for planning and reviewing lessons. Lack of collaboration for co-teaching classes represented a key constraint to the effectiveness of this approach. In addition, this paper argues for the provision of PD for class teachers to ensure that both they and SETs acquire a shared knowledge of the skills and expertise necessary for the successful implementation of co-teaching.

In some schools, the class teacher and SET did not have a shared vision with regard to the focus of intervention programmes in mathematics. One SET stated that the class teacher expected the SET to focus on the core mathematics text book - *"you're sent a maths text out with kids who are coming to support classes"*. Another SET said that in her school this expectation "causes a bit of tension" and that some class teachers "don't like it when you kind of suggest that you might prefer to do it some other way". Similar sentiments towards inclusive practices were previously noted in the study of Travers et al (2010). Participants in the current study were of the view that this lack of cohesion between themselves and class teachers could be overcome if class teachers had the opportunity to engage in PD in SEN.

A strong spirit of collaboration was evident between class teachers in a special school in this study. Teachers shared resources and ideas and the participant from this school felt that they "had a good system" going and that "we lean on each other" in terms of sharing knowledge and expertise in mathematics for pupils with SEN. A number of teaching staff in this school had completed the PD programme under study in this paper. They formed a core group of expertise within the school, sharing teaching strategies and resources.

Given that the development of the learner, the SET, is strongly influenced by his microsystem and by the interaction (bi-directional) between the members of his microsystem (mesosystem), it is necessary to conceptualise PD provision in special education for all teachers and principals in a school setting.

The exosystem, the third level of Bronfenbrenner's systems theory (1979) refers to the settings in which the learner is not present but yet affect his development through their interaction with the variables in his microsystem (Chau-Ying Leu, 2008; Hong & Garbarino, 2012). A number of variables external to the school setting indirectly supported the transfer of new practices for the participants in this study. For example, national policy directives such as the School Self Evaluation review (Department of Education

and Skills, 2012b) and the National Literacy and Numeracy Strategy (Department of Education and Skills, 2011) created new teaching opportunities in literacy and numeracy in schools. Participants referred to the development of whole school initiatives in mathematics which afforded them increased opportunities to implement new practices for pupils with SEN.

All participants in this study spoke of the lack of support from professional services such as educational psychology and speech and language therapy in mathematics. While difficulties in mathematics may be identified by such professionals, recommendations for teaching and learning were not provided. On the other hand, participants were satisfied with the level of support received from the same professionals in the area of literacy.

Participants referred to the influence of parents on their teaching of mathematics to pupils with SEN. The supportive role of parents (in two of the fourteen schools) was welcomed. However, it was generally noted that parental support was not forthcoming. Some participants expressed a view that this may be explained by the limited mathematics standards of parents themselves. It became apparent in this study also that parents of children with greater educational needs prioritised the development of language, literacy and social skills over mathematics. Recent research undertaken by Knapp and her colleagues (2017) concluded that parental support enhances the development of mathematical skills. Parents of children with learning difficulties in mathematics could play a key role in supporting their children acquire mathematical concepts (National Council for Curriculum and Assessment, 2007) by supporting them in generalisation activities and involving them in mathematics in real-life settings.

Represented as the outer layer in Bronfenbrenner's (1979) model, the *macrosystem* places the preceding systems in the cultural ideologies, attitudes and beliefs of the setting (Greene, 1994). Although somewhat removed from the immediate environment (*microsystem*) of the learner (SET), societal values and beliefs may have a significant influence on their development (Mc Guckin & Minton, 2014). The attitudes of society at large to a diverse culture has been influential in developing inclusive practices in schools. Supported by legislation to ensure that all children access education that is responsive to their needs (Government of Ireland, 2004; UNESCO, 1994) funding for additional resources to support the education of children with SEN continues to be provided in Ireland (Department of Education and Skills, 2017a, 2018a). The current emphasis on science, technology, engineering and mathematics (STEM) subjects has highlighted the necessity for all children, including those with SEN, to acquire skills and knowledge in these areas (Department of Education and Skills, 2017c). Educational initiatives are in place to improve numeracy skills for all children (Department of Education and Skills, 2011, 2016). Research to date indicates that achievement levels in mathematics have increased but not at the same rate as in literacy (Department of Education and Skills, 2017b). The specific focus on mathematics in the final stages of the National Strategy for Literacy and Numeracy for Learning and Life (2011-2020) and in the School Self-Evaluation process (2016-2020) will provide further opportunities for the participants of this study to implement their learning in collaborative learning environments in their school settings (Department of Education and Skills, 2011, 2016, 2017b).

Bronfenbrenner's (1979) systems theory supported a broader understanding of special education teacher learning in mathematics. The relationships and interactions between each of the inter-related systems (*microsystem*, *mesosystem*, *exosystem*, *macrosystem*) influenced their capacity to learn and to apply their newly acquired knowledge and skills. Reaching the goal of increased attainment levels in mathematics for pupils with SEN is dependent on the interplay of each of the four layers of the system.

5. Conclusions and implications for professional development

The implications of the findings suggest that increasing attainment levels in mathematics for pupils with SEN requires inclusive whole school approaches to the teaching and learning of mathematics. Given that the ultimate goal of PD is increased pupil attainment levels, it is evident that all personnel in the school, principal, class teachers and Special Needs Assistants (SNA) require PD in SEN to support their role in inclusive mathematics approaches. A whole school approach to PD in SEN in mathematics supported by supports at systems level will ensure that each pupil, including those with SEN, achieve their learning potential in mathematics. PD for SETs is but one variable in this process.

References

- Ainscow, M. (2007). From special education to effective schools for all: A review of progress so far. In L. Florian (Ed.), *The SAGE handbook of special education* (pp. 146-159). London: SAGE Publications Inc.
- Ainscow, M. (2014). From special education to effective schools for all: Widening the agenda. In L. Florian (Ed.), *The SAGE handbook of special education* (Vol. 1, pp. 171-185). London: SAGE Publications Ltd.
- Ainscow, M., & Sandill, A. (2010). Developing inclusive education systems: The role of organisational cultures and leadership. *International Journal of Inclusive Education*, 14(4), 401-416.
- Banks, J., McCoy, S., Frawley, D., Kingston, G., Shevlin, M., & Smyth, F. (2016). Special classes in Irish schools - Phase 2: A qualitative study. Retrieved from Dublin: <http://www.esri.ie/pubs/BKMNEXT308.pdf>
- Black-Hawkins, K. (2014). Researching inclusive classroom practices: The framework for participation. In L. Florian (Ed.), *The SAGE handbook of special education* (Vol. 1, pp. 390-403). London: SAGE Publications Ltd.
- Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper (Ed.), *Handbook of research methods in psychology* (Vol. 2, pp. 55-71). Washington DC: APA Books.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, Mass.: Harvard University Press.
- Brownell, M. T., Sindelar, P. T., Kiely, M. T., & Danielson, L. (2010). Special education teacher quality and preparation: Exposing foundations, constructing a new model. *Exceptional Children*, 76(3), 357-377.
- Brownell, M. T., & Smith, S. (1993). Understanding special education teacher attrition: A conceptual model and implications for teacher educators. *Teacher Education and Special Education*, 16(3), 270-282.
- Bryant, B. R., & Bryant, D. P. (2008). Introduction to the special series: Mathematics and learning disabilities. *Learning Disability Quarterly*, 31(1), 3-8.
- Chau-Ying Leu, J. (2008). Early childhood music education in Taiwan: An ecological systems perspective. *Arts Education Policy Review*, 109(3), 17-26.
- Chinn, S. J., & Ashcroft, J. R. (2007). *Mathematics for dyslexics-including dyscalculia* (3rd ed.). West Sussex, England: John Wiley & Sons Ltd.
- Chinn, S. J., & Ashcroft, J. R. (2017). *Mathematics for dyslexics and dyscalculics: A teaching handbook* (4th ed.). West Sussex, UK: John Wiley & Sons, Ltd.
- Christensen, J. (2010). Proposed enhancement of Bronfenbrenner's development ecology model. *Education Inquiry*, 1(2), 101-110.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches*. London: SAGE Publications Inc.
- Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston, MA: Pearson.
- CRIMSTeD. (2016). Diagnostic teacher assessments in mathematics and science - DTAMS,. Retrieved from <http://louisville.edu/education/centers/crmstd/diag-math-assess-elem>
- Department of Education and Skills. (2005). *Organisation of teaching resources for pupils who need additional support in mainstream primary schools-Circular 02/05*. Athlone, Co. Westmeath: Department of Education and Skills.

Department of Education and Skills. (2007). Special educational needs - a continuum of support: Guidelines for teachers. Dublin: The Stationery Office.

Department of Education and Skills. (2011). Literacy and numeracy for learning and life: The national strategy to improve literacy and numeracy among children and young people, 2011-2020. Dublin: Author Retrieved from http://www.education.ie/admin/servlet/blobservlet/lit_num_strat.pdf?language=EN&igstat=true.

Department of Education and Skills. (2012a). Combined post-graduate diploma programme of continuing professional development for teachers involved in learning support and special education 2012/2013 - Circular 13/12. (13/12). Athlone, Co. Westmeath: Author Retrieved from <http://www.sess.ie/sites/default/files/Circular%200013%2012%20PGSEN%20-%20201213.pdf>.

Department of Education and Skills. (2012b). Implementation of school self-evaluation. Dublin: Author Retrieved from http://m.into.ie/roi/circulars/circulars2012/cl0039_2012.pdf.

Department of Education and Skills. (2016). School self-evaluation guidelines 2016-2020 (Primary). Retrieved from Dublin: <https://www.education.ie/en/Publications/Inspection-Reports/Publications/Evaluation-Reports-Guidelines/School-Self-Evaluation-Guidelines-2016-2020-Primary.pdf>

Department of Education and Skills. (2017a). Guidelines for primary schools: Supporting pupils with special educational needs in mainstream schools. Retrieved from Dublin: <https://www.education.ie/en/The-Education-System/Special-Education/Guidelines-for-Primary-Schools-Supporting-Pupils-with-Special-Educational-Needs-in-Mainstream-Schools.pdf>

Department of Education and Skills. (2017b). Literacy and numeracy for learning and life 2011-2020: Interim review: 2011-2016, new targets 2017-2020. Retrieved from Dublin: https://www.education.ie/en/Publications/Education-Reports/pub_ed_interim_review_literacy_numeracy_2011_2020.PDF

Department of Education and Skills. (2017c). STEM education: Policy statement 2017-2026. Retrieved from Dublin: <https://www.education.ie/en/The-Education-System/STEM-Education-Policy/stem-education-policy-statement-2017-2026-.pdf>

Department of Education and Skills. (2018a). Chief inspectors report January 2013 to July 2016: Excellence in learning for all. Retrieved from Dublin: https://www.education.ie/en/Publications/Inspection-Reports-Publications/Evaluation-Reports-Guidelines/insp_chief_inspectors_report_2013_2016.pdf

Department of Education and Skills. (2018b). Post-graduate diploma programme of continuing professional development for special education teachers - 2018/2019. (04/18). Athlone, Co. Westmeath: Department of Education and Skills Retrieved from https://www.education.ie/en/Circulars-and-Forms/Active-Circulars/cl0004_2018.pdf.

Enochs, L. G., Smith, P. L., & Huinker, D. M. (2000). Establishing factorial validity of the mathematics teaching efficacy beliefs instrument. *School Science and Mathematics*, 100(4), 194-202.

Florian, L., & Black-Hawkins, K. (2010). Exploring inclusive pedagogy. *British Educational Research Journal*, 37(5), 813-828.

Forlin, C. (2010). Reframing teacher education for inclusion. In C. Forlin (Ed.), *Teacher education for inclusion: Changing paradigms and innovative approaches* (pp. 3-12). Oxon: Routledge.

Forlin, C. (2012). Future directions: What is needed now for effective inclusive teacher education? In C. Forlin (Ed.), *Future directions for inclusive teacher education: An international perspective* (pp. 173-182). Oxon: Routledge.

Forlin, C., Earle, C., Loreman, T., & Sharma, U. (2011). The sentiments, attitudes, and concerns about inclusive education revised (SACIE-R) scale for measuring pre-service perceptions teachers' perception about inclusion. *Exceptionality Education International*, 21(3), 50-65.

Geary, D. (2011). Consequences, characteristics, and causes of mathematical learning disabilities and persistent low achievement in mathematics. *Journal of Developmental & Behavioral Pediatrics*, 32(3), 250-263.

Government of Ireland. (2004). Education for Persons with Special Educational Needs (EPSEN) Act 2004. Dublin: The Stationery Office.

Government of Ireland. (2018). Action plan for education 2018. Retrieved from Dublin: <https://www.education.ie/en/Publications/Corporate-Reports/Strategy-Statement/action-plan-for-education-2018.pdf>

Grant, C., & Osanloo, A. (2014). Understanding, selecting and integrating a theoretical framework in dissertation research: Creating the blueprint for your house. *Administrative Issues Journal*, 4(2).

Greene, S. (1994). Growing up Irish: Development in context. *The Irish Journal of Psychology*, 15(2-3), 354-371.

Greene, S., & Moane, G. (2000). Growing up Irish: Changing children in a changing society. *The Irish Journal of Psychology*, 21(3-4), 122-137.

Hayes, N., O'Toole, L., & Halpenny, A. M. (2017). Introducing Bronfenbrenner : A guide for practitioners and students in early years education. Oxon: Routledge.

Hill, H., Rowan, B., & Lowenberg Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal*, 42(2), 371-406.

Hong, J. S., & Garbarino, J. (2012). Risk and protective factors for homophobic bullying in schools: An application of the social-ecological framework. *Educational Psychology Review*, 24, 271-285.

Hunt, T. E., Clark-Carter, D., & Sheffield, D. (2011). The development and part validation of a U.K. scale for mathematics anxiety. *Journal of Psychoeducational Assessment*, 29(5), 455-466.

Knapp, A., Landers, R., Liang, S., & Jefferson, V. (2017). We all as a family are graduating tonight: A case for mathematical knowledge for parental involvement. *Educational Studies in Mathematics*, 95(1), 79-95.

Lewthwaite, B. (Ed.) (2011). Applications and utility of Uri Bronfenbrenner's bio-ecological theory. Manitoba: Manitoba Education Research Network.

Maccini, P., & Gagnon, J. C. (2006). Mathematics instructional practices and assessment accommodations special and general educators. *Exceptional Children*, 72(2), 217-234.

Marshall, C., & Rossman, G. (2011). Designing qualitative research (5th ed.). Los Angeles SAGE Publications Inc.

Mastropieri, M., Scruggs, T., & Mills, S. (2011). Special education teacher preparation. In J. Kauffman & D. Hallahan (Eds.), *Handbook of special education* (pp. 47-58). New York: Routledge.

Mc Guckin, C., & Minton, S. J. (2014). From theory to practice: Two ecosystemic approaches and their applications to understanding school bullying. *Australian Journal of Guidance & Counselling*, 24(1), 36-48.

McLeskey, J., & Waldron, N. L. (2002). Professional development and inclusive schools: Reflections on effective practice. *The Teacher Educator*, 37(3), 159-172.

- McTernan, E., & Godfrey, A. (2006). Children's services planning in Northern Ireland: Developing a planning model to address rights and needs. *Child Care in Practice*, 12(3), 219-240.
- Miles, M., & Huberman, M. (1994). Qualitative data analysis: An expanded sourcebook (2nd ed.). California: SAGE Publications Inc.
- Mittler, P. (2000). Working towards inclusive education - Social contexts. London: David Fulton Publishers.
- National Council for Curriculum and Assessment. (2007). Mathematics: Guidelines for teachers of students with mild general learning disabilities. Dublin: Author.
- Neal, J. W., & Neal, Z. P. (2013). Nested or networked? Future directions for ecological systems theory. *Social Development*, 22(4), 722-737.
- NEPS. (2007a). Special Educational Needs - A continuum of support: Resource pack for teachers. Dublin: DES.
- NEPS. (2007b). Special educational needs: A continuum of support - Guidelines for teachers. Retrieved from Dublin: https://www.sess.ie/sites/default/files/neps_special_needs_guidelines.pdf
- O'Gorman, E., & Drudy, S. (2010). Addressing the professional development needs of teachers working in the area of special education/inclusion in mainstream schools in Ireland. *Journal of Research in Special Educational Needs*, 10, 157-167.
- Odom, S. L., & Diamond, K. E. (1998). Inclusion of young children with special needs in early childhood education: The research base. *Early Childhood Research Quarterly*, 13(1), 3-25.
- Odom, S. L., Vitztum, J., Wolery, R., Lieber, J., Sandall, S., Hanson, M. J., . . . Horn, E. (2004). Preschool inclusion in the United States: A review of research from an ecological systems perspective. *Journal of Research in Special Educational Needs*, 4(1), 17-49.
- Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81(3), 376-407.
- Pugach, M. C., & Blanton, L. P. (2014). Inquiry and community: Uncommon opportunities to enrich professional development for inclusion. In L. Florian (Ed.), *The SAGE handbook of special education* (Vol. 2, pp. 873-887). London: SAGE Publications Ltd.
- Riccomini, P., & Witzel, B. (2010). Response to intervention in math. Thousand Oaks: Corwin.
- Rice, J. K. (2003). Teacher quality: Understanding the effectiveness of teacher attributes. Washington, DC: Economic Policy Institute.
- Ring, E., & Travers, J. (2005). Barriers to inclusion: A case study of a pupil with severe learning difficulties in Ireland. *European Journal of Special Needs Education*, 20(1), 41-56.
- Rix, J., Sheehy, K., Fletcher-Campbell, F., Crisp, M., & Harper, A. (2013). Continuum of educational provision for children with special educational needs: Review of international policies and practices (Vol. 1). Trim, Co. Meath: NCSE.
- Rosa, E. M., & Tudge, J. (2013). Urie Bronfenbrenner's theory of human development: Its evolution from ecology to bioecology. *Journal of Family Theory & Review*, 5(4), 243-258.
- Rose, R., Shevlin, M., Winter, E., & O'Raw, P. (2015). Project IRIS- Inclusive research in Irish schools: A longitudinal study of the experiences of and outcomes for pupils with special educational needs (SEN) in Irish schools. Trim, Co. Meath: National Council for Special Education.
- Rouse, M. (2008). Developing inclusive practice: A role for teachers and teacher education. *Education in the North*, 16.

Rouse, M., & Florian, L. (2009). Effective inclusive schools: A study in two countries. In P. Hick & G. Thomas (Eds.), *Inclusion and diversity in education* (Vol. 2, pp. 255-268). London: SAGE Publications Ltd.

Schunk, D. H. (2014). *Learning theories: An educational perspective* (6th ed.). Essex, UK: Pearson.

Shevlin, M., Kenny, M., & Loxley, A. (2008). A time of transition: Exploring special educational provision in the Republic of Ireland. *Journal of Research in Special Educational Needs*, 8(3), 141-152.

Shevlin, M., Winter, E., & Flynn, P. (2013). Developing inclusive practice: Teacher perceptions of opportunities and constraints in the Republic of Ireland. *International Journal of Inclusive Education*, 17(10), 1119-1133.

Smith, D. D., & Tyler, N. C. (2011). Effective inclusive education: Equipping education professionals with necessary skills and knowledge. *Prospects*, 41(3), 323-339.

Stake, R. E. (1995). *The art of case study research*. London: SAGE Publications Inc.

Travers, J., Balfe, T., Butler, C., Day, T., Dupont, M., McDaid, R., . . . Prunty, A. (2010). Addressing the challenges and barriers to inclusion in Irish primary schools. Dublin: St. Patrick's College.

UNESCO. (1994). *The Salamanca statement and framework for action on special needs education*. Paris: UNESCO.

van Garderen, D., Thomas, C. N., Stormont, M., & Lembke, E. S. (2013). An overview of principles for special educators to guide mathematics instruction. *Intervention in School and Clinic*, 48(3), 131-141.

Ware, J., Butler, C., Robertson, C., O'Donnell, M., & Gould, M. (2011). *Access to the curriculum for pupils with a variety of special educational needs in the mainstream classroom*. Trim, Co. Meath: National Council for Special Education.

Westwood, P. S. (2013). *Inclusive and adaptive teaching: Meeting the challenge of diversity in the classroom*. London; New York: Routledge.

Winter, E., & O'Raw, P. (2010). Literature review of the principles and practices relating to inclusive education for children with special educational needs. Trim, Co. Meath: National Council for Special Education.

Assessment of Innovation Dimension in a MOOC Course “New Media in Education” focused on PBL Plans

Orly Melamed¹ & Rivka Wadmany²

Kibbutzim College of Education, Technology and Arts, Tel Aviv, Israël¹; Humanities and Arts of the Council for Higher Education, Israël²

Conference subtheme: Teacher Education & Digital Technology

Abstract

Education for entrepreneurship is important in the age of accelerated technological changes. MOOC courses, based on multiple choice automatic tests and on peer assessment, are expanding in higher education. MOOC courses in the new media, entrepreneurship and innovation fields are challenging its pedagogical developers to create a clear and measurable peer assessment process of innovative plans and projects. Research shows that innovation is an important criterion of evaluation; however, the concept has conflicting definitions.

The objectives of our action research are to study, about and from the analysis of peer assessments, how to improve the evaluation of PBL plans and its innovative aspects.

We analyzed 789 peer written assessments and grades of 89 PBL plans, which were submitted to ‘New Media in Education’ MOOC course in 2016. The research is based on quantitative and qualitative analysis of peers’ feedbacks.

Correlations were processed among peers final marks, innovation marks and other assessment categories of PBL plans marks. Regression analysis model indicates that compatibility of PBL plans to educational needs and its innovation are the strongest predictive factors of peers’ final marks.

The justifications of PBL plans assessments and of innovation assessment were analyzed through qualitative research.

The research findings recommend how to improve peer assessment process and how to supply guidelines for the assessment of innovation and other categories of PBL plans, based on new media and digital pedagogy.

Innovation Assessment, Peer Assessment in MOOCs, Entrepreneurship Education. New Media Education, Project Based Learning

Introduction

The accelerated innovations in technology (Christensen, Horn, & Johnson, 2008; Harari, 2015; Kurzweil, 2005; Tzenza, 2017) pose complex challenges for education systems. Primary, secondary and tertiary education systems struggle to keep pace with technological and cultural changes and provide an appropriate response to the needs of the twenty-first century information society. This situation calls for fundamental changes in teaching goals, approaches, and practices, and in the skills, knowledge, and competencies required of learners (Melamed & Goldstein, 2017; Poys & Barak, 2016; Wadmany, 2017, 2018).

In view of the current and anticipated acceleration in technological innovations, and employment instability, there is broad agreement in the western world that the development of entrepreneurial

Corresponding author

Email address: melamed.orly@gmail.com

skills, which are defined as the ability to devise new creative ideas, based on a desire to create new value (Volkmann et al., 2009), is essential for successfully negotiating a complex, changing, networked, technology- and knowledge-rich world. Based on this understanding, education programs in entrepreneurship have been developed in schools and higher education institutions in the EU and the US (Robinson & Aronica, 2016).

In Israel, too, there is a growing trend toward developing entrepreneurial education and establishing entrepreneurship and innovation centers within academic institutions. As part of its newly announced policy, the Commission of Higher Education (CHE) and its Planning and Budgeting Committee (PBC) issued in March 2018 a program to encourage entrepreneurship and innovation in the academia through support for the establishment or upgrading of centers of entrepreneurship and innovation in the academic institutions budgeted by the PBC. This announcement is in line with a new move led by the CHE and the PBC in the last two years concerning digital learning and support for the design and development of online courses in academic institutions. The vision behind this move is to transform Israeli academia and establish its role as a leader among institutions that teach, support entrepreneurship, and encourage innovation.

Conceptualizations and classifications of innovation

Innovation is considered to be a refreshing, original perspective that deviates from the common way of thinking; or a process of change that creates a new solution to a problem and produces a successful change (Poys & Barak, 2016).

Kotsemir, Abroskin & Meissner (2013) argue that the contemporary trend of multiple conceptualizations of innovation requires that theoreticians face the challenge of classifying different concepts and types of innovation into a more structured conceptual system; develop rigorous criteria to distinguish between true innovations and minor or cosmetic changes; and match criteria to clear, easy-to-understand and easy-to-use terms. They suggest an approach to innovation that extends beyond the common dichotomy that distinguishes between radical innovation and incremental innovation. They explore additional types of innovation and they suggest distinguishing between an innovative idea and innovation in the manner in which an existing idea is applied; between innovative product and innovative process; between innovation and its effects; and assess innovation according to the goals defined by the society or organization through which it is applied and operated.

The rigid dichotomy between revolutionary and incremental innovation is largely inaccurate and even misleading. For example, a historical study of the development of communication technologies shows that most technological developments were incremental rather than revolutionary innovations (Blondheim & Shifman, 2003). Sometimes what appears to be a minor technological innovation may have far-reaching societal effects, for better or for worse. The social network Facebook is an excellent example of an incremental technological and design innovation that engendered a global revolution in the manner in which people communicate with each other.

Educational innovativeness and its assessment

Many educators are searching for models to help them navigate the tangle of existing technologies and make decisions on which are preferable and how to choose the technology best suited to their teaching practice. Two pedagogical models the integration of technology in education offer different perspectives on innovation in education. TPACK (Technology, Pedagogy, and Content Knowledge) was developed by Mishra and Koehler (2006) as a foundation for planning teaching and learning. The underlying assumption of this model is that successful assimilation of technology in teaching requires an integration of three knowledge bases: technology, content, and pedagogy. The model was tested with different age groups and subjects, and in all applications it was found that a combination of technological, content, and pedagogical knowledge improves the integration of technology in teaching (Koehler & Mishra, 2008). According to a study by Kelly (2008), the TPACK model narrows the technological divide as well as cultural differences between different student populations. We can conclude from this model that assessment of innovation in educational projects should relate to technological, pedagogical and content knowledge innovation.

The SAMR (Substitution Augmentation Modification Redefinition) model was developed by Puentedura

(2014) and gained much popularity among educators. The model describes four stages in the assimilation of computer technologies by teachers: (a) substitution: the technology replaces non-digital tools that were previously in use; (b) augmentation: the technology helps us improve and increase the efficiency of what we were doing; (c) modification: the technology allows us to change our operating modes and practices; (d) redefinition: the technology provides new capabilities that were not previously possible and therefore poses new challenges.

Against the SAMR model, Hamilton, Rosenberg and Akcaoglu (2016) argue that it is hierarchical and therefore does not reflect the uncertainty or inabilities of the developer and user to predict the uses of the technology in complex environments, and the model also does not address the context of knowledge and highlights the assessment of the technological product at the expense of an assessment of the process.

In contrast to technological innovation, educational innovation involves teacher training and student and teacher learning. It may be characterized as the adoption of small changes that have already been performed in other sites, to create islands of innovation (Avidov-Ungar & Eshet-Alkalai). It may be a radical innovation that develops entirely new processes or systemic innovation, which tries to fundamentally change an organizational culture, ideological worldview, or values of an educational institution (Poys & Barak, 2016).

One of the barriers that inhibit the spread of innovation is a function of the difficulty to evaluate innovation in terms of the teacher's work, pupils' products, learning processes, and the educational organization itself (Poys & Barak, 2016). Although innovation is commonly used a criterion for assessing projects, its significance is complex, relative, and multi-dimensional (Oman et al., 2013) and resources must be invested to develop validated marking schemes to assess innovation and the success of entrepreneurship education programs (Duval-Couetil, 2013).

In general, studies point to the challenges of assessing innovation in education, whether the object of assessment is technological innovation or pedagogical innovation (Atar, Carmona, & Tal-Meishar (2017). Studies conducted in Israel found that the majority of students did not experience any pedagogical innovations in their training in academic teacher training programs, and they were unable to define what they could expect from a learning experience that is defined as being innovative. Furthermore, teachers perceive technological innovation as a prominent market of educational innovation, but when teachers are asked about the technologies they use in the class, they tend to note that they use computer technologies that are neither new nor highly advanced (Poys & Barak, 2016).

The ease in which it is possible to copy, upgrade, or edit new digital products in digital environments (Jenkins et al., 2006) reinforces the need and the significance of initiating, creating, and producing innovative digital media products that based on a remix and re-appropriation of existing digital media contents and products.

In the last decade, massive open online courses (MOOCs) have become popular in academic education (Christensen, Horn & Johnson, 2008). These courses are based on multiple-choice questions or assignments that can be automatically graded and/or peer assessments (Hativa, 2014). The challenge of these courses is to establish an innovative constructivist pedagogy that combines an appropriate assessment method and includes peer assessment. The development of simple, clear, and precise grading schemes for peer assessment of learning outcomes, and processes based on investigation, high-order reasoning, and creativity are essential for the success of MOOCs and their growing use (Suen, 2014).

Studies show that students consider peer assessments to be reliable and fair when assessment schemes are clear and quantifiable (Heng et al., 2014). In the new wave of MOOCs, peer assessment not only summarizes learning after it has been performed, but it part of the learning process of both the students who perform the assessment and the students being assessed. Introduction of assessment schemes based on alternative formative assessment is one of the most important challenges facing MOOC developers today (Sandeen, 2013).

The current study describes and examines the existing scheme used to assess projects in the New

Media in Education MOOC, and the role of innovation in these programs, with the aim of revising and improving the assessment scheme in general, and specifically the innovation assessment criteria used to assess the projects developed by future course participants.

About "New Media in Education" MOOC

The New Media in Education course is the first course of its kind to be developed as part of the move to encourage entrepreneurship and innovation in the academia and promote massive open online courses. The course is designed for all teacher trainees in Israel. The course took place in 2015 and 2016 in a college of education technology and arts in Israel, with the aim of training student teachers as educational entrepreneurs who combine and develop educational projects based on new media and networked pedagogy. Students in the New Media in Education MOOC were required to assess program based on new media and networked pedagogy developed by their peers, using both quantitative assessment measures and verbal feedback.

The course was inspired by the TPACK (Mishra & Koehler, 2016) model, which was used as a basis for the design of teaching and learning in the course. The innovative aspect of the course was reflected in the incorporation of the three elements of the TPACK model: technology, pedagogy, and content-knowledge, and the relations between them.

The course combines three technologies: video lessons presented on an interactive video platform (Interlude), which allows learners to select the order of topics to view in each lesson; a Facebook group used for discussions that take place after each lesson; and a peer-assessment platform developed specifically for this course.

The course combines three pedagogies: individual online learning through interactive video lessons; collaborative learning through peer assessments of the initiatives developed by students; and face-to-face consultations on the design of the initiatives.

The course contents revolve around a relatively new topic – new media in education – and convey basic technological knowledge (how to operate and develop applications, games, and personal and group pages on social networks), pedagogical knowledge (Education 2.0, teaching models such as flipped classes, sole, MOOC), and content knowledge (such as principles of entrepreneurship, effects of the information revolution on education, disruptive innovation).

Students in the course are requested to submit a detailed program for an educational project, and to assess three programs developed by peers using an assessment scheme developed specifically for this purpose. The assessment scheme includes the following criteria:

- Response to a need - Does the program describe the educational and learning need that the project fills?
- Innovation - Does the program explain in what sense the project is an innovation?
- Use of new media tools - Does the program explain how the program uses new media tools?
- Networked pedagogy - Does the program explain how the program uses networked pedagogy?
- Feasibility – Does the program explain how the project will operate and what it will look like in practice?

Students award a score between 1 and 10 to each of the above criteria and also gave summative and intuitive grade to peers project plans. The instructions that the students receive explain that an innovation may take many different forms, and is not limited to a technological innovation. However students didn't receive detailed instructions how to assess innovation. As a result, the quantitative assessment of the innovativeness of their peers' projects is based more on students' intuition than on an orderly format for innovation assessment that includes diverse well-defined features.

Students are also required to write a verbal assessment and state the positive points of the assessed program and the needed improvements, as well as a summative assessment of the program in general.

All programs were developed by students working independently or in groups of 2 or 3, and each program was assessed by 3-9 peers. The project assessment form included spaces for quantitative scores and a verbal assessment.

Project assessments accounted for 60% of students' final grade in the course (30% - peer assessment and 30% assessment by the course instructors).

The objectives of our action research are to examine the model of project plans' peer assessment in "New Media in Education" MOOC and to evaluate the innovation assessment in the model, in order to improve the assessment model of project plans in future "New Media in Education" MOOCs.

Research Questions

1. To what extent do innovation scores predict summative grades, compared to the predictive value of other assessment scores?
2. How do the students assess the innovative aspects of the project and give reasoning for their assessment in their written reports?
3. What additional criteria might be added to the peer assessment process and to the innovation score, based on the students' written reports?

Methodology

This action research is based on a qualitative and quantitative content analysis of 789 students' written feedback reports to project plans based on new media. The quantitative content analysis of scores and grades is based on statistical analyses - Pearson correlation tests, ICC-Intraclass correlations and regression analysis of 789 feedbacks submitted in two MOOC courses in 2015 and 2016.

The students' feedbacks included 5 categories of scores: response to a need, innovation, use of new media, networked pedagogy and feasibility. The students were asked to assess and write what was good in the project plan, what should be improved in the plan and to write summative assessment of the plan.

- a. We calculated Pearson correlations between innovation criterion scores and summative grades in 789 peer assessment reports.
- b. Intraclass correlations - (ICC) - We calculated the intraclass correlations between the scores awarded by students on the five assessment criteria in 789 peer assessment reports.
- c. We tested the predictive value of innovation scores for summative scores, compared to the predictive value of scores on other criteria, in 789 peer assessment reports.

The qualitative analysis included the following elements:

- d. We studied the innovation dimension in 789 verbal feedback reports and extracted the main themes related to assessment of innovation, following a method proposed by Shkedi (2003), using the following categories: what is defined as an innovation, the types of arguments that justify defining a program as an innovation, the types of arguments that reject defining a program as an innovation.
- e. We identified new assessment criteria that were not included in the original assessment scheme, based on the 789 peer assessment reports.

Findings

Correlations between summative scores and criterion scores

We calculated Pearson correlations between summative scores and each of the criterion scores. As shown in Table 1, moderate to strong correlations were found between programs' summative scores and each of the following criterion scores in the peer assessment reports:

- a. between summative scores and response to a need scores $r = 0.721$;
- b. between summative scores and innovation scores $r = 0.654$;
- c. between summative scores and new media integration scores $r = 0.621$;
- d. between summative scores and integration of networked pedagogy scores $r = 0.579$;
- e. between summative scores and feasibility scores $r = 0.573$

All correlations were significant ($p < .000$).

According to the findings presented in Table 1, summative scores had the strongest correlation with scores regarding programs' responsiveness to an existing need ($r = 0.721$), followed by a moderate-high correlation between summative scores and innovation scores ($r = 0.654$). A similarly strong correlation was found between summative scores and new media integration scores ($r = 0.621$). The similarity in the

strength of these associations suggests that the basis for an assessment of a program's innovativeness is the communication technology (medium) incorporated into the program. It is also important to note that the correlations between summative scores and each of the remaining criteria were moderate.

Table 1
Correlations between summative scores and other assessment criteria scores (Pearson correlation coefficients)

Correlations		
		MARK
NEW	Pearson Correlation	.654
	Sig. (2-tailed)	0.000
	N	789
NEED	Pearson Correlation	.721
	Sig. (2-tailed)	0.000
	N	789
PEGAGOG	Pearson Correlation	.579
	Sig. (2-tailed)	0.000
	N	788
NEW_MEDIA	Pearson Correlation	.621
	Sig. (2-tailed)	0.000
	N	789
PRACTIC	Pearson Correlation	.573
	Sig. (2-tailed)	0.000
	N	788

**. Correlation is significant at the 0.01 level (2-tailed).

Predictive value of criterion scores for summative scores

Results of the regression analysis presented in Table 2 show that all five criterion scores jointly predict 70% of the summative grades of the assessed projects ($r^2 = 0.708$). That is today, students used assessment elements that were not included in the assessment scheme, and these assessments explain an additional 30% of the summative scores.

Table 2
Regression analysis of the predictive value of criterion scores for summative scores

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.720 ^a	0.519	0.518	1.0157	
2	.782 ^b	0.612	0.611	0.9127	
3	.809 ^c	0.654	0.653	0.8624	
4	.829 ^d	0.687	0.686	0.8202	
5	.841 ^e	0.708	0.706	0.7934	

a. Predictors: (Constant), NEED

b. Predictors: (Constant), NEED, NEW_MEDIA

c. Predictors: (Constant), NEED, NEW_MEDIA, NEW

d. Predictors: (Constant), NEED, NEW_MEDIA, NEW, PRACTIC

e. Predictors: (Constant), NEED, NEW_MEDIA, NEW, PRACTIC, PEGAGOG

According to the results of the ICC test presented in Table 3, there are indications of moderate consistency in criterion scores ($ICC = 0.497$, $p < .000$). That is to say, peers tend to assign moderately similar scores on all criteria when assessing a project.

Table 3
Results of ICC test of five assessment criteria scores

Intraclass Correlation Coefficient ICC							
	Intraclass Correlation ^b	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.497 ^a	0.465	0.529	6.920	786	3930	0.000
Average Measures	.855 ^c	0.839	0.871	6.920	786	3930	0.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Project plan innovation assessed in students' verbal feedback

We performed a qualitative content analysis of students' verbal feedback reports in three categories: the positive features of the project, required improvements, and summative project assessments.

We found that in their verbal feedback, students refer to the innovativeness of the plans they are assessing using phrases such as "innovative" "brilliant idea" "great idea" "excellent idea" "good idea" or alternatively, "not really new" and "Facebook is passé."

Furthermore, analysis of the themes extracted from the feedback reports indicates that students consider innovation as a complex assessment dimension that includes multiple types of innovations, including technological innovations, content innovations, design innovations, pedagogical innovations, and recombinations of innovations or unique recombinations of existing elements. Most of the project plans were based on a unique remix and implementation of existing technologies, contents and pedagogies rather than inventing breakthrough technological innovation.

A prominent example of a remix is a program that proposed to establish a distant learning center for people with learning disabilities, based exclusively on new media: online games, websites, video lessons, etc. Each of these elements is already in use in the education system, but the bundle of all these options in a single learning site for a specific audience is a remix innovation.

Another example, a project that proposed to open an Instagram group on environmental issues, to which students can upload photographs of their own efforts in environmentalism, was not considered to contain any technological, design, or conceptual innovation, but the connection between environmentalism, educational goals, and a communication platform that is not frequently used in the education system, was judged to be an original connection and idea.

When a prominent and fundamental feature of the new medium was involved the plan was assessed as innovative. Examples include the use of Facebook timelines to teach the development of a series of historical events, or the use of social network profiles to create profiles for protagonists of plays and movies and creating imaginary conversations between them on social media.

Innovation assessments are context-dependent and depend on students' knowledge. There is a tendency to label all contemporary and unfamiliar technology as innovative, but assessing innovation of the projects is frequently a function of the medium that the project uses. Students' feedback reports indicate that students differ in their opinions about whether a Facebook-based project should be considered innovative: some argued that Facebook is an old mode of communication because more than a decade has elapsed since Facebook emerged, and children and adolescents make little use of this platform. In contrast, others argued that the use of Facebook was not common in the education system at the time. According to students' feedback reports, WhatsApp, Snapchat, Instagram, and Pinterest are considered innovative. The use of apps or simulators was also considered innovative.

Assessing the innovativeness of a technology apparently also depends on the students' own program of study. Students of design, communications, and cinema studies, who are more highly exposed to the use of net media tools, tended to define the use of Facebook as "old-fashioned." They also tended to include less well-known software for mapping, image processing, film editing, and content curation. Students of these fields also evaluated video film creation and uploading as less innovative, while students of theater and dance evaluated film creation as sufficiently innovative. Students of communications and cinema tended to make more critical remarks in their feedbacks on the use of film language in the clips that were produced for several projects to explain the project's operation.

However, a project that was not judged as being innovative, but provided an appropriate response to an important need, was generally judged to be very good and even innovative and would receive a high summative grade.

Based on an analysis of the students' feedback, it is possible to identify several sub-categories of innovation:

- Creative idea - assigning a creative name to a Facebook group, website, or digital media product.
- Implementation of innovative technology - use of new app or app with a unique use, use of simulations, use of relatively new social networks other than Facebook such as Instagram, WhatsApp, Snapchat and Pinterest.
- Development of an innovative technology - for example, developing an app for photography teaching, developing a simulator to deal with fear of public speaking.
- Content innovation - For example, producing films on Eshkol-Wachman movement notation for dance teaching; producing an interesting film that demonstrates the project's program, creating a blog based on radical feminist and transgender images and posts, developing an app for sex education.
- Functional innovation – Use of new technologies to satisfy existing educational needs which were satisfied before by face to face exercises. For example, use of Facebook pages to create profiles of imaginary characters; develop dialogues involving characters in a play; constructing a timeline of the development of communication technologies, the history of film or a series of historic events.
- Formative (Design) innovation - For example, developing a feminist magazine that has a unique design language, producing a film with a unique film language.
- Marketing innovation – customization to an audience. For example, customizing content and design of a social network page to a specific audience such as adolescents with acne or victims of violence or sexual abuse.
- Pedagogical innovation - teaching methods such as flipped classrooms that replace frontal lectures; collaborative learning; project-based learning; peer assessment; management of the pedagogical activity on a social network; MOOC or online video-based lesson. Occasionally a program's innovativeness stems from the distribution of a small innovation on a large scale. For example, a project that brings teenagers together or promotes inter-school collaboration on a social network will be thought of differently when a scaled-up model of the project is imagined in the form of a global network of teenagers or schools.
- Innovative remix - innovation based on a new multi-dimensional combination of all or of some of the elements mentioned before.

Additional project assessment criteria in students' feedbacks

Based on the verbal assessments of the projects, comments on the projects' strengths and ideas for their improvement, additional assessment criteria emerge that were not originally included in the peer assessment scheme. Assessments addressed the values that a project promotes, such as collaboration, solidarity and social cohesion, environmentalism, aid to weak populations, financial savings, time saving, and connection between reality and the virtual world. The assessment attributed importance to the extent of the project's contribution to learning and coping with problems and weaknesses. Projects that help weak population groups and individuals with learning disabilities (dyslexia, ADHD) tend to be assessed as good projects with a good contribution.

Assessments also addressed the need to improve the quality of the contents or language of the medium that the project either created or used.

Although they were not requested to do so, students were aware of the challenge to motivate school pupils to participate in and become involved in social networks and the Internet in general, and the assessments touched upon the issue of motivating participants to actively take part in the project. Projects based on what learners like were noted as offering an advantage. Projects were noted for being "cool" "interesting" "game-like" "fun" and that "pupils love music." In suggestions for improvement, the assessments challenged project developers to consider more deeply what would interest and motivate adolescents to participate. The assessments noted the need to create additional incentives to promote

pupils to participate, as the online audience is not a captive audience.

Although they were not requested to do so, the assessment also addressed economic and marketing aspects of the projects. Assessments noted the need to raise funds and support regarding projects that were based on a significant investment or time and resources. Assessments also noted projects' viral distribution potential as a foundation from which the project might grow and expand.

Several projects raised ethical concerns among the assessing students. For example, a project designed to create a social media support group for pupils suffering from acne, raised concerns regarding the expertise of the consultants, and it was suggested to add a dermatologist and psychologist on the advisory team that would be available to answer pupils' questions. A project concerning the development of a sex education app also raised several ethical concerns such as: what should the role of sex education experts be in the process; are ordinary teachers capable of leading a class in using such an app, should discussions on such sensitive and private issues be conducted in person rather than on the Internet; should discussions take place in groups or individual consultations; should a teacher force pupils to access the app in class; how would the app protect participants' privacy and would access be anonymous or not.

Summary and Conclusions

We found that summative scores had the strongest correlation with scores regarding programs' responsiveness to an existing need ($r = 0.721$), followed by a moderate-high correlation between summative scores and innovation scores ($r = 0.654$). A similarly strong correlation was found between summative scores and new media integration scores ($r = 0.621$). Those variables have the most predictive power of the summative grades. The existing model of assessment predicts 70% of the summative grades. The findings of the qualitative analysis of verbal assessment might suggest an explanation to the rest 30%.

We found students play a major role in MOOCs based on peer assessments. Assessing learning outcomes based on a process of planning and development, as were the project programs described above, is a significant challenge for MOOCs because such outcomes are difficult to assess using automatic schemes based on numerical scoring.

Important insights emerged from the findings of this study, which may contribute to the improvement of assessment schemes used to assess project programs integrating new media and networked pedagogy, and improve assessments of program innovativeness and peer assessments in general in MOOC courses.

The findings of this study show that students can be serious assessors. The peer assessments were valuable and contained breakthrough thinking on ideas and ways to improve the existing assessment scheme and to assess innovativeness.

The study offers an important contribution to rethinking of assessment of the project plans. We found the verbal assessment of the innovativeness of a project is not clear. It is based on the extent of subjective evaluation of the medium's innovativeness. This conclusion supports the arguments presented in the theoretical background to the study regarding the ambiguity and subjective nature of the concept of innovation and the difficulty in achieving a precise evaluation of innovativeness (Kalman, 2016; Kotsemir, Abroskin & Meissner, 2013; Poys & Barak,).

Qualitative analysis findings also indicate that innovation assessment should be considered composite assessments based on four main sub-categories: technological innovation, content innovation, pedagogical innovation, and remix innovation (stemming from combinations and connections between technology, content, and pedagogy), based on the TPACK model developed by Mishra and Koehler (2006). All the project programs submitted in the course, including those based on design and content innovations, were remix-type innovations rather than revolutionary or disruptive innovations. This is not surprising because in digital environments, the most accessible way to innovate is through remix (Jenkins et al, 2006) and this point should be taken into account in revising the assessment scheme. Indeed, many studies indicate that most innovations are incremental and only few are technologies that constitute a leap or a disruptive innovation (Blondheim & Shifman, 2003; Christensen, Horn, & Johnson, 2008).

The qualitative content analysis supports the arguments that assessing innovation in an educational organization must also be based on the goals of the organizations. It is advised to adjust the assessment scheme to ethical and learning values that are not necessarily technological or economic goals (Kalman, 2016; Poys & Barak 2016).

The assessment criterion "satisfies a need" was found to be the strongest predictor of the peers' summative grade awarded to the program. An analysis of the verbal assessments of this criterion highlights the need to further clarify the types of needs that peers should assess. In the feasibility criterion, students should be directed to assess cost-benefit aspects of the project and explain what resources are required for the operation of the project.

Following an analysis of students' verbal peer assessments, we propose to add the following three criteria to the assessment scheme in the next MOOC "new media in education":

1. Extrinsic and/or intrinsic motivations of teachers and pupils to participate in the project. As social networks are open communication arenas based on users' choice and spontaneous participation, the assessment of the project should explain the motivating factors used to promote participation of teachers and pupils in the project, as well as factors that might be barriers to participation.
2. The project's values and ethical principles. In view of the fact that many project programs are based on social networks and user content, project assessment should relate to ethical judgment and discretion in designing the projects, especially when implementation involves exposure of users' personal and sensitive information, and advice that may harm users' health and safety.
3. Program clarity. We found that the main reason for a low peer assessment score is a ambiguity and lack of clarity regarding the program and its implementation. Therefore this dimension should also be added as a criterion of assessment.

Developing an assessment scheme for project plans based on the insights of this study will improve peer assessments of projects based on innovation and creativity in MOOC-type courses. All the assessment criteria should be well explained and assessors should also be given opportunity to suggest additional criteria and categories of assessment.

References

- Atar, S., Carmona, R., & Tal-Meishar, H. (2017). The meaning of the concept of innovation in the discourse on learning technologies. In Y. Eshet-Alakalay, A. Blau, A. Caspi, N. Gery, Y. Kalman, and V. Zilber-Varod (Eds.), Proceedings of the Twelfth Chaise Conference on the Study of Innovation and Learning Technologies: The learning man in the technological age (pp. 269-270). Ra'anana: Open University. [Hebrew]
- Avidov-Ungar, O. and Eshet-Alkalai, Y. (2011). The Islands of Innovation Model: Opportunities and Threats for Effective Implementation of Technological Innovation in the Education System. *Issues in Informing Science and Information Technology*, 8, 363-376
- Blondheim, M. and Shifman, L. (2003). From the Dinosaur to the Mouse: The Evolution of Communication Technologies. *Patuach*, 5:22-63. [Hebrew]
- Christensen, C., Horn, B. M., & Johnson, C. W. (2008). Disrupting class: How disruptive innovation will change the way the world learn. New York: McGraw Hill.
- Duval-Couetil, N. (2013), Assessing the impact of entrepreneurship education programs: challenges and approaches. *Journal of Small Business Management*, 51, 394-409. doi:10.1111/jsbm.12024
- Hamilton, E. R., Rosenberg, J. M., & Akcaoglu, M. (2016). Examining the Substitution Augmentation Modification Redefinition (SAMR) model for technology integration. *Tech Trends*, 60, 433-441. Retrieved from <http://dx.doi.org/10.1007/s11528-016-0091-y>
- Harari, Y. N. (2015). The history of tomorrow. Tel Aviv: Kinneret, Zemorah Bitan, Dvir. [Hebrew]
- Hativa, N. (2014), The tsunami of MOOCs: Will they lead to an overall revolution in teaching, learning, and higher education institutions? Overview. *Horaah Ba'akademia*, 4. [Hebrew]
- Heng, L., Robinson, A. C., Young. J. P. (2014). Peer grading in a MOOC: Reliability, validity, and perceived effects. *Journal of Asynchronous Learning Networks*, 18(2), 2.
- Jenkins, H., Clinton. K., Purushotma, R., Robison. A., & Weigel, M. (2006). Confronting the challenges of participatory culture: Media education for the 21st century. PLACE: MacArthur Foundation.
- Kalman, Y.M. (2016). Cutting through the hype: Evaluating the innovative potential of new educational technologies through business model analysis. *Open Learning: The Journal of Open and Distance Learning*, 31 (1), 64-75. [accepted version] [e-print]
- Kelly, M. A. (2008). Bridging digital and cultural divides: TPK for equity of access to technology. In AACTE Committee on Innovation and Technology (Ed.), *Handbook of technological, pedagogical, content-knowledge (TPCK) for educators* (pp. pp. 31-58). London: Routledge.
- Koehler, M. J., & Mishra, P. (2008). What is technological, pedagogical, content knowledge (TPCK)? In AACTE Committee on Innovation and Technology (Ed.), *AACTE (Edited) Handbook of technological, pedagogical, content-knowledge (TPCK) for educators* (pp. 3-30). London: Routledge.
- Kotsemir, M., Abroskin, A. & Meissner, D. (2013). Innovation concepts and typology: An evolutionary discussion. Higher School of Economics, 1-49. DOI:10/2139/ssrn.2221299.
- Kurzweil, R. (2005). *The Singularity is near: When humans transcend biology*. New York: Viking Press.
- Melamed, A, & Goldstein, A. (2017). Teaching and learning in the digital era. Tel Aviv: Mofet. [Hebrew]
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A new framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.

- Oman, S. K., Tumer, I. Y., Wood, K., et al. (2013). A comparison of creativity and innovation metrics and sample validation through in-class design projects. *Research in Engineering Design*, 24(1), 65-92.
- Poys, Y., & Barak, Y. (2016). Pedagogical innovation and teacher training – An introduction. In Y. Poys (Ed.), *Teacher training in the maze of pedagogical innovation* (pp. 7-24). Tel Aviv: Mofet. [Hebrew]
- Puentedura, R. (2014). Learning, technology, and the SAMR model: Goals, processes, and practice [Blog post]. Retrieved from <http://www.hippasus.com/rrpweblog/archives/2014/06/29/LearningTechnologySAMRModel.pdf>
- Robinson, K., & Aronica, L. (2016). Creative schools: The grassroots revolution that's transforming education. New York: Penguin Books.
- Sandeen, C. (2013). Assessment's place in the New MOOC World. *Research & Practice in Assessment*, 8, 5-12.
- Shkedi, A. (2003). Words trying to touch. Tel Aviv: Ramot, Tel Aviv University. [Hebrew]
- Solomon, G. (1998). Communications. Tel Aviv: Am Oved [Hebrew]
- Suen, H. K. (2014). Peer assessment for massive open online courses (MOOCs). *The International Review of Research in Open and Distance Learning*, 15(3). PAGES
- Tzenza, R. (2017). Controllers of the future: Capital, government, technology, hope. Tel Aviv: Kinneret and Zemorah-Bitan. [Hebrew]
- Volkmann, C., Wilson, K. E., Vyakarnam, S., Mariotti, S., & Sepulveda, A. (2009). Educating the next wave of entrepreneurs: Unlocking entrepreneurial capabilities to meet the global challenges of the 21st century). A report to the Global Education Initiative. Geneva: World Economic Forum.
- Wadmany, R. (2017). Digital pedagogy in theory and practice. Tel Aviv: Mofet [Hebrew]
- Wadmany, R. (2018). Digital pedagogy: Opportunities for learning otherwise. Tel Aviv: Mofet [Hebrew]

Underequipped skilled educators. The case of Southern Italian high school teachers for students with special educational needs

Anna Dipace, Fedela Feldia Loperfido¹, Jarmo Viteli², Katia Caposeno¹ & Alessia Scarinci¹

Università di Foggia, Italy¹; University of Tampere, Finland²

This article has been developed jointly by the authors.

Katia Caposeno wrote the sections 1 - Introduction and 8 - Conclusions

Alessia Scarinci wrote the section 2 - Theoretical perspective

Anna Dipace wrote the sections 3 - Aims, 4 - The context and 5 - Data collection

Fedela Feldia Loperfido wrote the sections 6 - Data analysis methods and 7 - Results

Jarmo Viteli supervised the whole research design.

Conference subtheme: Teacher Education & Digital Technology

Abstract:

How is digital culture at school shaped? How do teachers perceive the use of ICT in education and, more specifically, in the teaching activities they arrange? This paper describes a research inspired to Opeka. This is a Finnish project realized by the University of Tampere since 2004 and aimed at grasping the teachers' perception on ICT in education through a 106-items questionnaire. By this first research, it emerged that four different factors (Leadership and Management, Time and Motivation, Resources and Access to Resources, Confidence and Competence) compose the teachers' digital culture. We translated the questionnaire from Finnish to Italian and administered it to the participants in the TFA program at the University of Foggia (IT). We then run Principal Component Analysis, and two Independent t-test and Manova test to grasp the differences of the factors in relation to some demographics. Results show that, in the Italian sample, the factors imply components about both rules and contribution of the educational community in the mediated learning activities. Several significant differences emerged in relation to demographics on the different factors. However, probably these differences can be culturally mediated.

Keywords: teachers' digital culture, media and education, factors, demographics and differences

1. Introduction

The use of ICT has modified the didactic practices and continuously transforms learning activities, methods and settings (Limone, 2012). In turn, pedagogy is required to strengthen the strategic role of ICT in the learning contexts (Dipace, 2015). These changes in the educational field is sustained by the development of new studies and by European polices trying to integrate Information and Communication Technology (ICT) in education. National and local laws as well are regulating the use of ICT at school and promoting the development of the so called "Digital Agenda". As Messina & De Rossi (2015) highlight, the knowledge society is trying to integrate the educational models in the changing contemporary society. According to this perspective, as new devices are developed and spread, students' digital skills have to be increased. In order to support this advancement, several dimensions should be taken into account when pedagogical activities are designed. In our view, they are the teachers' digital culture, the students' view on technology in education and the specific context within which these two dimensions interact with one another. We do claim that the context is composed, in turn, by several other characteristics, like specific laws, cultural values on ICT and education, principles within a school, historical aspects about ICT, and so on. In this paper, we focus on the dimension of the teachers' digital culture. We first propose a literature's frame on the topic, by describing how digital

Corresponding author

Email address: anna.dipace@unifg.it

culture at school can be understood, what aspects can compose it and how it can be described through both surface and deep levels. Then, we analyse how the teachers' digital culture is characterized in an Italian sample of students in a TFA course at the University of Foggia (IT).

2. Theoretical perspective

In the contemporary society, an enlargement of the educational contexts is needed, by integrating both formal and traditional educational institutions with no formal and informal ones. This process asks for the development of a new role for teachers, since new teaching skills have to be identified. These competences imply both appropriate design of innovative learning activities and use of ICT in education (Gallina, 2008). This implies the possible integration of both face-to-face and digital didactics, the blending of the traditional tools/activities (like the use of papers or the organization of the learning activities in a face-to-face classroom) with the virtual environment. In a broader view, we can say that: "The total competence of teachers and instructors consists of a number of components where professional competence, the ability to teach the subject, the ability to structure the learning activities and knowledge of assessment and guidance are central elements" (Brown, 2001, p. 281). At the specific level related to the hybrid learning activities, we ask what roles ICT can play. Ingrosso (2004) claims that the teacher is the director of a complex educational scenario, mediating between the learning practices the student participates in and the chances given by technology. This implies a new teacher-profile composed by innovative and complex characteristics. Indeed, the teacher is:

- A learning designer, since she plans pedagogical activities and experiences in blended (mixing virtual and face-to-face) environments;
- Authoritative but not commanding, since she empowers students in the management of their own learning path, supports personalized learning experiences, and shares with students digital, multimodal and social learning environments;
- Collaborative, since she uses the digital tools to create and share the learning projects, and to compare herself to colleagues;
- Digital, since she makes advantage of digital platforms not just as repository of books, exercises and so on, but as tools to develop new interactions supporting the learning processes;
- A researcher, since she organizes the educational activities by looking at the student's results;
- Able to create the so called "ubiquitous assessment" (Googman, & Carey, 2004), which implies the use of evaluation activities all along the learning process and not just during defined steps or at the end of the learning experience.

In this panorama, web 2.0 gives the chance to create virtual learning environments enabling both distance collaborative work and sharing of materials (Vayola, 2016). However, some studies (Avvisati et al., 2013) showed the difficulties of integrating educational technological tools. Such a difficulty often depends on "external" obstacles (like the lack of the adequate equipment in schools), which can be defined as first level barriers (Hew & Brush, 2007). However, there is also a second level of obstacles, which are the internal ones and are related to the know-how of teachers and schools about the educational technology, the teachers' digital skills, and their attitudes, beliefs and perceptions about the digital tools (Ertmer, 2005, 2012; Gallego & Masini, 2012). Buckingham (2007) claims that teachers are still resistant to the introduction of ICT in classroom, since its usefulness to the increasement of students' achievement is not clear. That is, very often teachers perceive the role of technology in education as being ambivalent. However, a question still stays on: how is the teachers' digital culture characterized? By referring to the general teaching process, Stevenson (2006) describes it as a system of relationships among the management, the rules and the artefacts. Furthermore, he defines four metaphors to describe ICT. They are depicted as resources, tutors, environments and tools. The idea of ICT as resource refers to the ways teachers choice different digital technologies and us them to answer the students' needs. The image of ICT as a tutor represents the idea that digital technologies are designed and built to support the students' learning process, to guide it and to scaffold its steps. The metaphor of Environment is about the idea that students can control and autonomously explore digital microworlds wherein they build their own knowledge. In other words, in this microworlds, students teach the computers, instead of being taught by them. The image of ICT as a tool is more common than the previous ones and has several meanings (a mere tool for doing a task, a resource to support thinking processes, and so on). These metaphors seem to describe the connection point between students and teachers, that interconnecting space between the main actors of the learning experience. However, by a more general view, Loveless (2011) suggests that three aspects shape the relation between ICT and

teachers' working. Namely, economic, social and cultural settings guide the us of ICT for both teaching and learning. Furthermore, the change over time of teachers' knowledge about ICT in education is a facet to be considered to understand the way the digital culture at school can be composed. Brown (2001) recommends that both tacit and explicit dimensions shape the digital teaching. The tacit one is like the roots of a tree or, in short, those deep and immerse meanings about digitally mediated educational processes. The explicit dimension, instead, is like the leaves, the visible aspects which are on the surface of the learning experiences. More specifically, "The tacit dimension is like the roots buried below the surface and deeply immersed in the soil that makes it robust. The explicit lives in books and in our brains as concepts and facts and deals with the "know-what." The tacit deals with the "know-how" that is best manifested in work practices and skills. The tacit resides in action, most often in participation with others. As a consequence, tacit knowledge can be distributed as a shared, socially constructed understanding that emerges from collaboration" (*Ibidem*, p. 68). Viteli, Sairanen, & Vuorinen (2013) elaborated a four-factors more specific schema to describe how both teachers' and schools' digital cultures are shaped. Namely, the following four dimensions characterize such cultures: 1) Leadership and Management. This is about the way teachers organize the digital tools for creating learning activities, the cooperative or conflicting interactions they have with colleagues and/or technical experts at school; 2) Resources and Access to resources. This is about the perception of having enough or insufficient resources (tools, infrastructures, and so on) for making mediated learning activities; 3) Confidence and Competence. This is about the skill and experience teachers have about the use of digital devices in the teaching activities; 4) Motivation and Time. This involves the motivational dimension supporting the teachers' use of ICT in education.

In this paper, we initially refer to this four-factors schema to grasp the factors composing the digital culture of the Italian burgeoning teachers involved in this study. Then, we grasp the characteristics of the dimensions grasped through Principal Component Analysis and the differences among participants according to some demographics.

3. Aims

- To measure which factors are associated with the perception Italian teachers have about the use of ICT at school;
- To analyse what demographics (gender, experienced/not experienced teachers, the level of schools) are associated with those factors in a TFA course for teachers of students with special educational needs;
- To analyse eventual differences and commonalities between two different educational contexts (the Finnish and the Italian ones).

4. The context

The research was inspired by Opeka, which is a Finnish project lead by the University of Tampere (FI). It was aimed at grasping the digital culture of schools by answering a 106 items self-report questionnaire exploring the dimensions shaping the teachers' perception of ICT at school. Namely, it is aimed at measuring the distribution of digital devices in schools, their use for didactic purposes, the teachers' digital skills and the digital competences teachers taught students. During Opeka project (since 2004 and still ongoing), more than 3000 teachers were interviewed in Finland. Right after the compilation, teachers received the results of the questionnaire compared with the results of their own school and the municipality where this is located. As results, it emerged that the four factors (Leadership and Management, Resources and access to resources, Confidence and Competence, and Time and Motivation) described in the paragraph "2.Theoretical perspective" compose the teachers' digital culture. In October 2017, we repeated the administration of the questionnaire in Apulia, a Southern Italy region. The participants were attending TFA, which is one of the possible alternative paths people can attend in Italy to become teachers. Namely, a person can get the qualification as a kindergarten or primary school teacher by attending a specific 5-years master degree. To become a secondary school teacher, instead, you have to get a master degree on a specific field (e.g. Science, Literature, etc.) and then a 1-year specialization degree (which is the TFA) to learn pedagogical theories, methods and tools. During TFA, students (the future teachers) participate in both theoretical and training activities to learn by senior teachers how to teach. After the qualification, teachers can work as substitute teachers or can participate in a public competitive exam to become tenured teachers. TFA are organized by public universities and to become a teacher for students with special educational needs you have to attend TFA even to teach in both kindergarten and primary school. The participants in this research were teachers attending TFA for

special educational needs organized at the University of Foggia for 2017-18 academic year. Therefore, in the entire sample of participants, there were four different groups of teachers corresponding to the four school grades existing in Italy (Kindergarten, 28%; Primary school, 28%; Middle school, 17%; Secondary school, 27%). Furthermore, some participants are already teachers taking the qualification for special educational needs (85,5%), some others are becoming teachers through TFA course (3,5%), some others are at the first year of teaching (11%).

5.Data collection

The original Finnish questionnaire was translated to Italian by two researchers who first made a literal translation. Then, a broader team of researchers (composed by four experts) checked the translation and rearranged it by taking into account the Italian cultural aspects about the teaching processes. During a third step, 10 teachers were involved to complete the questionnaire and indicated eventual unintelligible aspects. As a further step of the questionnaire's preparation, the team arranged the final questions according to the teachers' suggestions. The definitive tool was a 60-items self-report questionnaire (five demographic questions and 55 questions about the perception teachers have about the use of ICT in education). Each of the 55 items was structured as a five-points Likert scale (0=completely disagree, 5=completely agree) and the questionnaire was administered during the first week of the course by an online google module. Furthermore, the 55 items were split in four scales: 1) Digital working environment (5 items), composed by items about the technological infrastructures and the usability of ICT at school; 2) Organizational culture (8 items), composed by items about the use of ICT in the school community and the teachers' professional development; 3) Pedagogical activities (26 items), composed by items about the use of ICT in education, the activities teachers usually take at school by using ICT, the use of ICT in didactic activities by students (according to the teachers' perception), the evaluation practices mediated by technologies and related to ICT mediated educational activities; 4)The teachers' digital skills (11 items), composed by items exploring the planning of digital contents and environments by teachers, the safeness related to the use of ICT at school, the teachers' digital skills about old and new media for education.

6.Data analysis methods

After collecting data, we used the following methods of analysis:

- Explorative factorial analysis through Principal components method (PCM) to detect the dimensions composing the Italian teachers' digital culture. We run PCM by asking for four factors, according to literature;
 - The calculation of the reliability of the factors emerged through the factorial analysis;
 - The calculation of the correlation of the factors emerged through the factorial analysis;
 - The creation of four sum variables corresponding to the reliable factors;
 - The independent samples t-test to detect differences between males and females;
 - The independent samples t-test to detect differences between experienced teachers and not experienced teachers;
 - Manova test to detect the differences among the participants belonging to the several school levels (kindergarten, primary school, middle school and secondary school).
- All of the analysis was made through IBM SPSS software.

7.Results

An initial principal component analysis (PCA) was conducted on the 100 items (106 less the demographic items) with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, $KMO=.762$ («good» according to Field, 2009), but not all KMO values for individual items were above the acceptable limit of .5 (Field, 2009). Bartlett's test of sphericity $\chi^2(2346) = 6,722$, $p<.001$ showed that not all the correlations between items were sufficiently large for PCA. Therefore, just items with correlations larger than .3 were taken (Field, 2009), which were 55. PCA was conducted just on the 55 items with orthogonal rotation varimax. According to literature (op.cit.), PCA was run by asking for four factors. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, $KMO=.813$ ("great" according to Field, 2009) and all KMO values for individual items were above the acceptable limit of .5 (Filed, 2009). Bartlett's test of sphericity $\chi^2(1653) = 5,927$, $p<.001$ showed that all the correlations between items were sufficiently large for PCA. Table 2 shows the number of item clustered on the same component and the variance explained by each component.

Component	Number of items	Variance explained	Reliability (Cronbach's α)
1	17	15,79 %	.93
2	17	14,09%	.93
3	12	13,55%	.90
4	8	8,64%	.87

Table 2
COMPONENTS, NUMBER OF ITEMS, VARIANCE AND RELIABILITY

By analysing the items composing each factor, we defined the components as follows. Component 1 represents the "Use of ICT and teaching", since it is composed by items exploring the reasons why teachers could use digital tools during their job week or their students should use them (e.g., to build collaborative knowledge, for interdisciplinary learning activities, to interpret information, and so on). Component 2 represents "Innovative teaching and evaluation", which implies items grasping if and how teachers can use new technology for innovative learning and assessment activities (e.g. I use e-portfolios to evaluate students, I use learning analytics to assess the students' activities, I use virtual reality activities, and so on). Component 3 represents "Rules and digital skills", which involves those items analysing how teachers perceive the rules related to the use of technology (e.g., When I use a new digital tool I always read the terms of use and conditions, I guide students to protect themselves from the common risks related to the use of new technology, I know how to use digital materials for teaching, etc.). Component 4 represents "Educational community", which implies items exploring the technical support in the use of digital tools by colleagues and specialists (e.g. I receive technical support for the digital tools at school). Furthermore, it is saturated by items analysing the relational dimension of the school community and the eventual support it gives to the teachers (e.g. We share suggestions and support each other about the use of new technology for education). After running the PCA, we checked the correlation among the four factors through Persons' r. Results show that Component 1 has a significant positive relationship with Component 2, $r=.61$, p (one-tailed) $<.01$; Component 3, $r=.72$, p (one-tailed) $<.01$; Component 4, $r=.31$, p (one-tailed) $<.01$. Component 3 has a positive significant relationship with Component 2, $r=.74$, p (one-tailed) $<.01$ and Component 4, $r=.36$, p (one-tailed) $<.01$. Component 4 has a positive significant relationship with Component 2, $r=.36$, p (one-tailed) $<.01$ as well.

We also run the independent samples t-test to detect differences between males and females. Results show that, on average, male participants have a higher score ($M=49,88$, $SE=2,88$) than female ($M=41,97$, $SE=1,13$) on Factor 1. This difference is significant $t(153)=-2,32$, $p<.05$. On average, male participants have a higher score ($M=48,17$, $SE=3,12$) than female ($M=40,38$, $SE=1,15$) on Factor 2. This difference is significant $t(152)=-2,24$, $p<.05$. On average, male participants have a higher score ($M=42,11$, $SE=1,55$) than female ($M=38,62$, $SE=.89$) on Factor 3. This difference is not significant $t(153)= -1,33$, $p>.05$. On average, male participants have a higher score ($M=27,35$, $SE=1,12$) than female ($M=23,95$, $SE=.58$) on Factor 4. This difference is significant $t(155) = -1,98$, $p>.05$. Therefore, by giving a general glance to these results, there emerges that, on average, male have higher scores than females on all of the factors. These differences are significant for Component 1 (Use of ICT and technology), Component 2 (Innovative teaching and evaluation) and Component 4 (Educational community). They are not significant for Component 3 (Rules and digital skills).

Much more interestingly, we run the independent samples t-test to detect differences between experienced teachers (80%) and not experienced teachers (people having the first teaching experience during the TFA training) (20%). Results show that, on average, experienced teachers have a higher score ($M=43,62$, $SE=1,16$) than not experienced teachers ($M=39,25$, $SE=2,92$) on Factor 1. This difference is not significant $t(151) = -1,46$, $p>.05$. On average, experienced teachers have a higher score ($M=41,62$, $SE=1,18$) than not experienced teachers ($M=39,58$, $SE=3,33$) on Factor 2. This difference is not significant $t(150) = -.66$, $p>.05$. On average, experienced teachers have a higher score ($M=39,58$, $SE=.86$) than not experienced teachers ($M=35,87$, $SE=2,43$) on Factor 3. This difference is not significant $t(151) = -1,64$, $p>.05$. On average, experienced teachers have a higher score ($M=25,51$, $SE=.59$) than not experienced teachers ($M=23,38$, $SE=1,41$) on Factor 4. This difference is not significant $t(153) = -.771$,

$p>.05$. Therefore, by looking by a glance this analysis, we can see that, on average, experienced teachers have higher scores than not experienced teachers on all of the factors, but that these differences are not significant.

At the end, we run Manova test to detect the eventual differences on the factors in relation to the different levels of school (kindergarten, primary school, middle school and secondary school). Namely, A separate ANOVA was conducted for each dependent variable, with each ANOVA evaluated at an alpha level of .025. There was a significant difference among the teachers' groups on Factor 1, $F(4, 144)=11.85$, $p=.000$, partial $\eta^2=.248$ with secondary school ($M=52.08$) scoring higher than middle school ($M=46.92$), primary school ($M=42.71$) and kindergarten ($M=35.42$). There was a significant difference among the teachers' groups on Factor 2, $F(4, 144)=3.299$, $p=.013$, partial $\eta^2=.084$ with secondary school teachers ($M=48.229$) scoring higher than middle school ($M=40.28$), primary school (39.286) and kindergarten ($M=38.048$). For Component 3 "Rules and digital skills" the assumption of Levene's test $>.05$ was not met. For Component 4 "Educational Community" $p>.025$.

8. Conclusion

As quoted in Windschitl & Sahl (2002), several studies suggest that teachers who use technology tend to become more constructivist in their pedagogical orientation over time (Becker & Ravitz, 1999; Means, 1994; Mehlinger, 1996), but even that literature has not offered clear explanations for how or why some teachers transform their practice. Part of the reason for the lack of explanatory power in this research base is that the majority of studies have been devoted to tracing changes in individual teachers' knowledge, beliefs, and instructional practices, while ignoring the fact that teachers' thinking is often influenced by both the social contexts in which they operate and the institutional cultures that profoundly shape the meaning of their work (Little, 1990; Minick, 1985). This theoretical aspects seem to match and explain some results emerging from this research. Namely, we can say that an interesting difference emerges between the Finnish and the Italian contexts. That is, the Finnish components were "Leadership and Management", "Resources and Access to resources", "Confidence and competence", "Motivation and Time". In the Italian context, we defined the following factors "Use of ICT technology", "Innovative teaching and evaluation", "Rules and digital skills" and "Educational community". In some ways, the Finnish factor "Resources and access to resources" and the Italian one "Use of ICT and teaching" are similar. However, in the Italian sample, the use of digital tools seems to be connected with the teaching activities in a unique factor. The Finnish component "Confidence and competence" can be associated with the Italian one "Rules and digital skills", since both of them represent the dimension about digital competences teachers have. However, the Italian factor seems to stress the role of rules and, perhaps, the idea that teachers are not yet confident with the use of ICT at school and need to take into account what both formal and procedural rules point out to use ICT in an effective way. At the same time, the factor that we called "Educational community" emerges. In this sense, it seems that both co-constructivist and collaborative processes are in some ways related with the use of ICT. That is, the role of the community shaped by colleagues, principals, technical experts, and so on is defined as a component characteristic for the Italian context. Another interesting result is about the difference between male and female teachers in the sample. That is, according to the independent t-test, on average, males have significant higher scores on Component 1, 2 and 4. That is, by going in depth in the items of the respective factors, it seems that males are more confident than females with the use of ICT in education. In respect to the differences related to demographics, the independent t-test to get the differences between experienced and not experienced participants shows that there are differences between the two groups (more experienced teachers have, on average, higher scores on all the factors). This result suggests that can be a mediation of the experience in the way teachers perceive and use ICT for education. Manova test also shows that, on factor 1 and 2, there are significant differences among the several groups. Therefore, as you go ahead with the level of school, you can find higher scores on the average.

In a final synthesis, we can say that a difference in respect to the Finnish four-factors schema emerges, since the Italian one takes into account the importance of the rules and the crucial role of the educational community in the use of ICT at school. However, even if these results are interesting, further future research could be run. Indeed, some other questions and hypothesis can be explored, since, for example, cultural aspects can mediate the centrality of rules in the teachers' practice. At the same time, it can influence the emerging of the community aspects and the differences between females /males,

experienced/not experienced teachers, and among the different school levels. Furthermore, from a methodological point of view, this article can represent just a first step of analysis, since there is not a randomized sample. When we run PCA, we took just the items with significant correlations to grasp the four factors and the reliability of each factor was high enough. However, the questionnaire was not a validate scale and needs to be furtherly structured according to the Italian population. The high number of items for each factor can also positively impact on its reliability and subdimensions within each factor could be explored.

References

- Avvisati F., Hennessy S., Kozma R.B., & Vincent-Lancrin, S. (2013), Review of the Italian strategy for digital schools, OECD Education Working Papers, 90,
- Brown, J. S. (2001). Learning in the Digital Age, The internet and the university, 65-91.
- Buckingham, D. (2007) Beyond technology: children's learning in the age of digital culture (Cambridge, Polity).
- Dipace, A. (2015), Videogiochi, scuola e salute, Bari, Progedit.
- Ertmer P.A., Ottenbreit-Leftwich A.T., Sadik O., Sendurur E., & Sendurur P. (2012), Teacher beliefs and technology integration practices: a critical relationship, Computers e Education, 59(2), 423-435.
- Field A. (2009), Discovery statistics using IBM SPSS statistics, Los Angeles: Sage.
- Gallego A.M.J. & Masini S. (2012), Politiche educative e integrazione delle ICT nei sistemi educativi. La situazione italiana all'interno dello scenario internazionale, Profesorado, 16(3), 245-284.
- Gallina M. A. (2008), Insegnare nella società della conoscenza tra saperi dell'esperienza e nuove competenze, Roma, Aracne.
- Hew K. F. & Brush T. (2007), Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research, Educational technology research and development, 55(3), 223-252.
- Limone, P. (2012), Media, tecnologie e scuola, Bari, Progedit.
- Loveless, A. (2011). Technology, pedagogy and education: reflections on the accomplishment of what teachers know, do and believe in a digital age. Technology, Pedagogy and Education, 20 (3), 301-316.
- Messina L. & De Rossi M. (2015), Tecnologie, formazione e didattica, Roma, Carocci editore.
- Viteli J., Sairanen H. & Vuorinen M. (2013), The building blocks of a working digital culture: The case of some Finnish schools, Paper presented in ELearn 2013 - World Conference, Las Vegas.
- Wang J., Odell S. J. & Clift R. T: (2010). Past, present, and future research on teacher induction. An anthology for researchers, policy maker, and practitioners, New York, Rowman e Littlefield Publishers.
- Windschitl, M. &, Sahl, K. (2002). Tracing teachers' Use of Technology in a Laptop Computer School: The Interplay of Teacher Beliefs, Social Dynamics, and Institutional Culture. American Educational Research Journal, 39 (1), 165-205.

How to Motivate New University Teachers for Student-centered Learning

Karolina Duschinská¹ & Radka High¹

University of Chemistry and Technology, Prague, Czech republic¹

Conference subtheme: Professional Development of Teachers

Abstract:

Professional development of university teachers has always been an important issue due to the absence of their pedagogical education, but is particularly important now as the student population at universities has expanded to less prepared and/or qualified candidates. It makes sense that if students are less prepared, teachers need to be more prepared. Therefore, we have developed a new course that targets young and new teachers at the University of Chemistry and Technology, Prague. The rationale of the course curriculum design is presented and followed by the analysis of four complete course cycles. In designing the course it was felt that it would be most beneficial to teach the course tandemly, with one instructor an expert in pedagogy and the other in educational psychology. The positivity of this idea was confirmed in both the planning and teaching phases as the two specialities complemented each other quite nicely (although we would not try to dissuade others from trying different combinations). The course participants appreciated the new information in both pedagogy and psychology, sources of inspiring materials and recommendations for concrete teaching strategies. But perhaps most appreciated was the safe learning climate in the groups, creating a space for sharing and reflecting their own educational practices, including achievements, doubts, worries and uncertainties. Participants also valued their own experience with active learning strategies in the role of students, which points to a high importance of congruent teaching.

Keywords: student-center learning, higher education, university teachers, course curriculum

Description of the Educational Environment

Context

The authors of the article, faculty members of the Department of Education and Human Sciences at the University of Chemistry and Technology in Prague, Czech Republic, were asked to create and implement a course for new faculty members (or teaching assistants) at the University. Although the focus was on those with less experience, the class was open to experienced faculty as well. The aim of the course was to support and develop teacher competencies connected to learning and teaching. Each course cycle was made up of seven, four hour class meetings, plus e-learning support and preparation.

The Importance of Educating New University Educators

Many leading universities around the world have been recently introducing programs for educating their staff in areas of teaching and learning, this might be called a worldwide trend in higher education. New accreditation procedures in the Czech Republic give more responsibilities to the universities and require internal quality assurance. Part of the process is manifested by a growing number of programs offered for pedagogical education of academic staff.

What are the crucial requirements for being a successful university teacher? The authors, In accordance with the literature, strongly believe that this cannot be described by a simple list of do's and don'ts or a "cookbook" of teaching techniques. Furthermore, it is less about what teachers do than it is about what teachers understand in both their field of expertise and pedagogy. According to Bain (2004) the best teachers value human learning, they believe that their students can learn and that teaching can

Corresponding author

Email address: karolina.duschinska@vscht.cz

make a difference. Therefore they are able to engage and challenge students and ensure a supportive environment.

Target Group

We assume that participants attended the course voluntarily. An email with an offer to attend the course was sent to all faculties at the university. The majority of our course participants were new university staff, mostly doctoral students, who were expected to teach laboratory work and seminars. Most of them had very little education in pedagogy and a few hadn't even taught their first class yet. However, in every cycle, there were at least one or two experienced university professors who signed up simply because of their interest in becoming better teachers.

Unlike most teaching positions, being a university professor requires both research and teaching. And, while most professors are well trained in research through their Ph.D. programs, unfortunately very little time is given to training our professors how to actually teach. Furthermore it is known that young Czech academics are actually asking for more training to be better prepared for the classroom (Čejková 2017).

The Process of the Course Curriculum Design

Rationale and Sources for Higher Education on a General Pedagogical Level

We considered the most influencing sources for improving teaching and learning at the higher education level, starting with the concept of deep and surface approaches to learning (Biggs, 1982, Ramsden, 2003) and constructive alignment (Biggs, 1996). Great emphasis is placed on reflective and inquiring approach as a necessary condition for improving teaching (Ramsden, 2003). Learning from the student's perspective should be in the centre of interest, making learning possible is connected with specifying learning goals, activating prior knowledge and promoting students' motivation and participation. Ramsden (2003) identifies three theories of university teaching: one, teaching as telling; two, teaching as organizing; and three, teaching as making learning possible. Biggs (1999) on the other hand specifies: one, learning is primarily a direct result of individual differences between students; two, learning is primarily the result of appropriate teaching; and three, learning is the result of students' learning-focused activities which are engaged by students as a result both of their own perceptions and inputs and of the total teaching context. Biggs and Ramsden's theories might be useful for starting a discussion with university teachers about their own approaches to teaching and learning, and creating an understandable framework for possible future changes.

During the last two decades, the influence of evidence based approach to education has become the most significant. Teachers at all levels of schools should make informed decisions about choosing their teaching strategies and modifying classroom practices, regarding to "what works" evidence and high impact on students' learning. This is advocated by educational psychologists (Slavin, 2012), teacher educators (Petty, 2014) and educational researchers, represented by a synthesis of meta-analysis done by Marzano (2001) and the unprecedented work Visible Learning by Hattie (2012). These sources emphasize the role of a student as an active learner, the importance of teacher's attitudes and estimations of a student's potential and achievement. They also stress the importance of adopting effective teaching strategies, e.g. systematic feedback, setting learning goals, activating prior knowledge, cooperative learning, metacognitive strategies, etc. There has also been a growing educational research seen in science higher education, demonstrating the effectiveness of active learning approaches to teaching (Michael, 2006).

Rationale and Sources for Higher Education Pedagogy, STEM Specific

Michael (2006) summarizes evidence from the learning sciences, cognitive sciences and educational psychology, supporting the idea that active learning works better than conventional teacher-centered approaches. The key principles involve active construction of meaning by the learner, differentiation between declarative and procedural knowledge, context learning and transfer, cooperative learning and the importance of self-explanations.

Richard M. Felder, the Professor of Chemical Engineering at North Carolina State University and author of popular textbooks, His research and publications also deal with various aspects of teaching and learning, emphasizing student-centered instruction. Furthermore, his work includes inspiring practical ways of interactive lecturing big groups (Felder, 2016).

Instruction Methods and Relationships

We were convinced that we should not only "talk" about active and effective teaching and learning but rather, and even more so, to "perform and live" it together with our course participants. Later we

discovered that this principle can be related to so-called congruent teaching (Swennen, Lunenberg, & Korthagen, 2008). Thus, we were dedicated to serve as teacher role models. As early as twenty years ago, Johnson, Johnson, & Smith (1998) advocated for cooperative learning as one of the ways of motivating students. However, few students or teachers do not understand how to work cooperatively. Some teachers might even be convinced about the need for cooperative learning and try to organize group work but usually without any coherent plan. This approach rarely leads to success - teachers usually complain about disarray and noise, some students might complain about unequal division of labor and unfair assessment. Our research found that only way how to adopt and understand cooperative learning and avoid its most common traps, is to experience it and then to undertake a critical reflection and to analyze the advantages and limits of the method. However, cooperative learning should not be overestimated. We believe that a student should first have time for their own individual thinking and elaborating ideas prior to sharing them with the others.

Course methods included interactive lecturing, group discussion, workshops, experiential learning, product creation and analysis, sharing and presenting of experiences and self-study with online support in the e-learning environment Moodle. Most importantly, we wanted to create a safe learning climate, based on mutual respect and trust.

Three More Questions to Consider

After analyzing the most influential sources , we found three more important questions, relevant for the course:

1. Who is the young university teacher? How may his/ her personality, preferences and learning style influence his/ her own attitudes and beliefs about teaching and learning?
 2. Who is the university student?
 3. How to deal with stress and unexpectedly high demands of the new university teacher role?
1. Personality differences between teachers and students or between colleagues can lead to miscommunication. It has been shown (Clack, G. B., Allen, J., Cooper1, D. & Head, J. O., 2004) that people who are able to adjust to the communication style of others, are happier in the relationship. We tried to show these differences to our attendees in the course by one of the most used inventory in the world based on C. G. Jung's theory. Jung (1999) developed a theory of personality in where he distinguished four different dichotomous functions of mind: Extrovert (E) and Introvert (I); Sensing (S) and Intuitive (N); Thinking (T) and Feeling (F); Judging (J) and Perceiving (P). One function in each dichotomous pair is preferred by an individual. For the diagnostic of these function we used The Myers-Briggs Type Indicator (MBTI, Myers & Myers, 1993). MBTI helps to diagnose one of the sixteen personality types and therefore characterize the main aspects of the personality in relationship to a particular mental function. Knowing and understanding MBTI types can facilitate a better communication with those who are different in proceeding information. We are aware of some critical voices against using MBTI but our intention was to provide better understanding about individual differences, not obtaining a clinically accurate diagnostic. We also explained the individual differences due to individual learning styles (Felder & Brent, 2013), its possible strength and difficulties.
2. Our course participants are in contact with a specific group of young people - students who are at the important stage of their life. These students are according to Arnett (2004) in the stadium of emerging adulthood that occurs between adolescence and young adulthood. Arnett (2006) describes emerging adulthood with five features: 1. identity explorations: students can try many various features in the sense of love and work, 2. instability in career decisions, education, partners, 3. feeling in-between (they are not adolescent either adults) 4. self-focused, 5. age of possibilities. Students may feel unmotivated in their studies because their new life includes also other activities (jobs, hobbies, friends etc.) that intervene with studying (Lairio, Puukari, Kouvo, 2013). We try to explain to our attendees that this age is full of opportunities and exploration. Especially in the Czech republic young people highly appreciate the freedom to be single, work, travel and study (Nash, 2005 in Arnett, 2006). These specific issues affect not only the lives of students but also their teachers (our participants) by changing opinions studying and life in general.
 3. New teachers at any school level need both education and support. The specific supportive role should deal with their stress, doubts, worries, uncertainties, voice problems, high workload and, to a certain extend, underestimating of the young academic's work.

Talking is a physical activity that can be tiring. The human voice is the resultant of clearly defined and observable physiological processes. Equally important to these physiological processes is the level of our psychological experience. It should also be mentioned that our personality characteristics play a role here as well.

Dealing with work problems can be a sensitive issue and is sometimes associated with many personal and relationship problems, confusing the situation even more. We decided to use a Balint-like group session in the end of our course. Balint groups were originally used as regularly scheduled meetings within a homogenous group of professionals (e.g. doctors) with a goal to provide a safe, non-judgmental and sensitive environment where problematic and emotionally difficult situations can be discussed and shared. Academics can find themselves in a similar situation. We believe that this method helps with the personal and professional growth of the academics by talking, examining and reflecting their style of communication and teaching strategies.

The Course Curriculum

Within the tight time schedule, we had to choose only the most relevant issues. We decided to cover topics from personality and cognitive psychology, principles of teaching and learning, effective teaching strategies, presentation and class management skills, voice hygiene and problematic situations in teaching.

1. *What is the impact of a teacher's personality on teaching and on the teacher's development?*

Content: The strengths and weaknesses of the university teachers, how they are accepted by their students, self-diagnosis of personality types, what factors may influence personality and teacher type.
Activities: Prior to the lesson, course participants analyzed in the virtual learning environment Moodle a video with four sequences of different teaching models. They focused on interaction with students, style of teaching, etc. They also expressed their own concept of the ideal teacher. During the course, we first discussed their homework analysis and then introduced some theories of competence models and the model QTI - Quality of Teacher Interaction (Wubbels, T. & Levy, 1993). Then, we asked the participants to analyze the video and their own experience again in the light of the theoretical model and compare it with what they had previously thought. Participants were divided into groups on the basis of MBTI types. Each group was asked to describe and then present the prototype of best and worst students. Differences were discussed so that participants could see how different their preconceptions of what makes a good or a bad student.

2. *How do students learn?*

Content: Learning objectives, models of teaching, evidence based effective teaching startegies, ways of activating students, creating favorable conditions for learning, evaluation of student results.
Activities: Lecture on most influential learning paradigms - behaviorism, cognitivism, cognitive and social constructivism. Feedback, followed by formative and sumative assessment.

3. *How does one communicate with university students?*

Content: University students, their educational needs and the achievement motivation, teaching gifted and problematic students.
Activities: The theory of achievement motivation by Atkinson was presented. The participants then could try to diagnose their own achievement needs thanks to an activity (darts) that served as a goal (getting the right number of points) that had to be achieved. We then discussed possible strategies of how to achieve those goals. There was also a lecture that discussed how one engages gifted students.

4. *How to prepare a good lesson and how to teach it well.*

Content: Various forms of teaching at university, quality of lectures, seminars and labs, interaction and learning dialogue in class, lesson planning, preparation of study materials, continuity between seminars and lecture - exercises, teachers' communication. LMS Moodle as online learning support, pedagogical use of Moodle.
Activities: The theory and taxonomy of educational objectives, including Bloom (1956) and SOLO (Biggs & Collis, 1982) was introduced. Then, participants tried to specify prior knowledge and learning objectives aligned with course assessment for their own course or lab.
Model use of e-learning (Moodle) was presented. Participants had to use Moodle as students and

tried a variety activities. During the course they were asked to make a part of their own Moodle course.

5. *How to deal with conflicts and/or problematic situations.*

Content: A secure form of supervision led by the Balint-like Group structure

Activities: Prior to the session, participants were asked to specify a topic related to their pedagogical work, they would like to understand better. We divided the group into two parts, each with one instructor. First of all, we agreed upon safety, voluntariness of communication and confidentiality of all information. The session was focused primarily on understanding, only then on suggesting solutions. The last part was dedicated to analyzing both the individual benefits and the group process.

6. *How not to lose one's voice during teaching?*

Content: Communication skills, verbal and non-verbal communication. Working with one's own voice.

Activities: The goal of the class was to examine psychomotor patterns that we use as we speak, point out some mistakes and try new techniques leading to better voice hygiene.

7. *Participants' presentations*

Content: Individual presentations followed by a collective evaluation and discussion.

Activities: At the end of each cycle, participants prepared their own presentations, where lessons learned in the course would be applied. We offered a variety of tasks in order to support participants' inner motivation and ownership. Examples of tasks: 1. Analyzing the profile of a university teacher, 2. Case study of a university student, 3. Lecture Video Analysis - An Example of Good Practice, 4. Preparing for a teaching activity that includes selected effective learning strategies, 5. Moodle course structure, 6. MOOC - Analysis of own experience with passing the course.

Each individual presentation was followed by a thorough reflection: first, a presenter self-reflected upon his/her own performance. This was followed by a collective peer group reflection which was followed by the course instructors' reflections and evaluations.

Evaluation

During four consequent semester cycles we evaluated the experiences of 55 course participants. At the end of each course cycle we organized an evaluation focus group meeting and collected participants' feedback. The feedback analysis can be divided into three areas: one, knowledge based; two, learning experience; and three, safe climate and support. Additionally, we analyzed our own teaching experience in the roles of course instructors.

Knowledge Based

Participants appreciated new knowledge about research-based teaching and learning strategies, sources of inspiring materials, recommendations for concrete teaching strategies and practical tips and tricks. Young academics stated that it was useful for them to obtain a theoretical systematic structure for what they had been already doing, or, they had planned to do. In other words, they were more capable of promoting their thinking about teaching and learning from implicit to explicit (compare with Biggs, 1996).

Learning Experience

They also valued their own experience with active learning strategies in the role of students, which points to a high importance of congruent teaching. Advantages: one, participants gain a living experience; two, they can reflect this experience, analyze what they learned and how; and three, we (the instructors of the course) as a matter of trust, leave our instructors' roles and point out how we organized the instruction and why, what worked well and what didn't (etc.).

Safe Climate and Support

The participants appreciated the safe learning climate in the group, the possibility for sharing and reflecting their own educational practices, including achievements, doubts, worries and uncertainties. The course also served as a way to gain contacts to people with the same goal - to become a better university teacher. Creating a safe environment was also proven by the fact that some of our participants contacted us with a need of a follow up support.

Course Instructors' Experience

The tandem teaching by one expert in pedagogy and one in psychology had benefits for course instructors, which was reflected in close cooperation during both planning and teaching. At the beginning, the tandem supported assurance and safety in the new teaching role. Analyzing course topics and learning situations from two perspectives resulted in knowledge enrichment for both participants and course instructors. Moreover, it was fun.

Serving as role models requires not only performance, but reflection as well. There is also a risk that instructors' teaching activities might lack some aspects of effective teacher behaviour. On the other hand, these more or less successful experiences might be good learning material. We did not hesitate to discuss openly our planning intentions: ideal expectations compared to the reality. We analysed some possible mistakes, explained why it happened and what the positive (or even negative) outcomes were and how it could have been prevented. This openness required perhaps a bit of courage. On the other hand, surprisingly it was valued positively by the course participants and it turned out that it was a relatively quick way to promote safe environment, mutual respect, trust and understanding.

Conclusions and Perspectives

The participants were not only introduced to new psychological and pedagogical theories and techniques but also found out that some of them already use student-center activities. We tried to connect these experiences with appropriate theoretical conceptions to promote better understanding of students and students' learning. It should be noted that this course is just a beginning, opening the door towards a transition from an intuitive to an intentional teacher. We have planned other activities, including workshops and meetings with participants, that are going to take place in the upcoming weeks.

References

- Arnett, J. J. (2004). Emerging adulthood: The winding road from the late teens through the twenties. New York: Oxford University Press.
- Arnett, J.J. (2006). Emerging Adulthood in Europe: A Response to Bynner. *Journal of Youth Studies*. Vol. 9, No. 1, p. 111-123. Routledge. doi: 10.1080/13676260500523671
- Bain, K. (2004). What the best college teachers do. Cambridge, Mass.: Harvard University Press.
- Biggs, J. (1996). Enhancing Teaching Through Constructive Alignment, *Higher Education*, 32, 347-364.
- Biggs, J. (1999) What the Student Does: teaching for enhanced learning, *Higher Education Research & Development*, 18:1, 57-75, DOI:10.1080/0729436990180105
- Biggs, J.B., & Collis, K.F. (1982). Evaluating the Quality of Learning - the SOLO Taxonomy. New York: Academic Press. xii + 245 pp.
- Biggs, J., & Tang, C. (2011). Teaching for quality learning at university: what the student does (4th ed.). Maidenhead [etc.]: Society for Research into Higher Education & Open University Press.
- Clack, G. B., & Allen, J., & Cooper1, D. & John O Head, J. O. (2004). Personality differences between doctors and their patients: implications for the teaching of communication skills. *Medical Education*. 38, p. 177-186, <https://doi.org/10.1046/j.1365-2923.2004.01752.x>
- Čejková, I. (2017). Vysokoškolský učitel bez učitelského vzdělání: Problém, nebo výzva?. *Pedagogická Orientace*, 27(1), 160-. <https://doi.org/10.5817/PedOr2017-1-160>
- Felder, R. M., & Brent, R. (2013). Understanding Student Differences. *Journal Of Engineering Education*, 94(1), 57-72.
- Felder, R. M., & Brent, R. (2016). Teaching and learning STEM: a practical guide. San Francisco, CA: Jossey-Bass, a Wiley brand.
- Hattie, J. (2012). Visible learning for teachers: maximizing impact on learning. London: Routledge.
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative Learning Returns To College What Evidence Is There That It Works? [Online]. *Change: The Magazine Of Higher Learning*, 30(4), 26-35. <https://doi.org/10.1080/00091389809602629>
- Jung, C. G. (1999). Psychological types. London: Routledge
- Lairio, M., Puukari, S., & Kouvo, A. (2013). Studying at University as Part of Student Life and Identity Construction. *Scandinavian Journal of Educational Research*, *Scandinavian Journal of Educational Research*. Vol. 57, No. 2, p. 115-131, Routledge <http://dx.doi.org/10.1080/00313831.2011.621973>
- Marzano, R. J., Pickering, D., & Pollock, J. E. (c2001). Classroom instruction that works: research-based strategies for increasing student achievement. Alexandria, Va.: Association for Supervision and Curriculum Development.
- Myers IB, & Myers PB. (1993). Gifts differing: understanding personality type. Palo Alto, CA: Consulting Psychologists Press.
- McLaughlin, J. E., Roth, M. T., & Glatt, D. M., & Gharkholonarehe, & N., Davidson, C. A., Griffin, L. T. M., et al. (2014). The Flipped Classroom [Online]. *Academic Medicine*, 89(2), 236-243. <https://doi.org/10.1097/ACM.0000000000000086>

Michael, J. (2006). Where's the evidence that active learning works? [Online]. Advances In Physiology Education, 30(4), 159-167. <https://doi.org/10.1152/advan.00053.2006>

Petty, G. (2014). Evidence-based teaching: a practical approach (Second edition). Oxford: Oxford University Press.

Ramsden, P. (2003). Learning to teach in higher education (2nd ed.). New York: RoutledgeFalmer.

Slavin, R. E. (2012). Educational Psychology Theory and Practice (10 ed.). New Jersey: Pearson College Div.

Swennen, A., Lunenberg, M., & Korthagen, F. (2008). Preach what you teach! Teacher educators and congruent teaching [Online]. Teachers And Teaching, 14(5-6), 531-542. <https://doi.org/10.1080/13540600802571387>

Wubbels, T. & Levy, J. (Eds.) (1993). Do You Know What You Look Like? Interpersonal Relationships in Education. London: The Falmer Press.

Development of Inquiry Didactics Sequences for Science Teaching in a Brazilian Pre-service Chemistry Teacher Course: promoting Entrepreneurship Education.

Aparecida de Fátima Andrade da Silva, José Gomes Thomaz & Rosiane Keila Santos Costa
Universidade Federal de Viçosa, Departamento de Química, Brazil

Conference subtheme: Professional Development of Teachers

Abstract

Science teachers training is currently developed from models that promote effective reflections about teaching practices, with the execution of didactic sequence planning activities. That aims awareness exercises by future teachers of the different topics to be developed in the classroom and the multiple strategies necessary for the promotion of meaningful learning by the students. This research discusses the Teaching Models and the construction of Inquiry Didactic Sequence by six pre-service teachers during the "*Supervised Training in Chemistry Teaching II*", developed in basic education schools, which is regularly offered for the "Licenciatura" Chemistry Degree at the Federal University of Viçosa, Brazil. Then we discussed the CTS approach to teaching and developing scientific literacy by the question: How do pre-service teachers conceive, reflect and plan science teaching for scientific literacy? Their teaching models revealed inconsistent conceptions about the process of teaching and learning and also with the constructivist orientation models. Throughout the training course, the undergraduate students, assumed and developed an entrepreneurial attitude about its planning and analyzed it with an existing instrument in which are described hierarchical levels of pedagogical elements. This research aims to contribute to the formation of a new professional teaching profile with a view of improving the quality of Science teaching. The Didactic Sequence destined to students of the 3rd, High School, on "Food and Nutrition", in order to motivate students and encourage them to overcome the difficulties in relation to learning and to instigate their interest in Sciences. Sources such as documentaries, case study, games, multimedia resources and experiments were used. The developed activities enable the reconstruction of the teaching and learning process vision by the future professors of Chemistry and the development of a primordial set of teaching competences.

Key-words: Entrepreneurship education, Reflection Oriented Process, Inquiry Didactic Sequence, teaching conceptions and attitudes.

Background and justification

Challenges for teaching

Nowadays, there is an important purpose for Science Education for Basic Education around the world. A teaching that offers conditions for the development of Scientific Literacy, with a view to the formation of conscientious, responsible and critical citizens, who know how to position themselves in the face of everyday situations involving socio-scientific questions. In order to achieve this objective, it is necessary an inquiring teaching of science providing diverse experiences to promote student learning and development, which should also discuss and understand the Science / Technology / Society relations, so that they can judge decisions on the different techno-scientific innovations.

According to international recommendations (European Commission, 2007, OECD, 1999, Osborne, Dillon, 2008, Unesco, 1999), it is necessary to implement teaching strategies that offer a motivating and stimulating environment, problems and decision-making, to promote greater student autonomy and, thus, to develop high levels of scientific literacy.

Corresponding author
Email address: aparecida.silva@ufv.br

Given this context, should not teacher training be done? So that teachers can develop an appropriate and innovative Science Education, with a view to developing scientific literacy and citizenship.

According to García and Porlán (1997), the professional practical knowledge of the teacher will be constructed from the rigorous research of the professional problems in teaching Sciences and the planning, experimenting and evaluating justified hypotheses of intervention that intend to solve them.

For professional practical knowledge to be developed in an effective way, it is necessary to develop reflective practicing by the teachers. In this sense, teacher trainers have a great responsibility in promoting situations that enable the development of autonomous thinking systematically.

Alarcão (2010) contexts of teacher training based on experience, expression and dialogue play a very important role, in the sense of having a triple dialogue: the dialogue with oneself; the dialogue with others, their peers and those who are reference; as well as dialogue with one's own situation, which should not be merely descriptive.

In order to promote a reflexive practice, studies on Science Teaching with the CTS approach were carried out, in order to promote an internal process of growth. A gradual development, based on successive processes of metacognition by students, on the reflection and understanding of what they perceive, think and feel about Science Teaching / Chemistry and Teaching Models: a Reflection Oriented Process (PEME-ARANEGA et al., 2009).

To Más and Gómez (2009), the elaboration of a planning a Didactic Sequence of Science Teaching with a socio-constructivist orientation induces an important exercise for teaching training: the awareness and development of the main competences necessary for the teacher to develop classes well:

- (i) To know the history and epistemology of the theories and concepts that one will teach.
- (ii) Know how to sequence the objectives and contents of the curriculum according to a guideline.
- (iii) Consider the interests, ideas and arguments of the students in the field of teaching to be developed, as well as their difficulties and obstacles.
- (iv) Apply teaching strategies that can effectively help the learning process.
- (vi) To manage the implementation of the planned teaching sequence.
- (vii) The teacher must know how to continuously evaluate the teaching-learning process.
- (viii) Be able to prepare adequate materials for the implementation of the planned teaching sequence.

With a view to developing other important reflections on Science Teaching, as well as the main teaching competences pointed out by Más and Gómez (2009), Didactics Sequences were designed by pre-service teachers of Chemistry, contextualized and was made interdisciplinary, in order to contemplate Teaching by Inquiry and Scientific Literacy, promoting thus an Entrepreneurial Education in the Teacher Education.

But, what the Entrepreneurship Education? According to Key Competence Framework:

The entrepreneurship key competence refers to an individual's ability to turn ideas into action. It includes creativity, innovation, and risk taking, as well as the ability to plan and manage projects in order to achieve objectives (EURYDICE, 2012, p. 5).

In addition to its, self-confidence and adaptability in order to solve problems. Then it is vital that such an education is addressed from an early age and means a new role for teachers involving changes, mainly, in teaching conceptions and attitudes. This suggests that the first step in teacher education begins with reflexive planning. In Science Education the perspective of teaching by inquiry responds to the demands of Entrepreneurship Education.

However, the teaching of Chemistry has always been characterized by the activity of memorizing and using formulas, reinforcing the disciplinary and decontextualized approach. The consequent changes resulting from globalization have profoundly altered man's relations with society and technology in such a way that we are strongly influenced by the advances made by the scientific knowledge. The recognition of uncertainties (MORIN, 2013) called into question the idea of an objective, exact, neutral and impartial science and led to a new conception of scientific knowledge, taking it as the result of a collective, socially situated and subject to modifications, opposing the fragmented and disciplinary view.

In this context, the challenge to Science teaching is to educate citizens capable of understanding the different relationships between different knowledge within a systemic vision and to recognize the diverse relationships between Science, Technology and Society. The proposal of a scientific literacy aims to form scientific and technologically literate people, capable of promoting an active participation of the learner in their teaching-learning process and to promote the development of their autonomy. The CTS orientation implies a significant change in didactic-pedagogical practices, leading to a change in the teacher's posture in the classroom, to encourage active learning and the reconstruction of meaning (CHASSOT, 2005; DEBOER, 2006).

These changes will require significant changes in the way teachers themselves are educated. Teachers also feel that educational and school cultures do not fully support them in fostering creative and innovative approaches to learning. They need support throughout their careers, in their initial education, their professional development and in their day-to-day work.

In order to respond to this challenge, we are carrying out a Reflection Oriented Process, during the construction of Didactic Sequences with socio-constructivist principles and STS orientation, through which pre-service teachers acquire a primordial set of competencies can bring greater individual, social and economic benefits, allowed them develop entrepreneurial attitudes in their future work environment.

Teaching by Inquiry, contextualization, interdisciplinarity in the Chemistry Education

The marked characteristics of the proposal of Teaching by Inquiry are pointed out by Carvalho (2013 e 2011) from important theoretical references for the Science teaching and learning process, considering the ideas of Piaget to answer how the person constructs the scientific knowledge, the author proposes four moments for the investigative activities, presented below.

1º Moment: Proposition of the problem by the teacher and distribution of the experimental material. At this stage, the teacher organizes the class into small groups and distributes the material, then proposes the problem. In addition, the teacher checks if the students understood the problem to be solved.

2º Moment: Solving the problem by the students. It is important at this stage to privilege the manipulative actions so that the students can raise hypotheses and the tests of these hypotheses. The search for problem solving should be done in small groups, favoring the discussions carried out by students who have similar intellectual developments. It is important to value the error so that the students are aware that some hypotheses are not confirmed.

3º Moment: Systematization of the knowledge elaborated in the groups. At this stage, the teacher collects the material used right after the problem solving by the students so that then all of them, organized in a large circle, can by means of questions asked by the teacher collectively systematize the knowledge. In this sense, "in listening to the other, in responding to the teacher, the student not only remembers what he did, but also collaborates in the construction of the knowledge that is being systematized".

The teacher then seeks the effective participation of the students, again, directing them to become aware of their actions, thus favoring the passage from manipulative action to intellectual action. Intellectual action leads to the beginning of the development of scientific attitudes such as data collection and the construction of evidence. At the end of the report of the actions carried out by the students, the teacher will send a new discussion so that they seek a causal explanation, thus developing a scientific argument. As Lemke (2006) points out, it is the beginning of learning to speak science.

4º Moment: Write and draw. It is the stage of the individual systematization of knowledge, when the teacher asks the students to write and draw on what they learned in that class (CARVALHO et al., 2013, CARVALHO, 2011).

The problematization is a primordial element in the proposal of the Teaching by Inquiry aiming at the construction of new knowledge by the students. Thus, as Capecchi points out, in order to create a propitious problem-solving environment and for problems to be well structured before they are implemented, it is interesting to formulate "problems different from those students are accustomed to

elaborate, so as to opportunities for new knowledge to be built" (CAPECCHI, 2013).

The problematization should be contemplated from a contextualized and interdisciplinary problem situation, thus favoring the interest for socio-scientific questions by the students.

Etymologically, contextualize means rooting a reference in a text, from where it was extracted, and far from which it loses a substantial part of its meaning. Contextualize, therefore, would be a fundamental strategy for the construction of meanings insofar, as it incorporates tacitly perceived relations. And the Interdisciplinarity is establishment of an effective intercommunication between the disciplines, by means of the enrichment of the relations between them. Overcoming this way, the multidisciplinarity and the conservation of the objectives of each discipline (MACHADO, 2002).

Didactic Sequences

Considering recent studies in the Teacher Education field, it is desirable that Science teachers have opportunities to experience strategies that enable pre-service chemistry teachers to think about solutions that address scientific knowledge construction, like the Teaching by Inquiry and scientific literacy.

The Didactic Sequence expression will be used in a sense close to that proposed by Zabala (1998), referring to a set of ordered, structured and articulated activities for the accomplishment of some educational objectives, which has a beginning and an end known to both teachers and students. The organization of the didactic sequences can enable students to become aware of the objectives of the activities and what they are expected to learn from them, which makes much more sense to the dynamics established in the classes.

The elaboration of the Didactic Sequence was structured according to principles of the STS approach, contemplating investigative, contextualized and interdisciplinary activities, based on the study of the article by Más and Gómez (2009), addressing Teaching by Inquiry and scientific literacy with a view to developing Entrepreneurial Education and a new profile for the teacher of Science, aimed at promoting effective participation and learning by students. In this sense, thematic classes in which we can dialogue chemical content with subjects inherent to students' everyday life, may favor their interest in science.

Teaching models

Teaching Model is constructed by the teacher's intention in teaching their students and made up of beliefs, culture and social relations that underlie the process of teaching and learning. Taking into account five dimensions of the teaching and learning process, namely: objectives of teaching (why to teach), content (what to teach), strategies (how to teach), pupils' interests and evaluation (how to assess pupils' learning). Garcia (2000) presents four different approaches to characterize a teaching model: traditional, technological, spontaneous and alternative.

The Traditional Model focuses on content and is characterized by the emphasis on the assumptions of cultural transmission. The aim of Basic Education is to transmit the culture, not taking the social context of the school community into consideration. The methodology emphasizes the rote memorization of information and ignores the interests of the students. Assessment is based on traditional techniques, often demanding memorization of the concepts and not requiring students to demonstrate higher order cognitive skills.

The Technological Model is characterized by a technical and scientific perspective of teaching, responding to the relations between Science and Technology with society. The rationalization of curriculum and rigorous planning is proposed. Activities must be social-context based, be practical and be planned from updated teaching materials. In addition, they must focus on the development of competencies and abilities, providing the student with a "modern" and "efficient" education. The assessment aims to quantify their learning and verify the efficiency of this teaching approach. Students are supposed to participate in the activities prepared by the teachers, who are also responsible for maintaining order and discipline in the classroom.

The Spontaneous Model presents assumptions grounded in the libertarian ideas of the Enlightenment philosopher Jean-Jacques Rousseau, which represents an "ideological-political criticism" to culture depicted by rationalism and academicism. In this model, learning is understood as a "spontaneous"

process, which occurs naturally. Contents are selected based on the interests of students and teaching activities are open, flexible and multiple aiming the development of social values attitudes and autonomy. Assessment is based on direct observation of the student, analysis of classroom work and personal development of the student. The teacher is responsible for being the social and affective leader.

The Alternative Model assigns a complex perspective to learning taking into account the effective participation of the student and the role of investigator assumed by the teacher in teaching and learning process. The goal of Basic Education is the progressive enrichment of students' knowledge, enabling them to understand and act on their social reality. Activities are context-based from socially relevant themes. In this model, the teacher is responsible for planning and carrying out problem-based situations that stimulate and facilitate learning. The students are regarded as an active agent in the construction process of their own knowledge. The assessment has a formative character from the teachers' identification of students' difficulties and the promotion of reflections on their developments related to planned objectives.

Research design and methodology

The Didactic Sequence was developed as one of the proposed activities for "*Supervised Training in Chemistry Teaching II*", developed in basic education schools, which is regularly offered by the "Licenciatura" Chemistry Degree at the Federal University of Viçosa, Brazil. In Brazilian Educational System there are complete four years major programs leading to a degree in the teaching of Chemistry (as well as in other subject matters) called "Licenciatura". We do not identify a similar system in the USA or in the United Kingdom. Hence the use of pre-service in this paper.

Activities were developed by six "Licenciatura" Chemistry students, who produced these materials under a professor's supervision. The research was based on the qualitative paradigm. Data were collected through questionnaires, analyses of the Didactic Sequence and the class plans. Data analyses were made by content analysis (COUTINHO, 2013; BARDIN, 2010).

This research discusses the Teaching Models of the group of six students and the construction of Inquiry Didactic Sequence "Food and Nutrition" planned by two pre-service teachers during the "*Supervised Training in Chemistry Teaching II*", when we discussed STS approach to teaching and development of scientific literacy. The choice of theme was motivated by the need to develop in students a critical and responsible awareness about their eating habits, considering the importance of a healthy diet in this age group and also the innumerable possibilities of contextualizing the theme with daily life of students, making it more meaningful for them, according to the principles of the STS approach. The resources used in this Inquiry Didactic Sequence "Food and Nutrition" were documentaries, games, multimedia resources and experiments. The Inquiry Didactic Sequence designed to students of the 3rd, High School, intend to motivate the student in order to encourage them to overcome the difficulties in relation to learning and to arouse their interest in Science.

The research question was: How pre-service teachers conceive, reflect and plan science teaching for scientific literacy?

First, to investigate the Teaching Models, an instrument set by Novais and Marcondes (2011), which was based on other studies (Garcia 2000; Gil-Pérez and Carvalho, 1993; Peme-Aranega et al. 2009; Porlán et al. 1997) was used. The instrument has 60 statements that were made considering five dimensions of teaching planning: (i) why to teach (Objectives), (ii) What to teach (Contents), (iii) ideas and interests of students (Interests), (iv) how to teach (Methodology) and (v) how to assess (Assessment).

Therefore, for each of these dimensions, a set of three statements was made according the assignments of each Teaching Model: traditional, alternative, spontaneous and technical (Garcia 2000). For each statement, the teacher was asked to indicate his or her level of agreement or disagreement according to a Likert-type scale.

Throughout the training course, the undergraduate students, assumed and developed an entrepreneurial attitude about its planning and analyzed it with an existing instrument (Silva, 2011)

in which are described hierarchical levels of pedagogical elements. Besides, analyzing the cognitive abilities and attitudes to be developed by the students (SILVA, 2015).

Findings and discussions

Some conceptions and Descriptions of part of the Didactic Sequence

Their Teaching Models revealed inconsistent conceptions about the process of teaching and learning and also with the constructivist orientation models. The six students held several agreements with the statements in the five teaching dimensions of the different Teaching Models, showing an inconsistency in their teaching views and consequently a degree of inconsistency of their Teaching models.

The theoretical Teaching Models can provide the pre-service Chemistry teachers with opportunities to rethink and overcome their conceptions about teaching and learning in order to develop a more effective, coherent and responsible teaching strategies.

Throughout the training course with the objective of developing a Reflection Oriented Process, the pre-service teachers developed and assumed an entrepreneurial attitude about its planning and analyzed it with an existing instrument (Silva, 2011) in which are described hierarchical levels of pedagogical elements, presented below. Likewise, analyzing the cognitive abilities and attitudes to be developed by the students (SILVA, 2015).

Table of Pedagogical elements of a Inquiry Didactic Sequence

1	- Objectives
1a	- conceptual
1b	- pedagogical (competence / ability)
2	- Problem situation
2a	- problem to be solved by the experiment
2b	- questions of speculation
2c	- stories (books)
3	- Presentation of the content
3a	- introduction to the concept
3b	- data or information to aid analysis.
4	- Hypotheses
5	- Experimental procedure
5a	- experimental steps
5b	- presentation in a way to treat the data
5c	- request records (example: write down)
5d	- request for an analysis (example: compare)
6	- Data collection
6a	- table to fill
6b	- frame to fill
6c	- fill lines
7	- Analysis of data
7a	- observation issues
7b	- analysis questions
7c	- conceptual issues
8	- Conclusions / Concept formation
8a	- given
8b	- built
8c	- requested without forwarding
9	- New problem / application
10	- Deepening conceptual theories
10b	- not related to practice
11	- Text production
11a	- individual
11b	- collective
12	- Evaluation
12a	- formative
12b	- summative

From the analysis of the pedagogical elements carried out, the pre-service teachers reflected and became aware that they had to rethink the elaboration of the Inquiry Didactic Sequence, since several elements were absent in the first planning.

In another moment of Reflection Oriented Process, some aspects about the investigative activities were discussed and analyzed, such as: Goals; Survey of students' conceptions; Problematization; Activities in the Laboratory; Post-laboratory Activities; Systematization of knowledge; Role of the experiment; Role of the teacher; Role of the student. When the students again realized the absence of important characteristics of the investigative activities in their Inquiry Didactic Sequence.

The Inquiry Didactic Sequence "Food and Nutrition": focus on chemical aspects

In this paper, will be presented a example, the Inquiry Didactic Sequence "Food and Nutrition" which was planned and organized by two students, with the following topics:

- Mapping and showing the students' eating habits;
- Food composition: carbohydrates, fatty acids, proteins, minerals, vitamins, fiber;
- Energy values of food;
- Peptide bond.

As well as multiple strategies were used in planning the Inquiry Didactic Sequence: documentaries, case study, journalistic texts, experiments, games and multimedia resources.

At the end of this Inquiry Didactic Sequence "Food and Nutrition", the student of the third year of High School should be able to:

- develop a critical awareness of their eating and drinking habits;
- recognize the importance of a balance and a balanced diet, based on chemical knowledge on the constitution of foods.

Example of the Inquiry Didactic Sequence activity: "Food and Nutrition"

Case study: a teenager with diabetes mellitus

Objectives: relate excessive consumption of sugars to an unbalanced nutritional diet and the evidence of its connection with health; and make students aware of sugars intake.

To end the carbohydrate topic with the students, the teacher can propose a case study of a teenager with diabetes in nutritional therapy. The purpose of the study is to show the connection between this type of nutrient and its importance for the main biological processes. To begin, the teacher should conduct the activity of probing the students' previous knowledge about the subject, asking them if they know someone who has diabetes and what they know about the disease and the dietary restrictions of their patients. In this study, it is necessary to take into account all the factors involved from the beginning of the finding of the disease until the need to form new eating habits for its control, always maintaining a critical perspective regarding the conditioners of this process. At the end of the study, the teacher will be able to resume the problematization started in previous classes and conclude together with the students that a high carbohydrate diet is not satisfactory for the body and can cause harm to the health of teenagers, children and adults and that this type of fundamental substance to many biological processes, must be consumed in a conscious and responsible way, respecting the minimum quantities required by the organism.

Conclusions and contributions for science education

From this perspective, we believe that these proposals are potentially viable for the development of competences by the pre-service teachers and can give them a new meaning to their learning. Enabling them to contribute to the development of scientific literacy, decision making and the exercise of their citizenship.

In order to promote the Entrepreneurship Education is important to develop a Reflexive Oriented Process that favors the development of creative thinking, critical thinking, autonomy and decision

making in the face of problematic situations in school life, planning and administering projects.

Throughout the Reflection Oriented Process, the reflective exercises allowed the pre-service teachers analyzed different didactic and pedagogical aspects about their Inquiry Didactic Sequences, such as: teaching approaches, characteristics of inquiry teaching, development of cognitive abilities and attitudes, as well as scientific concepts. They became aware about of their own difficulties and demonstrated an entrepreneurial attitude in seeking new ideas for planning their Inquiry Didactic Sequences in order to conduct a significant learning.

Besides, the developed activities enable the reconstruction of the teaching and learning process vision by the future professors of Chemistry and the development of a primordial set of teaching competences to turn ideas into action, to promote significant changes in the way teachers are working as well as educational and school cultures.

Acknowledgments

We would like to thank the Chemistry students who participated in this research and the Federal University of Viçosa, Brazil.

References

- Alarcão, I. (2010) Professores Reflexivos em uma Escola Reflexiva. São Paulo: Cortez Editora.
- Bardin, L. (2010) Análise de Conteúdo. Lisboa: Edições 70, 4. ed.
- Deboer, G. E. (2006) Historical Perspectives on Inquiry Teaching in Schools. In: Scientific inquiry and nature of science: implications for teaching, learning and teacher education. Organizado por FLICK, L. B. & LIDERMAN, N. G. Springer, p. 17-18.
- Capecchi, M. C. C. M. (2013) problematização no ensino de ciências. in: Carvalho, a. m. p. (org.). Ensino de Ciências por Investigação: condições para implementação em sala de aula. São Paulo: Cengage Learning.
- Carvalho, A. M. P. (2013) O ensino de ciências e a proposição de sequências de ensino investigativas. In: CARVALHO, A. M. P. (org.). Ensino de Ciências por Investigação: condições para implementação em sala de aula. São Paulo: Cengage Learning.
- Carvalho, A. M. P. (2011) Ensino e aprendizagem de ciências: referenciais teóricos e dados empíricos das sequências de ensino investigativas (SEI). In: O uno e o diverso na educação. Uberlândia: EDUFU.
- Chassot, A. (2005). Alfabetização Científica, Ujuí: Editora Unijuí.
- Coutinho, C. P.(2013) Metodologia de Investigação em Ciências Sociais e Humanas: Teoria e Prática. Coimbra: Almedina.
- European Commission. Key Competence for Lifelong Learning - A European Framework Retrieved. 2007. Disponível em: <http://www.britishcouncil.org/sites/britishcouncil.uk2/files/youth-in-action-keycomp-en.pdf>. Acesso em: mai. 2014
- Eurydice (2012). Entrepreneurship Education at School in Europe. National Strategies, Curricula and Learning Outcomes. Brussels: EACEA.
- Garcia, F. F. Perez. (2000). Los modelos didácticos como instrumento de análisis y intervención em la realidade educativa. Revista Bibliográfica de Geografía e Ciencias Sociales. Universidad de Barcelona, n. 207. Available at <http://www.ub.edu/geocrit/b3w-207.htm> Access on 20/02/2013.
- Gil-Pérez, D.; Carvalho, A. M. P.. (1993). Formação de Professores de Ciências: tendências e inovações. São Paulo: Cortez.
- Machado, N. J. (1995). Epistemología e Didáctica. São Paulo: Editora Cortês.
- Más, C. F.; Gómez, C. F. ¿Cómo diseñar una secuencia de enseñanza de ciencias com una orientación socioconstructivista? Educación Química. 8^a. Convención Nacional y 1^a. Internacional de Profesores de Ciencias Naturales, p. 246-251, jun. 2009. Disponível em: <http://www.educacionquimica.info/busqueda.php>. Acesso em: abr. 2014.
- Morin, E. (2014) A cabeça bem-feita. Editora Bertrand Brasil LTDA. Rio de Janeiro. 24^a edição.
- Novais, R. M., C. T. Siqueira, and Marcondes, M. E. R. (2011). Modelos Didáticos: um referencial para reflexão sobre as crenças didáticas de professores. In: Anais do VIII ENPEC - Encontro Nacional de Pesquisa em Educação em Ciências and I CIEC - Congresso Iberoamericano de Investigación em Enseñanza de las Ciencias, 9-23. Campinas: ABRAPEC.
- OCDE – Organización para La Cooperación y El Desarrollo Económico. Proyectos sobre Competencias en El Contexto de La OCDE. Análisis de base teórica y conceptual. Neuchatel, 1999. Disponível em: <http://www.deseco.admin.ch/bfs/deseco/en/index/03/>

OSBORNE, J.; DILLON, J. *Science Education in Europe: Critical Reflections*. London: King's College London. The Nuffield Foundation, 2008, 30 p.

Peme-Aranega, C. et al. (2009). La interacción entre concepciones y la práctica de una profesora de Física de nivel secundario: Estudio longitudinal de desarrollo profesional basado en el proceso de reflexión orientada colaborativa. *Revista Electrónica de Enseñanza de las Ciencias*. 8 (1): 283-303.

Porlán R. A., Rivero, A. G. and Martín del Pozo, R. (1997). Conocimiento profesional y epistemológico de los professores I: teoria, métodos e instrumentos. *Enseñanza de las Ciencias*. 15 (2): 155-171.

Silva, A. F. A. (2015). Processo de Reflexão Orientada na Formação de Professores dos Anos Iniciais: Concepções e Práticas sobre o Ensino de Ciências. Tese de Doutorado. São Paulo: Universidade de São Paulo, 2015.

Silva, D. P. (2011). Questões propostas no planejamento de atividades experimentais de natureza investigativa no ensino de química: reflexões de um grupo de professores. Dissertação de Mestrado. São Paulo: Universidade de São Paulo.

UNESCO. Declaração sobre a Ciência e o uso do saber científico. Paris: 1999.

Zabala, A. (1998). A prática educativa: como ensinar. Porto Alegre: Artmed.

