Université de Montréal

E-Learning Culture: Operationalization of a Systemic Model to Support ICT-Integration in Pre-Service Teacher Trainers' Practice.

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Thèse présentée à la Faculté des études supérieures
en vue de l'obtention du grade de Philosophiae Doctor (Ph.D.)
en sciences de l'éducation option psychopédagogie

Juin 2016

Faculté des études supérieures

Cette thèse intitulée:

E-Learning Culture: Operationalization of a Systemic Model to Support ICT-Integration in Pre-Service Teacher Trainers' Practice.

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Résumé

Le développement professionnel des enseignants a longtemps été identifié comme essentiel à la réussite de l'adoption des TIC en éducation (BECTA, 2009). Des programmes de formation efficaces sur les TIC pour le développement professionnel des futurs enseignants devraient veiller à ce que, une fois diplômés, les enseignants aient les compétences et les connaissances nécessaires pour utiliser efficacement les TIC dans les salles de classe non seulement en raison de la nécessité pour les enfants de développer des compétences qui leur permettront de bien se débrouiller dans la société moderne (UNESCO, 2011; Dede, 2014), mais aussi, en raison de la valeur potentielle de ces technologies comme outils d'apprentissage (Gill and Dalgarno, 2008). Les TIC sont donc, devenues des incontournables pour les enseignants et les apprenants dans le contexte de la société du savoir. Cependant, lorsqu'on regarde leurs usages et leurs impacts on n'est pas satisfait après tout ce qui a été investi en termes de formation, argent, équipement, etc. Une des causes semble être la formation des enseignants, notamment dans son contenu et dans les stratégies de formation adoptée (Villeneuve, et al. 2012). Nous avons développé une intervention de formation pour rendre opérationnel le modèle IntersTICES (Peraya and Viens, 2005) et aider les formateurs d'enseignants intégrer les TIC dans leur pratique d'enseignement. Cette opérationnalisation impliquant les enseignants travaillant dans le programme de formation initiale des maîtres à l'Université de Montréal, a mis en perspective l'importance de la culture e-learning des formateurs d'enseignants, de l'accompagnement, et des interventions de suivi pour les activités, y compris l'utilisation pédagogique des TIC. La recherche a porté sur l'analyse de l'impact de l'intervention de formation sur la culture e-learning de participants, ainsi que sur leur intention d'adopter et d'utiliser les TIC dans leurs cours. Les résultats suggèrent que l'opérationnalisation du modèle IntersTICES via une intervention de formation de type IntersTICES, peut fournir les formateurs des formateurs une occasion de réflexion et de sensibilisation sur leurs représentations personnelles concernant tous les aspects de leur culture e-learning. De plus, cette opérationnalisation a aidé les formateurs des formateurs à prendre conscience de l'impact que leur culture e-learning a sur leur pratique tout au long et à n'importe quel stade du développement et de la mise en œuvre de leur activité choisie intégrant les TIC.

Mots-clés : intervention de formation, dispositif systémique, culture e-learning des acteurs, intégration des TIC, valeur pédagogique ajoutée.

Abstract

In today's knowledge society, ICT has become essential for teachers and learners (BECTA, 2009) not only because of the need for children to acquire and develop skills that will help them grow as collaborative, problem-solving, creative learners (UNESCO, 2011; Dede, 2014), but also because of the potential value of such technologies as tools for learning (Gill and Dalgarno, 2008). However, when looking at the current educational ICT uses reported by research conducted with teachers and students, (Karsenti and Lira, 2010; Villeneuve et al., 2012) and the low impact observed on learning - despite the substantial investment in equipment and material -we can only question the possible reasons for such a situation. One of the causes identified in the literature is teacher training, especially in its content and the training strategies adopted by teacher educators (Angeli, 2009; Enochson, and Rizza, 2009). We developed a training intervention to operationalize the IntersTICES model (Peraya and Viens 2005) and help teacher trainers integrate ICT in their teaching practice. This operationalization involving teachers working in the teacher training program at Université de Montreal, put into perspective the importance of teacher trainers' e-learning culture, personal support and follow-up interventions for activities including pedagogical use of ICT. The research focused on analyzing the impact of the training intervention on participants' e-learning culture, as well as on their intention to adopt and use ICT in their courses. Findings suggest that the operationalization of the IntersTICES model via an interactive training intervention, can provide teacher trainers with an opportunity for reflection and awareness about their personal representations regarding every aspect of their e-learning culture. Furthermore, it helped teacher trainers becoming aware of the impact their e-learning culture has on their practice throughout and at any stage of the development and implementation of their chosen activity integrating ICT.

Keywords/Expressions: Training intervention, systemic tool, participants' e-learning culture, ICT integration, ICT pedagogical added value.

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List of Acronyms

AR: Action Research

BECTA: British Educational Communications and Technology Agency

CAFPE: Quebec's Steering Committee of Teacher Training- Comité d'agrément des programmes de formation à l'enseignement or CAPFE

eTQF - Teacher ICT Qualification/Competency Framework

FTIT: Fast Track into Information Technology

ICT: stands for Information and Communication Technology

IntersTICES Model: *Intégration par la Recherche et le Soutien des Technologies de l'Information et de la Communication pour l'Enseignement Supérieur* - Integration through Research and Support of Information and Communication Technologies for Higher Education (Our translation)

ISTE: The International Society for Technology in Education

MELS: Ministère de l'éducation, du loisir et des sports, now called MEES: *Ministère de l'Éducation, de l'Enseignement supérieur* -The Ministry of Education, Recreation and Sports of Quebec

NETS-T: National Educational Technology Standards for Teachers

OECD: Organisation for Economic Co-operation and Development

OED: Oxford English Dictionary

PAV: Pedagogical Added Value

PTT: Participant Teacher Trainer

StudiUM: Learning platform/Course management system used at Université de Montreal

TPACK Framework: Technological- Pedagogical and Content Knowledge

UNESCO: The United Nations Educational, Scientific and Cultural Organization

UNESCO’S ICT-CFT: UNESCO’s 2 ICT Competency Framework for Teachers

To my husband, Gonzalo, an exceptionally smart, unselfish, decent man. For his loving support, patience, unbreakable trust in my abilities –which I very often doubted-, and for always being there for me, no matter what.

To Juan Sebastian and Natalia Rosa for making me the proud mother of two of the kindest, most loving and talented persons I've ever met.

To my dear and brave sisters Luz Mery, Myriam and Dorita, for being role models to follow, their unconditional love and support.

To my dearest friend Sara Falla and her ability to put things back into perspective through her marvelous outbursts of laughter.

To Farah Arab, this dear and unexpected beam of light that shone upon me in my darkest moment of solitary work and isolation.

Acknowledgements

I am truly thankful to my doctoral supervisor Dr. Jacques Viens for having accepted me as his PhD student, his continuous support and guidance, his always pertinent suggestions, and rigour.

I am also very grateful to Dr. Marcelo Maina for having accepted being my co-doctoral supervisor, his rigour and pertinent remarks that greatly enriched my work.

To both of them a heartfelt thank you for their intellectual generosity!

My sincere thanks and appreciation to Dr. Ratna Ghosh, Dr. Claude Lessard and Dr. Michel D. Laurier, my referees for admission to the PhD program, for their timely support and trust in my abilities to fulfill the academic expectations of the program.

Un gros merci to Dr. Jacques Langevin and Dr. Sylvie Rocque for their friendship, and making me feel that I could always count on them. For having made a place for me in their lab during my first years in the program.

I would also like to thank my dear friend and colleague Irma Alaribe for her availability to meet, chat and her insightful feedback.

My appreciation to Mr. Jean-François Durnin, Mr. Yan Vallée, Mr. Jason Madooray and Cedric Medina-Labrecque from the EPC-Bio Library for their direct and indirect contribution to my work.

My sincere gratitude to Dr. Claudine Jomphe for her effective, sensible recommendations, and great kindness while advising me on applying for (and obtaining!☺) a scholarship.

My sincere thanks to Ms. Cécile Sike Mouen and Ms. Marie-France Lauzon for their continuous support, kindness and effective collaboration in any matter related to my doctoral studies.

Last but not least, I would like to express great thanks and appreciation to the five anonymous participants in my research study. You made it possible. I have a very special place in my heart for all and each one of you!

Thesis Outline

This thesis is built around five chapters. The first two chapters correspond to the theoretical framework. Chapter 1, presents the research problem and the state-of-the-art regarding teachers' ICT competencies, as well as factors, issues and concerns in terms of ICT integration in education. Chapter 2, presents the literature review related to benchmarks, factors influencing teachers' ICT adoption, models, pedagogies and approaches. Chapter 3 encompasses the research method. Chapter 4 comprises the results regarding the design and implementation of a training intervention using Interstices. It also presents the impact of our intervention, the follow-up and personal support on participant pre-service teacher trainers' e-learning culture, as well as on their intention to integrate ICT in their teaching practice. The last chapter, Chapter 5, presents the discussion and concluding remarks, and makes the link between the results of our training intervention and new avenues for research.

"I believe that education is the fundamental method of social progress and reform. All reforms which rest simply upon the law, or the threatening of certain penalties, or upon changes in mechanical or outward arrangements, are transitory and futile…
But, through education, society can formulate its own purposes, can organize its own means and resources, and thus, shape itself with definiteness and economy in the direction in which it wishes to move…
Education thus conceived, marks the most perfect an intimate union of science and art conceivable in human experience."

John Dewey. My pedagogic creed. 1897.

Chapter 1: Research Problem

This chapter presents the context and the research problem addressed by this thesis. We start by describing the situation regarding pre-service teacher trainers. We introduce next the issues and concerns regarding ICT integration in education throughout the world as well as in Quebec. Then, we outline some policies regarding ICT competency in initial teacher training programs. We introduce the factors influencing teachers' ICT competency found in the literature we reviewed, followed by a chapter conclusion, the objectives set for our research and a statement about the pertinence of the research.

Context and General Research Problem

1. Training the Pre-Service Teacher Trainers

The term "training" may raise images of military drills, but in practice the training of university teachers often involves relatively sophisticated processes underpinned by theoretical models of professional development (Schön, 1987) and change over time in teachers' conceptions of teaching (Trigwell, Prosser and Waterhouse, 1999).

Research states that students should leave secondary school having acquired the so called 21st century skills (Dede, 2008; Papert, 2006; Scardamalia and Bereiter, 2006; Sawyer, 2006, 2014). Research (e.g. Gill and Dalgarno, 2008; McDougall, 2008) has also shown that effective ICT[1]-related training programs for professional development of pre-service teachers should ensure that once graduated, they have the appropriate skills and knowledge to effectively use ICT in the classroom "not only because of the need for children to develop skills that will empower them in modern society, but also because of the potential value of such technologies as tools for learning" (Gill and Dalgarno, 2008). There would be a need, then, to intervene and equip pre-service teacher trainers with the appropriate strategies and knowledge to help them integrate ICT pedagogically into their teaching practice.

Moreover, the importance of teachers' information and communication technologies (ICT) competencies has been acknowledged in a variety of countries all around the world such as the Netherlands, Canada, Greece, China, Belgium, USA, Spain, Chile, UK, and Israel, among others (e.g., see Angeli, 2004, 2009; Davis, 2008; Karsenti and Larose, 2005; Law, 2008; Lefebvre and Loiselle, 2010; Koehler and Mishra, 2005, 2008; Swain, 2006; Ottesen, 2006; Valanides and Angeli, 2008; Villeneuve, 2011; Woznie, Venkatesh and Abrami, 2006).

In 1990, Hawkridge described several rationales for Information and Communication Technologies (ICT) in education (Voogt, 2008). These rationales are useful for understanding intentions of policy makers for the role they attribute to ICT in the curriculum. As such, the *social rationale* refers to the preparation of students for their place in society. The *vocational rationale* highlights the importance of giving students appropriate skills for future jobs. The *pedagogical rationale* focuses on the improvement of teaching and learning with the help of computers. The *catalytic rationale* supposes an important role for ICT in realizing educational change. The *information technology industry rationale* is related to the promotion of the ICT industry in education. Finally, *the cost-effective rationale* implies that ICT will reduce the costs for education (Hawkridge, 1990). Although all these rationales could be recognized in many ICT-related policies of governments, two rationales were very prominent in the

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[1] ICT stands for information and communication technologies and are defined, for the purposes of this thesis, as a "diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information." These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony. (Blurton, C., "New Directions of ICT-Use in Education". Available online http://www.unesco.org/education/educprog/lwf/dl/edict.pdf; accessed 7 August 2002, as cited by Tinio,, 2003, p.4)

introduction of ICT in the primary and secondary school curriculum: the pedagogical and the social rationales (Hawkridge, 1990).

According to the Ministry of Education of Quebec - MEQ[2] (2001) it was also the case in Quebec[3], the introduction of ICT in the primary and secondary school curriculum often started with an emphasis on the social rationale – students had to learn about ICT (learning to use ICT). Currently, "the policies in many countries highlight the pedagogical rationale", and ICT are used as a medium for teaching and learning (using ICT to learn) (Voogt, 2008, p.118). However, in the rhetoric of policy makers, using ICT to learn not only has a pedagogical background, but often also reflects a vision that ICT are a means to transform education (Voogt, 2008).

Therefore, one of the goals for integrating ICT in education is to enhance teaching and learning practices thereby improving quality of education (BECTA, 2009). It appears that teacher professional development has long been identified as critical to the successful adoption of ICT in education. Starting from the early 1980s when computers were introduced in schools, helping teachers to acquire this prerequisite knowledge and skills have concerned those interested in promoting the integration of computers in the classroom (Law, 2008).

However, as Haugen, Ask, Bratseth, Engelsen, Lysne and Tvedte (2000) observed, it seems that teacher education is and has for years been a theoretical and academic kind of education with some practice added. It is evident that there is a gap between the university classroom and the real world, as the study by Karsenti and Lira (2010) has shown, and because of the lack of demonstrations of how working with ICT looks like, pre-service teachers often, -unfortunately, even to this day- find it difficult to associate theory with practice, as Haugen and his colleagues observed more than a decade ago.

This situation is quite similar among future teachers in Quebec. Prospective teachers use ICT regularly and reflectively to plan their classes, communicate, search for

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[2] Currently called Ministère de l'Éducation et de l'Enseignement supérieur (MEES), formerly known as MEQ -for Ministère de l'éducation du Québec, until 2005; and MELS Ministère de l'Éducation, du Loisir et du Sport, until 2015.

[3] In Canada, elementary, secondary and post-secondary education is a provincial responsibility.

information, and prepare educational materials. However, only few of them either use ICT in the classroom or encourage their students to do so (Karsenti and Lira, 2010). Moreover, when asked whether they used ICT during their internship, 64,4% future teachers in preschool and primary education answered “never” to “rarely” to qualify the frequency of ICT use while teaching, whereas 54,6 % future high school teachers answered “never” to “rarely” (Villeneuve, Karsenti, Raby, Meunier, 2012, our translation).

These findings illustrate Hunt’s (1995) still pertinent comments, “[…] seeing technology used in a few university courses is insufficient for preparing knowledgeable consumers of technology. Students must have many models of effective technology use” (p.49).

Therefore, since ICT use in the classroom is still limited and the competence levels of in-service and newly graduated teachers regarding ICT integration to their practice remains modest (Villeneuve, 2011), it seems necessary to focus on bridging up this gap between university classroom and the real world, by implementing some proven effective pedagogical models integrating ICT in pre-service teachers’ training. This will allow future teachers to acquire the knowledge, skills and attitudes that will empower and equip them with the required skills to effectively respond to the needs of today’s society students.

Research have reported that the large amount of investment in technology integration in education did not reap the desired results (e.g. Divaharan, 2011). Concerns were raised that the potential for ICT to change how teachers teach and how students learn had not been fully realized (Bate, 2010). Other studies reported that although technology integration has taken place, teachers were not making effective use of ICT for teaching purposes (OECD, 2011; OECD, 2014; Venezky and Davis, 2002; Voogt, 2008; Wray, 2009; Zhao and Cziko, 2001; Meredyth, Russell, Blackwood, Thomas, and Wise, 1999).

1.1. Issues and Concerns about ICT integration in Education throughout the World.

Teacher training is considered as the key success factor when fostering ICT integration in education (Kirschner and Selinger, 2008). Already, back in the 1990s, authors as Davis and

Tearle (1998) noted that many countries around the world are implementing strategies to update their educational systems, facilitate equality of access and ensure that the key ICT skills are developed in their schools and other educational institutions.

It is now widely acknowledged that it is essential to provide teachers with quality training in ICT skills and appropriate pedagogical approaches.

Teachers everywhere have been challenged to ensure that students meet the myriad of required national, state and local standards. For example, and as illustrated by Angeli and Valanides (2008), "citizens of information-age societies are required to be able to think critically, problem solve, collaborate with others, communicate, use various technologies, take initiatives, and bring diverse perspectives in the learning situation." (p.154). These demands constitute new challenges, that according to Sefton-Green (2006, as cited in Angeli and Valanides, 2009) require fundamental transformations in the ways teachers teach and learners learn in schools.

Already in 1995, the Office of Technology Assessment for the US Congress recognized that even though technology was not a panacea for all educational ills, the new technologies were essential tools for teaching. Moreover, the pedagogical affordances[4] of these technologies, when used appropriately, involve great potential for transforming the teaching and learning environment (Cognition and Technology Group at Vanderbilt, 1996; Jonassen, Howland, Marra, Crismond, 2008). To use these tools well, teachers need visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment. In other words, teachers need to know how to use technology to transform their teaching with technology and how to create environments that enhance opportunities for learning. Only then can teachers be informed and fearless in their use of new technologies. Therefore, developing future teachers who know how to use modern learning technologies to

[4] An affordance is defined as an action that an individual can potentially perform in their environment by using a particular tool. In other words, an affordance is a "can do" statement that does not have to be predefined by a particular functionality, and refers to any application that enables a user to undertake tasks in their environment, whether known or unknown to him/her. For example, blogging entails typing and editing posts, which are not affordances, but which enable the affordances of idea sharing and interaction (McLaughlin and Lee, 2007).

improve student learning is a major challenge facing our nation's teacher preparation system. (Preparing Tomorrow's Teachers to Use Technology, 2002).

1.2. Issues and Concerns Regarding ICT Integration in education in Quebec

1.2.1. Element 1: The Students -An Updated and Desired Portrait

Since the reform and implementation of the training program of the School in Quebec (Canada) in the early 2000, primary and secondary school students are required to develop during their education, Competency 6 - a cross-curricular competency, which refers to the exploration of ICT.

This competency involves using ICT thoughtfully and effectively and encompasses creating opportunities for learners to exercise critical judgment. It entails access to appropriate resources and ongoing support and supervision. It is therefore important to provide students with a stimulating environment in which ICT affordances are used not only to create and to communicate, but also in teaching subject content. Furthermore, ICT are suitable for use in differentiated learning situations in which students are expected to take responsibility for the construction of their learning. Moreover, by providing access to a multitude of information sources and experts, ICT give students the benefit of knowledge and know-how from throughout the world and enable them to share ideas and achievements of all kinds. (Quebec Education Program, Cross-Curricular Competencies, p. 15).

"The potential offered by ICT in learning and instruction, combined with the role they play in society, means that they are essential components of today's schools. Given their threefold mission of instructing, socializing and qualifying, schools must allow students to acquire the ICT-related methodological competencies they will need for their future social and professional lives" (MEES, 2001, p.92).

Researchers (e.g., Dede, 2014; Klopfer and Sheldon, 2010; Jonassen, 2002; Jonassen, Howland, Marra, Crismond, 2008; Papert, 1980, 2006; Schank, 1984, 2006; Scardamalia and Bereiter, 1996, 2003) posit that when teachers create student-centered environments where technology is used to engage and support learning processes, learners are ready to accept responsibilities.

Accordingly, Heller, Wolfe and Steinberg (2013 as cited in Dede, 2014) argue that by adhering to “student-centered” practices in high school classrooms,

“[M]ost, if not all, students benefit when given ample opportunities to:

- Participate in ambitious and rigorous instruction tailored to their individual needs and interests
- Advance to the next level, course, or grade based on demonstrations of their skills and content knowledge
- Learn outside of the school and the typical school day
- Take an active role in defining their own educational pathways” (p. ii)

According to Conley (2013), students’ command of academic skills and content certainly matters, but so too does their ability to communicate effectively, to work well in teams, to solve complex problems, to persist in the face of challenges, and to monitor and direct their own learning. This is the kind of “readiness” -as labelled by Conley, (2013) - future secondary education should prompt in their students for them to be able to become genuinely prepared for college, careers and civic life, and which corresponds largely to the aforementioned threefold mission set by the Ministry of Education of Quebec, i.e. instructing, socializing and qualifying.

Thus, there is a need for teaching strategies very different from the familiar, lecture-based forms of instruction characteristic of industrial-era schooling, with its emphasis on rote memorization, simple comprehension, and the study of a prescribed, one-size-fits-all curriculum (Dede, 2014). Rather, there must be a shift towards those already known -but rarely used- instructional approaches (e.g. interdisciplinary projects, apprenticeships, collaborative investigations, extended inquiries) that provide opportunities for students to discuss and elaborate on complex ideas, to connect academic subjects to their personal interests, and to confront open-ended, real-world problems (Dede, 2014).

However, considering that students' learning strengths and preferences are changing as their usage of media outside academic settings shape them (Dieterle 2009), teachers may find it hard to provide deeper learning opportunities without employing technology.

The increasing availability and affordability of powerful mobile devices (e.g., smartphones and tablets) facilitates informal learning, participation, creation, and sharing (Dede, 2014; Ito, Gutiérrez, Livingstone, Penuel, Rhodes, Salen, Schor, Sefton-Green, and Watkins, 2013). Jenkins, Clinton, Purushotma, Robison, and Weigel have been exploring how people learn through what they describe as "new media literacies," which embody the kinds of intellectual, personal, and social fluencies learners develop as they use technology for learning and doing (Jenkins, et al. 2006)—by contrast, the notion that younger people are "digital natives" and older ones "digital immigrants" (Prensky 2001) is a less useful way to conceptualize this, as people's learning preferences and strengths are shaped by their current patterns of media usage, not simply by what happened when they were children. In fact, many adults have new media literacies, and some youth do not (Dede, 2014). "Many people born before 1980, too, are skilled at using new digital technologies, often more skilled in fact than their younger counterparts." (Palfrey and Gasser, 2011).

It is notable that Prensky himself – the originator of the terminology of "digital natives" and "digital immigrants"- has backpedaled from this position somewhat; in a 2011 piece, he explains that he simply meant to create a metaphor, and even posits:

> "Being a Digital Native is not, at its core, about capabilities, or even knowledge, regarding all things digital. No matter who you are, all those things have to be learned in some way. The distinction is, I think, much more about culture. It is about younger people's comfort with digital technology, their believe in its ease, its usefulness, and its being generally benign, and about their seeing technology as a fun "partner" that they can master, without much effort, if they are shown, or choose to." (Prensky, 2011, p.17)

It is true, however, that a substantial and rising proportion of young people do have technology-based learning strengths and preferences, presenting challenges for their engagement in traditional education (Collins and Halverson 2009). Much research is under way that examines various patterns of participation by youth in these new cultures, relating these to opportunities for connected learning, which encourage students to pursue opportunities to study outside of their classrooms and campuses (Ito et al. 2013).

The Ipsos Canadian Inter@ctive Reid December 2012 report, (see Table 1 below) provides us with detailed examination of who is on the Internet, why they are on it, and what they use it for. This report not only portrays online teens as “technology enthusiasts, teens today are the first generation to grow up with unlimited access to online technology”, but also corroborates findings of the study *Generation M^2. Media in the Lives of 8-to 18-Year-Olds* (2010).[5]

According to these findings, “eight- to eighteen-year-olds spend more time with media than in any other activity besides (maybe) sleeping—an average of more than 7½ hours a day, seven days a week”. The data presented below, may be taken as confirmation of the fact that today’s students learn *with* technology outside of the school and without the teacher’s intervention. This indicates the need for teachers to not only become familiar with some of the technology used by teens on a daily basis, but also to get to know how to make assertive use of these tools in the classroom -and outside of it- both to facilitate students’ learning and to keep up-to-date regarding real life matters.

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[5] *Generation M2. Media in the Lives of 8-to 18-Year-Olds*. http://files.eric.ed.gov/fulltext/ED527859.pdf

Table 1: Online teens (The Ipsos Canadian Inter@ctive, Reid, 2012)

CANADIAN ONLINE TEENS
Majority own or share ownership of a computer (83%), gaming console (75%), and mobile phone (67%); 12% own a tablet computer
Compared to 15% in 2009, 24% today spend on average 3 hours online each day
Teens spend on average as much time doing school work online (2.9 hrs.) as they do offline (3.4 hrs.)
Weekly, 86% of teens use a search engine, up 19 points from 2009
Majority visit sites like YouTube (79%), online social networks (69%), and music sites (61%)
Daily, teens use texting (54%) and online social networking (48%) the most to communicate
Significantly more teens pay for music online today (76%) compared to 2009 (52%)
Half have streamed TV shows (52%) and full length movies (46%) online
Most feel they need to keep up with latest technologies (63%) and feel they will miss out by not going online every day (57%)

1.2.2. Element 2: The Current Teacher

In Quebec, during the late 1990's, the consultations and debates held during the Estates General on Education led, in particular, to a redefinition of the mission of the schools in Quebec. The various actions taken as part of the curriculum reform process clearly affected the role of teachers and, as a result, the professional competencies that they must develop during their initial training, one of which, competency-8 specifically related to ICT use in the classroom, is presented in detail in section 1.4 (Table 3, p.22). Essentially, the new programs of study are based on a concept of learning that is part of the socio-constructivist school of thought and that places students at the very heart of the learning process. Each student becomes the principal agent of his or her learning (MEES, 2001).

However, traditionally, teachers are hired and rewarded for their assumed appropriate content expertise (Kinchin, Cabot and Hay, 2008). Teachers' main responsibility and activity have been directly instructing students, and acting as transmitters of knowledge. That is, telling students what they know and how they interpret the world according to the curriculum, textbooks, and other resources they have studied (Jonassen, Howland, Marra, Crismond, 2008).

The required new approach affects then, the traditional role of the teacher; instead of transmitting knowledge, the teacher becomes more of a guide, supporting students as they construct their knowledge.

Moreover, nowadays, many teachers are experiencing difficulties with ICT. They do not always have the knowledge, skills or resources to integrate ICT in the classroom in innovative ways (Angeli and Valanides, 2009; Dede, 2014; Koehler, Mishra, Yahya and Yadav, 2004; Villeneuve, 2011). Nevertheless, teachers are expected to attain a good technical mastery of technological tools, and they should also know how to integrate ICT in the classroom (Mishra and Koehler, 2009; Somekh, 2008; Villeneuve, 2011).

A report by the Quebec's Steering Committee of Teacher Training (CAFPE) (2002) still relevant regarding current teachers' situation in the province, shows that ICT are factors of teachers' feelings of pedagogical incompetence. Without being the only factor, this feeling of incompetence generates some consequences: The lack of fluency in these areas makes them vulnerable, hinders their effectiveness in the classroom and harms their professional development. Sometimes it arises a questioning about their professional commitment and, in the absence of adequate support, many teachers consider dropping out the profession. (Steering Committee for Teacher Ed., 2002, p. 29). This critical situation is not restricted to Quebec, though. The Inspectorate of Education of the Netherlands, (2015) reports that starting teachers are not receiving enough support: 12% of newly qualified primary school teachers, and 22% of their secondary counterparts, leave teaching within a year (OECD, 2016).

As Sedivy-Benton and Leland (2011) posit if we are able to craft informal learning experiences into meaningful, deliberate instructions for pre-service teachers, then hopefully, we can retain stronger teachers who remain in the profession longer. This will also help to inform the latest trend in K-12 education that is currently attempting to connect the academic success of students in classrooms to not only the teacher they interact with, but the teacher preparation program that the classroom teacher graduated from. The better job these programs do of exposing the realities in classrooms to pre-service teachers, the stronger they will become.

For example, student teachers from a local university in Montreal, found that the discussion panels organized during their last Education Seminar, was a valuable experience and expressed their appreciation for the opportunity to have pedagogical consultants (PC) from a school board sharing their knowledge and expertise regarding specific characteristics of the school milieu. PCs allocated extra time to discuss about inner city and outreach schools' most challenging and frequent issues they had to deal with regularly, as well as tips for approaching and addressing them. Following Wenger (1998), we were aiming at creating a group of individuals who shared a concern or passion for teaching, while equipping pre-service teachers with strategies and understandings to effectively respond to the job demands.

Also, regarding newly teachers, the support provided to them is often organizational rather than pedagogical, and temporary staff receive little support (Van der Boom, Vrielink and Fontein (2015). Still at present, most teacher professional development programs are not of high quality, offering "fragmented, intellectually superficial" seminars (Borko, 2004, p. 3, as cited in Dede, 2014, p. 21), which are unable to provide ongoing daily guidance for teachers as they attempt to implement novel curricula or pedagogies, often in environments made hostile by reluctant peers or administrators who see those innovations as undercutting the existing school culture (Dede, 2014).

It is then critical to note that technology is just a tool, one that can empower people to change the ways in which education is structured and delivered, and that teachers are most successful when they use technology to enable new and better types of work processes rather than to automate traditional ones (Angeli and Valanides, 2009; Dede, 2014; Law, 2008; Somekh, 2008).

However, rather than assuming that an educational technology "is effective" in some universal manner (Means 2006, as cited in Dede, 2014), research and development should focus on what works for whom, when, and in what contexts. Numerous studies document that no single pedagogy is optimal for all subject matter and every student (Dewey, 1897; Lampert 2001; Leinhardt and Greeno, 1986; Shulman, 1986). The best way to invest in the pedagogical integration of ICT is to begin by acknowledging that context matters, and that the tools must be flexible enough to serve the given school, its teachers and students, its curriculum, and its culture. In short, such tools should be designed with local adaptations in mind. Education reformers often assume that innovations cannot be brought to scale unless they can be replicated precisely and implemented with fidelity (Clarke and Dede 2009).

Nevertheless, as research have found (e.g. Angelis, 2004; Dede, 2014) the successful implementation, and pedagogical use of ICT tools often depends on the process of evolution that teachers undergo at the local level, and as Viens, Villa, Stockless (2015) argue, it is also determined by their e-learning culture - defined by Viens and Renaud (2001), as the teachers' representations regarding ICT, their attitudes, and their skills and resources that reflect in their habitual teaching practice.

1.2.3. Element 3: The Pre-Service Teacher and their Educators (Faculty and Lecturers)

In the late 1990's the consultation process that involved various partners in the education system established the official Ministry of Education of Quebec guide for teacher training in the field of general education. The Committee responsible for accrediting teacher training programs (*Comité d'agrément des programmes de formation à l'enseignement* or CAPFE) was asked to review the current training programs and to examine the new programs submitted in response to the document Teacher Training – Orientations – Professional Competencies. In addition, to guarantee the coherence and professional character of all training programs, the Committee was also asked to ensure that responsibility for teacher training was assigned to a single authority.

This promoted concerted action between the education faculties or departments and the other university faculties or departments responsible for specific subject areas, and an effective partnership between the university community and the school system. In this way, the government believed that Quebec would be able to train teachers to meet society's expectations in terms of education. The government expected that all the stakeholders, and the universities in particular, would respond to its call to unite their forces to train a new generation of professional teachers (Gouv. du Québec, Ministère de l'éducation et de l'enseignement supérieur, (MEES, 2001).

In the same line of thought, the literature makes evident that there is a widely held view that all teachers should graduate from their pre-service programs with good skills in ICT (Zang and Martinovic, 2008). According to Webb (2005), where there is no agreement is whether these skills are best obtained through separate ICT subjects (with titles such as "ICT in the classroom") or through using ICT integrated across the curriculum throughout the teacher education program (p.462). Downes, Fluck, Gibbons, Leonard, Matthews, Oliver, Vickers and Williams (2001) point out that the separate ICT subjects provide a focus on skills acquisition and seem appropriate where accreditation of skills is necessary, but tend not to provide the opportunities for teacher education students to consider the use of ICT across a range of subject areas, and rarely lead to integration within practical experience in schools.

Accordingly, these authors provide a framework that identify four distinct types of ICT related activity in educational settings. These types are presented as:

1. An object of study for the acquisition of ICT skills as an end themselves;
2. A tool for learning to enhance students' abilities to deal with the existing curriculum;
3. An integral component of broader curricular reforms that change not only how students learn but also what they learn; and
4. An integral component of curricular reforms that alter the organisation and structure of schooling itself. (Downes et al. 2001)

Watson (2001, as cited by McDougall, 2008) argues for a need to "rethink professional development intentions from skill provision with infrequent curriculum integration examples to a model that will enable teachers to see the reforming or transforming possibilities of ICT" (p.463). There is a need for programs to prepare teachers for changes of role when using ICT pedagogically in classrooms (Law, 2008, Jonassen, Howland, Marra, Crismond, 2008, Somekh, 2008).

Moreover, the evidence suggests (e.g. Angeli and Valanides, 2009) that new affordances provided by ICT-based learning environments require teachers to undertake more complex pedagogical reasoning than before in their planning and teaching that incorporates knowledge of these specific affordances and how these relate to their subject-based teaching objectives as well as the knowledge they have always needed to plan for their students' learning. The need for teachers' professional development is clear but enabling teachers to adapt their pedagogical reasoning and practices in response to learning opportunities provided by ICT is likely to be a very difficult and complex process (McDougall, 2008).

It appears that there is a need for teachers to develop a new professionalism to be able to play the role of catalysts in the knowledge society (Dede, 2014). According to Hargreaves (2003) "they should promote deep cognitive learning; learn to teach in ways they were not taught; commit to continuous professional learning; work and learn in collegial teams; treat parents as partners in learning; develop and draw on collective intelligence; build a capacity for change and risk, and foster trust in processes" (p. 24).

However, and as MacDougall (2008) suggests, building up these capacities requires that teacher training programs prepare educators to go beyond knowledge. Student teachers need to develop the metacognitive ability (as an autonomous learner to identify problems and knowledge gaps, monitor and review their own professional learning, and to assess the extent to which the problems are resolved or targeted goals are achieved), which will foster in turn their ability to implement activities that develop their students' metacognitive skills (Hargreaves, 2003*)*. Nevertheless, as Scardamalia and Bereiter (2006) point out, knowledge building is not something that happens naturally, but requires shared intentional efforts from members of the community. Hence, educators need to develop the socio-metacognitive capacity required for knowledge building through professional development efforts that engage them as contributors in a knowledge-building community (Scardamalia and Bereiter, 2006).

Moreover, educators must gain some familiarity with the technology. They must gain skills and fluency with the technology, helping students learn *with* technology without necessarily acting as the expert. Rather, educators should learn to coach the learning of technology skills, and in some instances they will be learning with the students. Already in 2008 Jonassen, Howland, Marra, Crismond, stated that teachers had to accept that students can and are learning *with* technologies, with or without the help of the teacher, we could only expect that by this year of 2016 teachers are integrating some ICT in their teaching practice.

Research (e.g. Schleicher, 2016; OECD, 2014) suggest that preparing technology-competent teachers is a challenging and sensitive issue that starts in initial teacher education. No doubt, teacher educators play an important role in building the capacity of pre-service teachers. There is need to examine how pre-service teachers' learning should be designed so that they know how to effectively plan technology integrated lessons for their students. Since pre-service teachers are relatively unfamiliar with teaching practices, the methods for teaching them about pedagogical uses of the technology tools could differ from that for in-service teachers (Divaharan and Koh, 2010). Therefore, educators must not only learn new content and skills but, at the same time, "unlearn" many common beliefs and assumptions about the nature of teaching, learning, and schooling. For those educators who cannot relinquish the lectern, and who feel uncomfortable letting students make and discuss their own scientific predictions, or participate in unscripted simulations, or design their own virtual experiments, such digital tools will be problematic (Dede, 2014). Some researchers would argue (e.g. Dede, 2014; Dunleavy and Dede, 2013) that if we want educators to learn programs such as SimCalc and EcoMUVE effectively, then we should give them professional development opportunities that also make use of digital teaching platforms and immersive authentic simulations, demonstrating the opportunities that we hope they will provide to their students.

Accordingly, there is substantial evidence that faculty modelling of technology use is a particularly successful strategy for pre-service teachers' technology integration training (Divaharan and Koh, 2010); McDougall, 2008). Handler (1993, as cited in McDougall, 2008) found that those who frequently saw computers being used in their pre-service methods course felt better-prepared to use the computer as an instructional tool. However, many faculty members continue to rely on traditional, lecture-based teaching methods and make only modest attempts to incorporate technology into their own teaching practice (Brown and Green, 2013). In fact, if the only technology use pre-service teachers see modelled is PowerPoint-based lecture the likelihood of them using other tools for technology integration will be limited. Thus, to fully support pre-service teachers' ability to integrate technology into their practice, it is incumbent upon their educators to model how to integrate technology in teaching. As Koh and Divaharan (2011) posit, modelling is a key element for pre-service teachers' acceptance of a given instructional technology; without the opportunity to see it in use, student teachers are far less likely to be able to imagine how a given tool might be integrated into classroom practice.

When tutor modelling is followed by opportunities for them to practice and apply technology tools in the design of lessons, it increased their self-reported confidence level for utilizing these technologies in the classroom (Pope, Hare and Howard 2005).

Therefore, building relationships and modelling effective teaching appear to be important roles played by teacher educators (Marlow and Nass-Fukai, 2000); Sharp and Turner, 2008). Howitt (2007) found that modelling of effective teaching strategies by the teacher educator was one of the biggest influences on the pre-service teachers' confidence in teaching science. Howitt also found, that pre-service teachers have to trust their educators in order to develop confidence in their own teaching, and gain valuable feedback and encouragement about their development as a teacher.

1.3. Rise of Policies Regarding ICT Competency in Initial Teacher Training

In the early 1990's the Ministry of Education of Quebec (MEES) launched a major reform of teacher training programs. The Ministry realized that there was an urgent need to reform recognized by all stakeholders. This reform was intended to make the act of teaching a professional act, which required rethinking the teacher training needs along with new approaches to training, as well as new training programs (MEES, 2001).

Demonstrating consistency of purpose, the MEES initiated in 1997 a Plan of Action entitled "Information and Communication Technology in Education" in order to contribute to better preparing student teachers to integrate ICT in their teaching. One of the main observations contained in the Plan was that universities only considered technology training as a specialisation and failed to see it as a pedagogical tool (Rizza, OECD, 2009). To improve this flaw, in 2001 the Ministry of Education of Quebec acknowledging the numerous possibilities offered by ICT in education stated that the teaching competencies required in the ICT field are related more to how ICT tools and other resources are used in teaching competencies than to advanced technical knowledge of the computer environment (MEES, 2001).

Continuing its initiatives on mobilizations started in the early 1970's regarding ICT integration, MEES' standpoint was the publication in 2001 of the "Teacher Training Orientations: Professional Competencies" that to date is considered to be *the* official reference concerning teacher education in Quebec. It presents the 12 competencies that teachers of primary and secondary schools are supposed to have acquired by the end of their initial training. One of these competencies –Competency 8- refers specifically to the pedagogical use of ICT by teachers, "[…] Integrate ICT in order to prepare, control teaching-learning activities, and administrate teaching and professional development" (p.97). The *Teacher Training Orientations: Professional Competencies* provides also the definition of competency:

> "Generally, a professional competency is applied in a real-life professional setting; follows a progression from simple to complex; is based on a set of resources; is based on the ability to mobilize resources in situations requiring professional action; involves a successful, effective, efficient, recurrent ability to act; is part of intentional practice; and is a project, an ongoing pursuit." (MEES, 2001, p.46)

Reference Frameworks for Competencies. Nations and states around the world take good care in establishing and providing benchmarks and standards to guide specific aspects of education at diverse levels. We observe a rise of policies regarding ICT competency in initial teacher education aiming at improving the flaw of universities failing to consider ICT as a pedagogical tool (Rizza, 2010; OECD, 2009; OECD 2011, OECD 2014). Moreover, since they usually serve as reference when taking decisions about education, we present a few of them here:

The International Society for Technology in Education (ISTE) provides educators with a framework and standards, including those regarding teachers' technology training. This framework is kept up-to-date and delivers the standards for the teachers' techno-pedagogical competencies provided by the National Educational Technology Standards for Teachers (NETS-T). First published in 2008, the NETS-T comprise five components:

1) Facilitate and inspire student learning and creativity: Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate effective learning experiences and promote creativity and innovation in both face-to-face and virtual environments;

2) Build and develop learning experiences and assessments: Teachers design, develop and evaluate authentic learning experiences integrating ICT and resources to develop the knowledge, skills and attitudes specified in the Standards;

3) Show, by example, the use of ICT for learning at work: Teachers exhibit knowledge, skills and work processes representative of an innovative professional in a global and digital society;

4) Promote and show by example, digital citizenship and responsibility: Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit ethical behavior in their professional practice;

5) Engage in professional development and leadership: Teachers continuously develop their professional practice, model lifelong learning, and exhibit leadership by promoting and demonstrating effective use of digital tools and resources (iste.org/standards, 2008).

UNESCO's 2 ICT Competency Framework for Teachers (2 ICT-CFT) 2011. This framework updates the one published in 2008. It highlights that modern societies are increasingly based on information and knowledge. So they need to:

1) Build workforces which have ICT skills to handle information and are reflective, creative and adept at problem-solving in order to generate knowledge;

2) Enable citizens to be knowledgeable and resourceful so they are able to manage their own lives effectively, and are able to lead full and satisfying lives;

3) Encourage all citizens to participate fully in society and influence the decisions which affect their lives; 4) foster cross-cultural understanding and the peaceful resolution of conflict.

UNESCO'S 2 ICT-CFT (2011) guides teacher educators concerning ICT-related professional development. It emphasizes the need for teachers to acquire and develop ICT competencies to be able to teach them to their students. Teachers are also expected to help their students grow as collaborative, problem-solving, creative learners through using ICT so they become effective citizens and members of the workforce.

This Framework, presented in Table 2, is arranged in three successive stages of teacher's development and addresses all aspects of a teacher's work:

1) Technology Literacy, enabling students to use ICT in order to learn more efficiently;

2) Knowledge Deepening, enabling students to acquire in-depth knowledge of their school subjects and apply it to complex, real-world problems;

3) Knowledge Creation, enabling students, citizens and the workforce they become, to create the new knowledge required for more harmonious, fulfilling and prosperous societies.

Table 2: The UNESCO ICT Competency Framework for Teachers (2ICT-CFT, 2011)

THE UNESCO ICT COMPETENCY FRAMEWORK FOR TEACHERS			
	TECHNOLOGY LITERACY	**KNOWLEDGE DEEPENING**	**KNOWLEDGE CREATION**
UNDERSTANDING ICT IN EDUCATION	Policy awareness	Policy understanding	Policy innovation
CURRICULUM AND ASSESSMENT	Basic knowledge	Knowledge application	Knowledge society skills
PEDAGOGY	Integrate technology	Complex problem solving	Self-management
ICT	Basic tools	Complex tools	Pervasive tools
ORGANIZATION AND ADMINISTRATION	Standard classroom	Collaborative groups	Learning organizations
TEACHER PROFESSIONAL LEARNING	Digital literacy	Manage and guide	Teacher as model learner

The UNESCO framework sets out the skills required to integrate ICT in teaching. It also serves as a guide to enhance the development of teachers' professional skills in teaching, teamwork, and in the ability to innovate by using ICT. Finally, the framework is utilized to standardize the vocabulary related to ICT use in the education community. The broad lines of this standard include six categories as shown in Table1:

1) Understanding ICT in Education;

2) Curriculum and Assessment;

3) Pedagogy;

4) Information and Communication Technology (ICT);

5) Organization and Administration;

6) Teacher Professional Learning.

The European Commission used the earlier UNESCO's 2008 Framework, to further develop a benchmark to guide teachers in developing their ICT skills across Europe. It is called eTQF - Teacher ICT Qualification/Competency Framework (Fast Track into Information Technology (FTIT), 2010). The eTQF benchmark is divided in four sections, each one with increasing proficiency levels:

1) Information and Communication Technology;

2) Education;

3) Curriculum and Evaluation;

4) Teachers' Professional Development.

In Quebec, as aforementioned, the Ministry of Education published in 2001, the "*Teacher Training Orientations: Professional Competencies"*. This framework contains 12 competencies that student teachers should have developed by the end of their teaching training. Among these competencies, Competency 8, states the need for teachers to become knowledgeable in the use of ICT: To integrate information and communications technology (ICT) in the preparation and delivery of teaching/learning activities and for instructional management and professional development purposes.

Table 3 below, presents the 6 features of Competency 8 that further explain what is expected from teachers in terms of pedagogical use of ICT in the classroom.

Table 3: The 6 components of Competency 8 that integrates ICT. (MEES, 2001)

FEATURES OF COMPETENCY 8
1. Exercises critical judgment regarding the real benefits and limitations of ICT as teaching and learning resources, and regarding the social issues they raise.

2. Assesses the instructional potential of computer applications and networking technology in relation to the development of the competencies targeted in the programs of study
3. Communicates using various multimedia resources
4. Uses ICT effectively to search for, interpret and communicate information and to solve problems
5. Uses ICT effectively to build networks that facilitate information sharing and professional development with respect to his or her own field of teaching or teaching practice
6. Helps students to familiarize themselves with ICT, to use ICT to carry out learning activities, to assess their own use of ICT, and to exercise critical judgment regarding the information they find on the Internet

By including Competency 8 in the official reference for teaching education in Quebec, the government of Quebec clearly shows coherence between its national policy and its expectations in terms of implementation of ICT in initial teacher education.

Having a closer look to the above-mentioned frameworks, any random education administrator in charge of teachers' training, may be misled to think that what these frameworks specify as standards for the competence requirements for integrating ICT in teaching is all they need to take into consideration when planning for teachers' professional development. Even though these frameworks are based on sound and extensive research, they do not explicitly show or at least openly acknowledge that there exist another set of framework regarding human factors (e.g. teachers' low self-efficacy beliefs ⁄ feelings of ICT incompetence). Research (e.g. Baskin and Williams, 2006; Fullan, 2007, Gill and Dalgarno, 2008; Kirkland and Sutch, 2009; Wang, 2002) has equally shown that it is these factors that determine teachers' preparedness to start using ICT in their teaching and, therefore, should be considered as essential in any training aiming at fostering any pedagogical integration of ICT. Therefore, it not due to lack of knowledge about the latter set of framework. Analysis of the reasons why these international and local entities (e.g. UNESCO, eTQF, ISTE) do not equally weigh up these frameworks, is, however, beyond the scope of our research.

1.3.1. Policy and reform have paved the way, but… what is still missing?

Research confirms the increasing use of ICT in schools in many countries around the world and in Quebec[6] (Larose, Grenon, and Karpati, 2011; Karsenti, Raby, Villeneuve, Gauthier, 2007; Karsenti, Collin, 2013; Law, 2008; OECD, 2009: OECD 2011; Ottesen, 2006; Swain, 2006; Valanides and Angeli, 2008, 2009; Zhao, 2009).

Along with Rizza (2010), we have realized through our literature review, that although many of the participating OECD countries, have undergone major curriculum reforms recently so as to incorporate not only digital competencies but, more broadly, the wider set of 21st century skills, there is often a mismatch between curricular reforms and what is going on in initial teacher education. Furthermore, research shows that students in initial teacher training programs still have deficiencies not only in the competencies required to be able to successfully integrate ICT, but also in the mastery and integration of technologies- even of the basic tools at the basic level (Enochson, and Rizza, 2009).

These studies show that the integration of ICT both in Quebec's schools and abroad has not yet reached its full potential. Furthermore, it doesn't change much. More precisely, results from a study involving 1,180 teachers in Quebec (Canada) show that most of them are only able to use some office software, email and Internet (Larose, Grenon and Palm, 2004; Larose, Grenon, and Karpati, 2011). Moreover, it appears that the use of ICT to support interdisciplinary projects or the implementation of a scientific approach among students remains a limited teaching practice (Larose, Grenon and Palm, 2004; Larose, Grenon, and Karpati, 2011). The new technologies remain, though, for most of these teachers, marginal pedagogical tools (Larose, Grenon and Palm, 2004; Larose, Grenon, and Karpati, 2011; Villeneuve, Karsenti, Raby, and Meunier, 2012).

The detrimental implications of these findings are even greater as Karsenti, Raby and Villeneuve (2008) argue that in universities where ICT lessons have been removed, the lack of

[6] As already mentioned, in Canada, elementary, secondary, and post-secondary education is a provincial responsibility.

teaching concerning the pedagogical integration of ICT has a negative impact on uses of ICT by student teachers in their classrooms.

As we mentioned before, the situation is similar among future teachers in Quebec. A study aiming at portraying the level of professional competence of 2,065 prospective teachers from nine francophone universities in Quebec (Canada) to integrate ICT in the classroom, shows that pre-service teachers, use ICT regularly and reflectively to plan their classes, communicate, search for information, prepare educational materials, solve problems, or improve themselves professionally (Villeneuve, 2011). However, only a very low proportion of future teachers either uses ICT in the classroom or encourages their students to do so (Karsenti and Lira, 2010). Results from this study also indicate that one of the six components of competency 8, is usually mastered (c1), four are only partially mastered (c2, c4, c5, c6) and one remains to be developed (c3) (Villeneuve, Karsenti, Raby, Meunier, 2012). (See Table 3, above as a recall). Moreover, and as stated before, neither half of future teachers in preschool and primary education use ICT during their internship nor future high school teachers use ICT while teaching (Villeneuve, Karsenti, Raby, and Meunier, 2012).

Thus, since ICT use in the classroom is still limited and the competence levels of in-service and newly graduated teachers regarding ICT integration to their practice remains modest, it seems necessary to focus on the training activities which are offered to teachers in order to allow them to develop their technological competencies. It is important to note, however, that a major contributing factor to the failure to prepare teachers to teach with technology is that these courses emphasize the acquisition of technical skills. Although essential, technical skills are not enough for preparing teachers to teach with technology because they are usually taught disconnected from subject-specific contexts (Selinger, 2001).

As Kenny (2002 cited in Angeli and Valanides, 2008) stated, the lack of a subject-specific focus in many technology preparation programs remains an issue, but even in those cases where subject applications are discussed, matters of how technology interacts with the content and content-specific pedagogy are not sufficiently explored. It seems then, that teacher education programs fail to adequately prepare teachers to establish pedagogical connections between affordances of technology and the teaching of a content domain (PCK) (Angeli and Valanides, 2008, p. 155).

Nevertheless, regarding this domain of teaching with technology, and to address the disparity in terms of technology integration, while fostering some understanding derived from the literature on expertise in teaching, Pierson (2001) suggests another component to the model pedagogical-content knowledge (PCK) suggested by Berliner, 1986; Leinhardt and Greeno, 1986; Shulman, 1986; and Wilson, Shulman, and Richert, 1987, as cited in Pierson, 2001). According to these researchers, expert teachers possess both *content knowledge* and *pedagogical knowledge,* the intersection of which is described as *pedagogical-content knowledge,* or knowledge about specific learners, curriculum, and the various and most useful ways to represent the particular subject-matter taught. The component proposed by Pierson (2001) is that of *technological knowledge.*

> "This knowledge would include not only basic technology competency but also an understanding of the unique characteristics of particular types of technologies that would lend themselves to particular aspects of the teaching and learning processes. A teacher who effectively integrates technology would be able to draw on extensive content knowledge and pedagogical knowledge, in combination with technological knowledge. The intersection of three knowledge areas, or *technological-pedagogical-content knowledge,* would define effective technology integration." (Pierson, 2001, p.427)

Besides the issues mentioned above, we consider important to present some other factors that are found to have an impact on teacher education at different levels. These factors allow us to somewhat illustrate what we mean, along with Enochsson and Rizza (2009), when we posit that there is sometimes a mismatch between curricular reforms and what is going on in initial teacher education.

1.4. Factors Influencing Teachers' ICT Competence

What influences teachers' preparedness to use ICT in the classroom? An often cited BECTA commissioned review of the literature relating to barriers to ICT integration provides insight into what influences teacher preparedness to use ICT. Preparedness defined as “state or condition of being prepared; readiness”, and emphasizes the attitudinal aspect of being prepared to do something (OED Online, 2013). BECTA reports that in addition to a lack of time, resources and training, the human factors including a lack of confidence in using ICT, a resistance to change and negative attitudes to ICT, and a lack of perceived benefits were key and consistent barriers to teacher use of ICT (BECTA, 2004, BECTA, 2009; Kirkland and Sutch, 2009).

Numerous researchers have developed models that attempt to explain, if not predict acceptance and implementation of ICT. The Technology Acceptance Model (TAM) developed by Davis (1986) (see Figure 1) is one of these, and makes part of the Unified Theory for Acceptance of Use of Technology (UTAUT) developed by Venkatesh, Morris, Davis and Davis, (2003). The TAM, which as its name suggests, examines user acceptance of computer technology, is based on the Theory of Reasoned Action (TRA), (Ajzen and Fishbein, 1980 as cited in Davis, Bagozzi and Warshaw, 1989) a model used for predicting and explaining behaviour in a range of contexts.

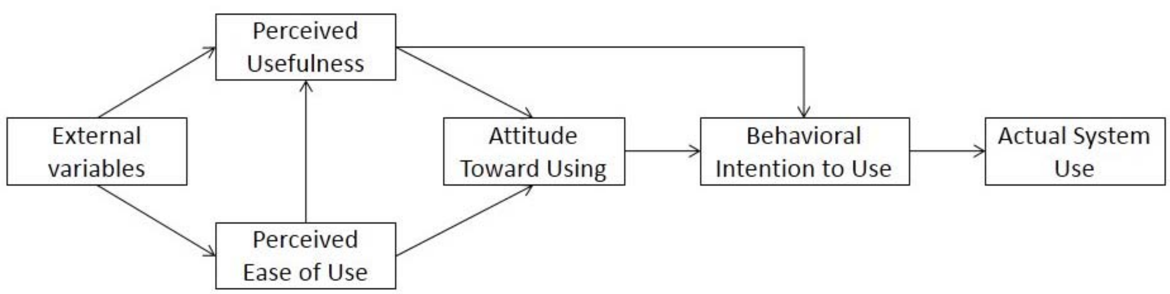

Figure 1 : Technology acceptance model (TAM) (Davis, Bagozzi and Warshaw, 1989)

The TAM was assessed by Davis, Bagozzi and Warshaw (1989) in a study that examined 107 full-time MBA students at the University of Michigan. They found that beliefs of “perceived usefulness [were] a major determinant of people's intentions to use computers [and that] perceived ease of use [was] a significant secondary determinant of people's intentions” to accept technology (Davis, Bagozzi and Warshaw, 1989, p. 997).

Gill and Dalgarno (2008) conducted a review of studies using the TAM model, and found that for example, Smarkola, (2007), confirmed the validity of perceived usefulness and perceived ease of use as predictors of user acceptance of computer technology, and that also provided support for the currency of the model. Based on two other studies of their review, Gill and Dalgarno (2008) also report that Sime and Priestley's (2001) study of student teacher views of ICT in teaching found the perception that even when resources were limited and access to computer suites was problematic, the individual teachers' attitude was the vital factor in determining ICT use. Galanouli and McNair (2001 as cited by Gill and Dalgarno, 2008) also found this to be the case, stating that although lack of equipment was considered an important factor, it was clear that teachers' attitudes play the most crucial role. These findings are confirmed by Villeneuve (2011) whose study on the techno-competency of pre-service teachers in Quebec shows that "it is not only technical problems that affect future teachers to integrate ICT, but that personal factors such as motivation and perceived competence towards ICT also have a role to play." (Our translation, p.29)

Providing some insight into the issue of teacher preparedness to use ICT for learning and teaching, Granger, Morbey, Owston and Wideman (2002), explain that the relationship between teachers' ICT skills and successful implementation is complex and may include a range of contributing concerns such as teacher attitudes, philosophies, communication, and access to skills training, in addition to having the necessary equipment, support, and education. Accordingly, Wang (2002) asserts that pre-service teachers' beliefs and perceptions play a crucial role in shaping their future teaching behaviours. Baskin and Williams (2006) agree and posit that human factors are the most critical ones when developing teachers' ICT culture and sustaining teachers to be able to use ICT effectively in their teaching.

With a view to increasing the preparedness of pre-service teachers to use ICT, Brownlee, Purdie, and Boulton-Lewis (2001) suggest that teacher educators need to focus on teacher thinking and teacher beliefs to facilitate changes in the teaching/ learning process. From these findings it would seem clear that human factors such as attitudes and beliefs have a significant influence on teacher behaviours, and consequently their preparedness to use ICT for learning and teaching.

InterSTICES[7] (Viens, Peraya, Bullat-Koelliker, 2004; Viens and Peraya, 2004; Peraya and Viens, 2005) is another one of the models comprising human factors that could be used when aiming at providing researchers with the appropriate means to effectively planning and intervening for a successful adoption of ICT. These researchers "decided to use the InterSTICES model as well as the pedagogical engineering approach it facilitates, since they had already proven effective (Viens, Bullat-Koelliker, Peraya, 2004; Viens, Peraya; Bullat-Koelliker, 2004) in providing researchers with the appropriate means when planning and implementing the type of intervention as the one [they] have designed." (p.1)

As aforementioned, it has been found that human factors become essential when designing and implementing teacher training programs to help pre-service teachers trainers integrate ICT pedagogically and effectively in their teaching practice (Baskin and Williams (2006); Wang, 2002; Ertmer, 2005). InterSTICES takes into account the actors and their characteristics that are encompassed in its e-learning culture dimension (Peraya and Viens, 2005). In fact, it takes a deep approach to intervening and working with people. It allows placing any training intervention within the context where teachers interact (Viens, Villa, Stockless, 2015).

It follows then, that the Interstices model (Peraya and Viens, 2005) may be used for this research as a viable solution, which may adequately support design when looking for appropriate essential methods for teacher training programs in ICT integration. However, the description of characteristics of an InterSTICES-type activity are neither operational nor systematic. Furthermore, there are currently no means that allow to understand how to plan

[7] *InterSTICES*: Intégration par la Recherche et le Soutien des Technologies de l'Information et de la Communication pour l'Enseignement Supérieur. (Du Latin *insterstare*, se trouver entre) (Viens, 2002).

InterSTICES: Integration through Research and Support of Information and Communication Technologies for Higher Education (our translation) and organize such an activity. Related literature is rather descriptive focusing on the relationship among IntersTICES components i.e. the pedagogical added value; the spaces of pedagogical ICT integration, as well as the internal consistency of the pedagogical activity; and the e-learning culture of actors, from a systemic perspective. Therefore, our intention is to work on operationalizing the IntersTICES model and better understand its scope in the context of a training intervention.

1.5. Conclusion

The presence of technology in our classrooms today imposes, therefore, the taking into account of the relationship between technology, human factors and pedagogical practices. This relationship can be conceptualized as ‘sustaining or subversive’ (Law, 2003, p. 453), depending on whether the use of the technology is aimed to strengthen existing pedagogical processes to better achieve existing curriculum goals or to bring about new goals, new processes, and new relationships. It seems, then, that pedagogical innovations are disruptive precisely because they challenge long-standing values and beliefs in education (Law, 2008). Professional development efforts that do not address these aspects of teacher learning will not measure up to the demands of preparing teachers for the twenty-first century. It is important to note that this categorization of sustaining or subversive uses of technology does not depend on the technology alone, but also on the intended use of the technology in the specific educational context (Law, 2008).

Furthermore, one of the problems regarding these disruptive uses of technology in an educational context, is that it requires some pedagogical innovations to take place to benefit from them. These pedagogical innovations, in turn, require an e-learning culture, which entails some changes to take place, when planning and implementing for technology use and integration in education (Viens, Villa, Stockless, 2015). Researches on pedagogical innovation e.g. Somekh, (2008); Angelis and Valanides, (2009), are of major importance for the perspectives they provide regarding taking into account factors having an impact on innovation and change in educational contexts.

1.6. Research Objectives

The specific research question of this research, its related goal and specific objectives are stated as follows:

How can the IntersTICES Model be used in a training intervention to support pre-service teacher trainers in the design of activities to successfully integrate ICT into their teaching practice and enable them to get the very most out of the pedagogical added value of ICT?

In order to answer this specific research question, we have identified the goal of this research and two specific objectives:

To support the development of the e-learning culture of teacher trainers teaching subjects different from ICT in initial teacher training programs;

1. To operationalize[8] the IntersTICES model through a training intervention

2. To examine the impact of the training intervention, the follow-up and personal support on participant teacher trainers' e-learning culture and on their intention to integrate ICT in their teaching practice.

1.7. Relevance of this Research

Research studies (e.g. Villeneuve, 2011) show that there is a gap between how people use new technologies in their everyday lives and how they are integrated –or not in the classroom. This gap is still causing distress among teachers and even dropping-outs from the profession (Steering Committee for Teacher Ed., Quebec (CAFPE), 2002, p. 29; the Inspectorate of Education of the Netherlands, (2015) and the OECD, 2016). As aforementioned, a lack of fluency in these areas makes teachers vulnerable, hinders their

[8] Operationalize: To develop practical methods and approaches from theoretical concepts in order to enable response personnel to achieve optimal results in the field.

effectiveness in the classroom and rises a questioning about their professional commitment, and, in the absence of adequate support, many teachers consider dropping out the profession. Furthermore, teacher trainers' e-learning culture is important as it is that that shapes their practice (Viens and Renaud, 2001), but such staff are lacking in training in this area. Professional development activities do not train teacher trainers on their e-learning culture. These training activities focus on ICT use. There is no actual inclusion of reflective exercises regarding ICT integration.

This research has both a relevant and current character that can have an impact on teacher training programs in Quebec and elsewhere.

The scientific relevance of this research is based on the lack of (rather general) understanding regarding the need of helping teachers become aware of and develop their e-learning culture, and of effective training interventions to facilitate this type of training. Moreover, as the field of ICT is constantly evolving, it seems evident that this research, focusing both on the pedagogical integration of ICT and on pre-service teacher's e-learning culture, will benefit the community of researchers interested in the field. Furthermore, the new knowledge brought by this thesis will also help initial teacher training programs respond to the Ministry of Education and societal demands regarding teachers' mastery of the professional competence to integrate ICT (Competence 8).

As for the social relevance, this thesis will allow universities to take appropriate action to improve initial teacher training programs. We consider that the impact of integrating ICT tools in education, does not have to be limited to the teacher trainers' practice. It has to go further and benefit learners at school level, as a side effect. Therefore, regarding the recommendations that would be considered for initial teacher training programs, pre-service teachers could receive the appropriate training, then, hopefully, as Sedivy-Benton and Leland (2011) argue, we can retain stronger teachers who remain in the profession longer. This will also help to inform the latest trend in K-12 education that is currently attempting to connect the academic success of students in classrooms to not only the teacher they interact with, but the teacher preparation program that the classroom teacher graduated from.

Chapter 2: Theoretical Framework and Literature Review

2.1. Introduction

The previous chapter put forward that researchers agree on considering teachers as being key to successful adoption of ICT and most agree that teacher professional development needs to focus on both technology skills and support for pedagogical change to embed ICT in the teaching practice (BECTA, 2004, 2009; International Society for Technology in Education, 2008; National Council for Accreditation of Teacher Education, 1997; Thompson, Schmidt, and Davis, 2003). Some exemplary practices and strategies on how to help teachers learn about and start using ICT have been identified as been able to have a positive impact on ICT-integration in pedagogy. In this regard, several theoretical models have been developed in the international literature to address the issue of the pedagogical integration and use of ICT and most of them from a constructivist / socio-constructivist approach. It is important to notice, however, that the many operational definitions of technology integration in studies in the literature might suggest that schools being so keen to acquire and have teachers begin using technology may mistake simply having and turning on a computer as integration (Pierson, 2001, Somekh 2008).

The theoretical framework of a research as Gohier (2000) indicates should include research and analyses done on the key concepts of that research. However, Torraco (2005) argues that literature reviews can also be used as "a distinctive form of research that generates new knowledge about the topic reviewed" (p.356). Since our work focuses on the pedagogical integration of ICT, it involves in particular: The notion of competency; Factors affecting and/or determining ICT adoption and; Models, one of which encompasses the central notion of our study i.e. the e-learning culture; as well as Frameworks and Approaches for teacher training.

We will first explore the concept of *competency* vis-à-vis core competencies identified in exemplary teacher education practices to understand the what, how, and especially the *why* of the pedagogical use of ICT in teacher education programs. As we have seen in the research problem, there are issues that slow down or hinder the acceptance and integration of ICT in the classroom. We will then examine the factors determining the integration of ICT, followed by the introduction of models for teacher training, including the presentation of the e-learning culture dimension, as well as well-known frameworks and approaches for teacher training. Finally, the last section will be a return to the items seen in this theoretical framework.

The epistemological position adopted in this research is socio-constructivist. This position is justified not only by the fact that most models and theories of learning that support innovative educational contexts are those of constructivist and/or socio-constructivist approaches, but also and especially because along with some socio-constructivists authors e.g. Vygotsky (1978) and Bruner (1986) we do believe that any knowledge is socially constructed or constructed in interaction with our social environment.

2.2. Benchmarks to Explain some ICT Competencies

Research shows that teacher learning for pedagogical innovation is becoming increasingly important in the 21st century when the focus in education shifts toward lifelong learning and knowledge creation, demanding changes in educational goals, as well as curriculum and pedagogical processes (Dede, 2014; Dieterle, 2009; Pelgrum and Law, 2003).

If teachers are to engage in pedagogical innovation then they need to be prepared with knowledge beyond what is essential for operating in classrooms, as they are currently constituted (Law, 2008). Most of the research on technology for education agrees that teacher learning should prepare teachers not only for any kind of technology integration, but also should equip teachers for “best practices” in ICT integration that contribute to improving existing teaching practice to achieve the goals of school reform (Holland, 2001; McDougall, 2008; Somekh, 2008). However, research continues to find that, even in teacher preparation programs that promote use of ICT for active student learning, ICT is used mostly for information presentation (Graham, Tripp, & Wentworth, 2009).

Other research that directly addressed the question of innovation with pre-service teachers found that their understandings of pedagogical innovation and capacity to deal with it varied (Davis, Hartshorne, & Ring, 2010) with the implication that program designers need to consider readiness for change when promoting unfamiliar pedagogical approaches. In this endeavour, there is a need for benchmarks in relation to policy development and assessment using ICT as well as for pedagogical use (Kirschner, Wubbels, & Brekelmans, 2008). It is therefore expected that teacher education programs promote and encourage the pedagogical use of ICT to improve existing teaching practices and contribute to the development of new, innovative teaching practices.

Based on the assumption that in exemplary teacher education practices we can observe what teacher educators consider to be the competencies that good teachers need to have, Kirschner (2003) identified and proposed a number of core competencies. The exemplary practices were analyzed with respect to the emphasis they placed on different aspects of ICT-use in teacher education, the depth and the breadth of the practices, and the pedagogy employed. The programs chosen as best practices conformed largely to the ideas of modern constructivist education, where learning is seen as an active process and where a balance is required between learner support and teacher guidance.

Regarding the developing of benchmarks for both pre- and in-service teacher education programs, Kirschner, Wubbels, and Brekelmans, (2008) used the analyses of exemplary teacher education programs included in Kirschner and Davis (2003), together with a review of the research literature on teacher education for the pedagogical use of ICT. Kirschner and Davis analyzed 26 good practices in ICT-supported teacher education, which were collected from five regions around the world and aimed at the preparation of student teachers for working in an ICT-rich environment.

This collection of exemplary practices is at the core of the nine benchmarks that Kirschner, Wubbels and Brekelmans (2008), formulated for teacher education programs on the pedagogical use of ICT. However, for this research, only the first four and the last one (i.e. Benchmark 9) were kept and are presented more in detail here. They seem best aligned with the skills that prospective teachers in Quebec are supposed to have acquired by the end of their initial training regarding Competency 8, which refers specifically to the pedagogical use of ICT by teachers: "[…] Integrate ICT in order to prepare, control teaching-learning activities, and administrate teaching and professional development." (Teacher Training Orientations: Professional Competencies, 2001, p.97).

2.2.1. Benchmark 1: Personal ICT-Competencies

A prerequisite for using ICT as a pedagogical tool is that the teachers themselves can use ICT as a work tool (e.g. posting course materials in an electronic learning environment), a communication tool (to liaise between school, parents, local community, and beyond) and an administration tool. Teacher education programs, pre- or in-service, should thus facilitate teachers to become competent personal users of ICT. Minimally, today's teachers require basic competencies with office applications (word processing, spreadsheets, databases, drawing packages, and a simple web page editor); resource tools (CD-ROMs, Internet, web-portals, different types of search engines), and communication tools (email, discussion lists and synchronous chat) (Kirschner, Wubbels, and Brekelmans, 2008).

Regarding this need of facilitating teachers to become competent users of ICT, Nachmias, Mioduser, Cohen, Tubin, and Forkoshc-Baruch (2004) reported an interesting phenomenon detected in one of the schools participating in their research study in which students, *computer trustees,* had a part in staff training: "The training of computer trustees left a strong impression because of two reasons: one, we learned through the point of view of the kids, and secondly, not less important, the kids found out that we are also flesh and blood: not always understanding and knowing, and in fact, behaving like them, like students". (A teacher) (Nachmias et al. 2004, p.301). These students acting as *computer trustees* were not only helping their teachers acquire and develop some ICT skills, but by doing so, they were also contributing to the innovative learning experiences of all.

Why: To develop the learner (and teacher)'s ability to use ICT effectively for communicating between and within student (and teacher) groups; communicating with other teachers; lifelong learning, including self-assessment of learning and learning needs.

Some countries have introduced an "ICT driving license" for these competencies. (e.g., Turcsányi-Szabó, 2008)

2.2.2. Benchmark 2: ICT as a Mind Tool

As posit by Dede (2014), Jonassen (2000) and Klopfer and Sheldon (2010), mind tools scaffold different forms of reasoning about content; they require students to think about what they know in different, meaningful ways. At this point we must make a distinction between learning *with* ICT (i.e., as a productivity tool) and learning *through using* ICT (i.e., as a mind tool) (Law and Plomp, 2003). In the former, ICT is the enabler, such as in using a project-planning program to help students plan their projects properly and hand in their projects on time. In learning through using ICT, the expected outcome is for ICT to bring about a change in the way one thinks and works (Kirschner, Wubbels, and Brekelmans, 2008).

Programs should train teachers and student teachers to be able to use ICT as mind tools to represent what they know as they transform information into knowledge and to engage in, and facilitate, critical thinking and higher order learning. For instance, van den Berg, Wallace and Pedretti, 2008), posit that this can be done by focusing on reflection-on action, referring to the deliberate process occurring outside action (Schön, 1983), which also may be viewed as critical thinking. According to the authors, immediate actions embody the heart of daily teaching activities, and can be approached by levels, the first of which, as suggested by van der Berg consist of the formation of what the author – based on experiences with concrete examples, called an *image* or Gestalt. (Gestalt psychology, the discipline that studies how people see and understand the relation of the whole to the parts that make up that whole, is central in this level approach suggested). This is illustrated as follows:

> “In a multimedia case, this image (or gestalt) is connected with the concrete situation depicted in the video in a multi-layered way, and restricted to certain characteristics of this situation. An essential characteristic of an image is its implicit or tacit character. Reflection on images leads to more “aware” levels in which mental networks are constructed by practical (level 2) and theoretical (level 3) reasoning. Contrary to in situ classroom teaching, video cases have unique features to facilitate this sense making process because they can be viewed over and over again by a great number of people (both face-to-face and virtual)” (van der Berg et al. 2008, p.480).

As van der Berg, Wallace and Pedretti, (2008) argue, one of the most remarkable differences between classroom teaching and watching a video is that the latter does not ask for immediate action. Furthermore, in the absence of the immediacy of action, teachers have the time to intentionally make sense of the images formed out of their experience of watching the video. This sense making is facilitated by the additional "add-ons" of multimedia cases, which serve to further stimulate teachers' reflection through discussion and consideration of alternative perspectives. Reflecting, discussing and considering different perspectives result in mental recordings of the images of the video footage in comprehensive reasoning. This type of teacher knowledge, teacher practical theory, is rooted in practice and is no longer implicit because of its verbal articulation.

Why: To integrate in their practice the use of ICT as a mind tool to support different approaches to reasoning, new ways of thinking and doing things.

2.2.3. Benchmark 3: Social Aspects of ICT-Use in Education

ICT and the so called Web 2.0 technologies are having an increasing prominent role in education due to their potential to effectively enhance teaching, promote the 21st century learning and succeed in today's information and knowledge society (Collins and Halverson, 2009; Conley, 2013; Thomas and Knezek, 2008; Partnership for 21st Century Skills, 2010).

Butler (2012), defines Web 2.0, as "a wide array of web-based applications which allow users to collaboratively build content and communicate with others across the world" (p.139). Wikis, blogs, social networking sites and social bookmarking are some of the most commonly used Web 2.0 technologies. These technologies have proven useful in providing effective means for the transfer of information, active class member engagement and interaction, as well as platforms for both individualized and collaborative learning and co-creation of knowledge (Bower, 2012; Hartshorne & Ajjan, 2009)

Nevertheless, as a sociocultural phenomenon, ICT / Web 2.0 changes teachers and students' roles in schools. It creates opportunities for collaborative knowledge production and problem solving, breaking earlier limits of time, distance, and possession of knowledge. At the same time, it also creates new social dysfunctions such as problems of privacy, escapism or anonymity, lack of commitment and false role images. Pre- and in-service teacher education must face these issues (Kirschner, Wubbels, and Brekelmans, 2008).

The introduction of ICT is changing interpersonal relations. Accordingly, 21st century teachers must have sufficient digital technology skills and pedagogical knowledge in order to take advantage of these tools, namely, to be able to create socially active learning environments that encourage cooperative interaction and collaborative learning (Nelson, Christopher, and Mims, 2009). It is important that teachers and teacher educators engage as members of a (wired) school community. For this reason, as aforementioned, the International Society for Technology in Education (ISTE, 2008) highlights the need for teachers to gain the fundamental knowledge, skills, and attitudes for incorporating contemporary tools and appropriate resources within their classrooms to facilitate and inspire student learning and creativity.

Why: Teachers are increasingly expected to provide a role model of good ICT practice; learn to share and build knowledge, and realise and discuss the impact of ICT on society.

2.2.4. Benchmark 4: Adopting ICT in Teaching

Pre- and in-service teacher education and professional development programs should prepare teachers not to adapt their teaching to ICT, but to adopt ICT in their teaching. Teachers must find ways of exploiting the power of the new technology.

According to Cuban (1999), teachers tend to take ownership of new technologies and incorporate them into their traditionally held views of teaching and learning. Cuban argues that the overhead projector and video made very little impact on teaching styles, and so why should computers be any different? Computers, however, are substantially different from previous technologies because they give students access to new ways of thinking through dynamic images, simulations and models, and a huge array of – worthwhile and worthless – information.

Moreover, as facilitators in learning processes, teachers can provide the initial impetus that encourages students to become active learners, capable of using different resources, seeking information and becoming creative problem-solvers. As such, a “learning culture” is fostered as a climate of active and productive learning. This approach is flexible and emphasises complex skills such as problem solving and critical thinking.

Why: Student teachers need not only to know the theory behind *why* and *how* to use ICT, but also develop competencies in planning for relevant individual, group and whole-class activities; preparing and producing learning materials with the help of ICT; dealing with the possibilities and consequences of using ICT; teaching and learning specialist subjects with ICT, and team teaching in situ or at a distance.

2.2.5. Benchmark 9: Embedding Learning about ICT in Other Content Domains of Teacher Education

Teacher education programs are usually structured around disciplines and courses such as educational psychology, foundations of education, teaching methods, linguistics and – unfortunately – multimedia and ICT. Such a structure promotes compartmentalisation of what is experienced and learned and, thus, inhibits student teachers from integrating insights from different disciplines for the solution of practical problems (Merriënboer and Kirschner, 2007, p.445). Pre-service teachers' experiences should therefore integrate a holistic program structure, to facilitate using their technology skills in activities integrating ICT to foster student learning (Mims et al., 2006; Kirschner, Wubbels, and Brekelmans, 2008).

Why: A holistic approach can help teachers to deal with complexities that are often encountered in teaching without losing sight of the separate disciplinary elements and the interconnections between them. It allows for the integration of knowledge, skills, and attitudes; the coordination of qualitatively different constituent skills and the transfer of what is learned in the taught courses to daily life and work settings.

The above mentioned benchmarks provide a better illustration and understanding of what is expected from teachers in terms of ICT use in pedagogy; which aspects, issues and possibilities they need to be aware of and keep in mind for actually planning and implementing a pedagogical activity integrating ICT. This is why we have chosen to include them.

The other four Benchmarks, from Benchmark 5 to Benchmark 8, are listed and briefly described below following Kirschner, Wubbels, and Brekelmans (2008) as:

Benchmark 5 – Cooperative Education: Combining Institutional Learning and Learning in the Workplace, in which institutions explicitly specify the competencies it wants its staff members to achieve or possess, so they need to check whether they have been acquired or are present (p.441).

Benchmark 6 – Communities of Practice. In the case of teacher learning for pedagogical use of ICT this would include getting student teachers to contribute from their knowledge base on the use of ICT (and thus provide information to established teachers), while established teachers in the community can contribute their vast knowledge of teaching and learning praxis (p.442).

Benchmark 7 – Embedding Learning about ICT in an Open, ICT-Rich and Flexible Environment. Specifically designed and developed educational tools, applications and software (e.g., digital content, electronic learning environments, digital portfolios, electronic assessment programs) as well as tools, applications and software not specifically made for teaching and learning, but that can play a role in both processes, are plentiful. These learning tools and teaching aids are readily available and can often be integrated with each other (p.443).

Benchmark 8 – Learning about ICT through Structured Experiences. Van der Dool and Kirschner (2003, as cited in Kirschner, Wubbels, and Brekelmans, 2008) posit that the start of learning lies in the experience of the student teacher both as a student and a staff member. Starting from practical experiences can be a viable and fruitful avenue in teacher education to stimulate integration of theoretical notions in teacher actions with each other *and* with "reality." But to achieve this, careful planning, structuring and supervision is needed. Clift and Brady (2006 as cited in Kirschner, Wubbels, and Brekelmans, 2008) confirmed this, concluding that engaging in tasks associated with full responsibility may discourage or inhibit continuous attention to individual students.

The following section elucidates why some teachers may still be reluctant to integrate ICT in their practice, while also providing some understanding on how to proceed when designing a training intervention.

2.3. Factors Affecting/Determining ICT Adoption and Use

2.3.1. What Influences Teachers' Preparedness to Adopt and Effectively Use ICT in the Classroom?

A comprehensive body of literature from technology and education, the adoption and diffusion of innovation, acceptance and use of ICT in teaching/learning processes and practices, school improvement and reform, comparative education, cultural psychology, and 'human ecology' provides a conceptual framework of the factors that may influence the adoption and pedagogical use of technology in the classroom and its impact on teaching and learning.

Innovation is defined by the Merriam-Webster's Collegiate Dictionary (2005) as the "Act of changing or the change made in established laws, customs, rites, and practices by the introduction of something new." An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organ.

In this framework, innovative pedagogical practices are at the core of contextual levels that effect, mediate and influence the change required for ICT integration to take place. "Pedagogical practices consist of patterned sets of goals, materials, activities, and people engaged in classroom teaching and learning." (Kozma, 2003, p.11) The contextual levels of these practices are the classroom (micro level), the school or local community (meso level), regional, national, and international entities, and policies (Macro level). At each of these levels there are actors and factors that mediate and influence change (Bronfenbrenner, 1979; Kozma, 2003). For our research we focus on actors and factors interacting at the micro level, to respond to demands from actors and factors at the meso and macro levels, as illustrated below, and in Sections 2.3.3 and 2.3.4, based on a review of empirical investigations conducted.

Taking for example, the research study conducted by Angeli and Valanides (2009) to examine the impact of Technology Mapping (TM) on student learning within the context of two design tasks in a pre-service primary teacher education course. They aimed at understanding and promoting a situative methodology toward the development of teachers' ICT-TPCK. The results of this study clearly showed that the teaching instructional design process presented in combination with the implementation of an assessment model chosen, had a positive impact on the development of pre-service teachers' ICT-TPCK knowledge. Their ICT–TPCK[9] competence (evaluated following three forms of assessment: expert assessment, peer assessment, and self-assessment) significantly improved over the course of a semester. In terms of restructuring old teaching practices, results also showed that teachers must be trained in powerful learning environments where teaching is situated in real and authentic tasks, and in ways where teachers themselves constitute a part of a larger learning and professional community for the purpose of exchanging perspectives, resolving dilemmas, and confronting uncertainty in transforming classroom practice. Based on evidence from their empirical investigation, the authors concluded that TPCK is a unique body of language constructed from interaction of its individual contributing Knowledge (K) bases (i.e. Pedagogical (P), Technological (T), and Content (C)) and where the mere development of one or more of its knowledge bases does not guarantee and does not imply concurrent development of ICT-TPCK. In their research, it was emphasized that ICT–TPCK is what makes a teacher competent to design technology-enhanced learning. It can be described as the ways knowledge about tools and their affordances, pedagogy, content, learners, and context are synthesized into an understanding of how particular topics that are difficult to be understood by learners or difficult to be presented by teachers can be transformed and taught more effectively with technology in ways that signify its added value.

Accordingly, in the literature as just exemplified, the successful implementation of innovative practices depends not only on the characteristics of the innovation but also on factors such as organization and organizational characteristics of the teachers, personal/professional learning networks (PLN) and students (micro level), the school infrastructure and organization and personal characteristics of administrators and community leaders (meso level), and regional and national policies and curricula as well as research, international trends (macro level) (Kozma and Voogt, 2003; Law, Pelgrum and Plomp, 2008; Nachmias, Mioduser, Cohen, Tubin and Forkosh-Baruck, 2004). It seems that an integral,

[9] **ICT–TPCK** is "knowing how to operate a computer and how to use a multitude of tools/software as well as troubleshoot in problematic situations" (Angeli and Valanides, 2009).

transactional, relationship between successful technology-based innovations and this extended set of personal, pedagogical, curricular, and organizational factors constitute the context of their use (Kozma, 2003; Matthing, Kristensson, Gustafsson and Parasuraman, 2007. It appears, then, that the essential conditions for the successful use of learning technologies in the schools include complementary shifts in curriculum, pedagogy, assessment, professional development, administration, organizational structures, and partnerships between schools, businesses, homes, and community (Dede, 2008).

The possible interrelationships among factors affecting ICT adoption are illustrated in the model we present below (see Figure 2). We used Bronfenbrenner's (1979) Ecological Model. We also drew on literature on change (e.g. Fullan, 2001) some criteria for successful innovations to take place, e.g. clarity and relevance to respond to identified needs.

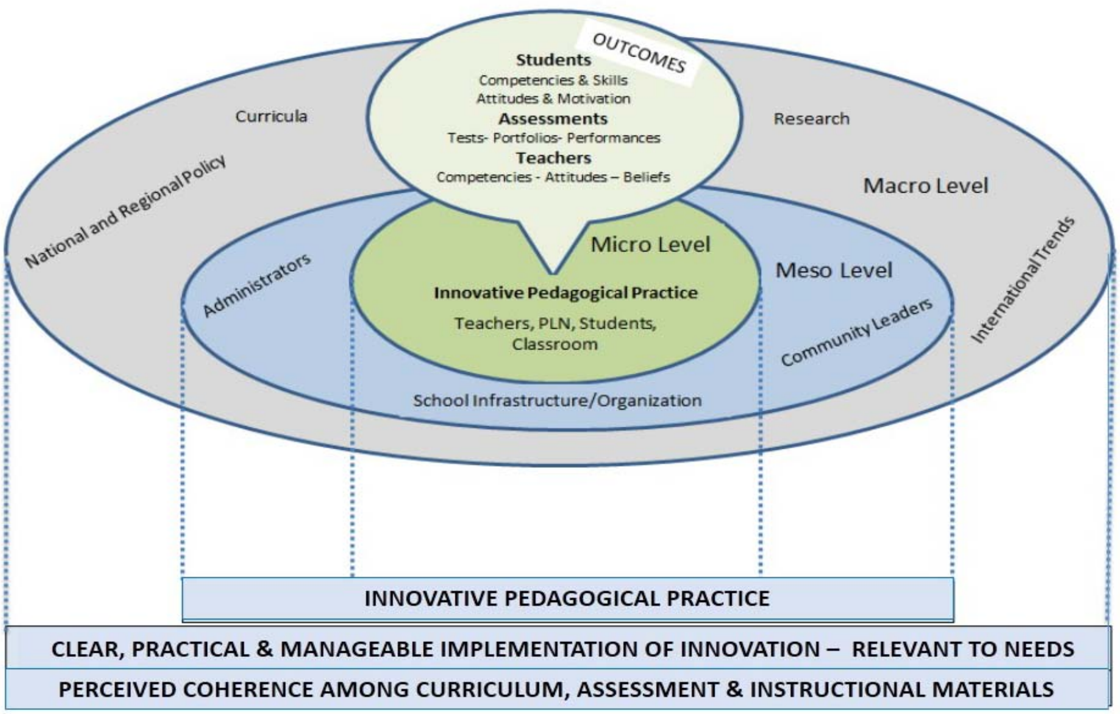

Figure 2: Interrelationships among Factors Affecting ICT Adoption (Adapted from Bronfenbrenner, 1979; Fullan, 2001)

2.3.2. Micro Level

In the center of the diagram in figure 2, there is the change in ICT-supported pedagogical practices that effect classroom learning. Plomp, Brummelhuis and Rapmund (1996) define classroom learning as a process in which four components interact: 1) the teacher, 2) the student, 3) curriculum content and goals, and 4) instructional materials and infrastructure- in this case ICT infrastructure.

Classroom research has documented a strong association between technology-based and changes in curriculum and pedagogy. For example, as a result of using educational technology within a context of school improvement or reform, there is an instructional shift towards constructivist approaches to teaching and learning. Students are often encouraged to work collaboratively to solve complex, authentic interdisciplinary problems. Instead of delivering knowledge, teachers implement projects, enable access to appropriate resources, and create organizational structures and support that facilitate learning and can help students succeed (Angeli and Valanides, 2009; Dieterle, 2009; Dunleavy, and Dede, 2013, Kozma, 2003; Law, 2008; Nachmias, Mioduser, Cohen, Tubin and Forkosh-Baruck, 2004).

This approach moves the concept of learning beyond the rote memorization of facts and procedures to learning as a process of knowledge creation (Scardamalia and Bereiter, 2006). It envisions a learning process in which students as self-regulated learners set their own goals, plan the learning activities, and monitor their mastery and understanding in preparation for lifelong learning. It moves concepts of school beyond the notion of place where knowledge is imparted to one of classrooms, organizations, and societies as knowledge-building communities (Bereiter, 2002; Dieterle, 2009; Scardamalia and Bereiter, 1996, 2006, Sawyer, 2014). These practices are more in agreement with the requirements of the knowledge economy and information society than current, traditional didactic practices (Dede, 2014; Kozma, 2003, Sawyer, 2006, 2014).

Such changes in the nature and organization of the students work correspond to changes in the organization of work in the knowledge economy where individuals work collaboratively, are flexible and creative, and possess problem-solving and continuous learning skills OECD, (2011).

However, since these changes imply also a change in teachers practice, at classroom level, there is need to take into consideration three aspects of their e-learning culture: 1) their previous teaching practice; 2) their representations of facilitating conditions and constraints for effectiveness of integrating the innovation in their practice. For example, teachers may think that integrating ICT in their practice is very good; that there is potential in their use. But they may also wonder under what conditions and constraints it can be done; and 3) their skills and resources available to support them in the change process (i.e. time, training, and a technician). Along with their attitudes toward the innovation ⁄ change in their teaching practice, it seems that teachers' intended practice is highly dependent on the combination of the three above-mentioned aspects (Viens and Villa, 2012). Then, in line with their feelings, which may mirror their particular e-learning culture, they decide whether or not to embark on this innovative process.

2.3.3. Meso Level

It appears that at this level, leadership and a supportive organizational environment foster innovation and change within institutions (van der Akker, Keursten, and Plomp, 1992 as cited in Kozma, 2003; Fullan, 2001; Senge, Kleiner, Roberts, Ross, Roth, and Smith, 2000). Therefore, innovative practices are prone to succeed in a school environment where administrators support the practice, practice is supported by the school organization, the practice fits the curriculum, and the practice is part of the teacher's routine. These efforts involved coordinated changes in curriculum, instructional strategies, and learning focus for both teacher and students that place different demands on resource allocation and use (Louis and Miles, 1991 as cited in Kozma 2003).

As illustrated by Nachmias, et al. (2004) who as part of the (SITES M2) [10] conducted a research study involving 10 Israeli schools, combining an international set of criteria with

[10] The Second Information Technology in Education Study Module 2- SITES M2 (www.sitesm2.org) was a project of the International Association for the Evaluation of Educational Achievement (IEA; www.iea.nl) that involved research teams from 28 countries in Europe, North America, Asia, Africa, and South America. At the international level, the project was coordinated by an International Coordinating Committee (ICC) of six scientists

local concerns, aiming at analyzing the factors involved in the implementation of pedagogical innovations using technology. They found for example, that *Partners outside the school* or intervening organizations have a profound influence on the innovation. Results from their study showed that in fact, in all participating schools an external factor was involved, in financing, planning and decision-making processes or in the diffusion of the innovation. Among these were academic institutions, research institutes, hi-tech industries or companies that see schools as sites for technological development, for examining products and learning about their potential implementation in the educational system.

Their findings confirm what Fullan (2001) posits regarding innovations being likely to be more successful if they are relevant to some need or problem that is articulated in the environment. Their success is measured based on the extent to which it is clear that the innovation can be implemented within these contexts and the extent to which the complexity is manageable and the implementation is practical, while taking into account the demands and limitations of the specific environment. Consequently, we look here at factors related to school culture[11] and support as well as community involvement.

2.3.4. Macro Level

International trends, as well as national and regional policies can influence classroom practices in terms of curriculum and assessment, and professional development.

Countries implement policies to influence practices in schools and classrooms. Research has found that there is often a gap between national or provincial policies and the classroom practices that they are meant to influence (Cohen and Hill, 2001). It appears, however, that practices are more likely to be changed when teachers not only perceive certain

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from the United States, Canada, and The Netherlands and directed by the Center for Technology in Learning at SRI.

[11] The term *school culture* generally refers to the beliefs, perceptions, relationships, attitudes, and written and unwritten rules that shape and influence every aspect of how a school functions, but the term also encompasses more concrete issues such as the physical and emotional safety of students, the orderliness of classrooms and public spaces, or the degree to which a school embraces and celebrates racial, ethnic, linguistic, or cultural diversity. (The Glossary of Education Reform, 2013 - http://edglossary.org/school-culture/

coherence among curriculum, assessment, instructional materials, and instructional guidance, but also when they are given opportunities to learn these policies in connection with specific, and practice- oriented materials, strategies, and activities (Kozma, 2003; Somekh, 2008; McDougall, 2008; Ebert-May, Derting, Henkel, Middlemis, Monsen, Monsen, Arnold, and Passmore, 2015).

As such, at the macro level, this framework guides the examination of national and local policies related to ICT educational change, and as aforementioned, these policies can influence classroom-based practices.

To illustrate this, we have for example Ebert-May, et al.'s (2015) study conducted with postdoctoral (PD) fellows working in Science Technology Engineering and Mathematics (STEM) programs. This study aimed at determining the extent to which these PDs believed in and implemented evidence-based pedagogies after completion of a 2-yr professional development program, Faculty Institutes for Reforming Science Teaching (FIRST IV). Results largely corroborate the above-mentioned statements about providing teachers with the appropriate means and opportunities for improving their teaching practice. In fact, the researchers found that after participating in the FIRST IV program, PDs were implementing learner-centered teaching practices in the classroom, and teaching in ways that were different from peers who had not completed the FIRST IV program. Thus, contributing to achieving the goal of schools, colleges, universities, and funding agencies[12] of assisting teachers to address the need for transformation of the STEM classroom experience through current and future faculty professional development. Also, addressing the critical need to improve the returns on time and funds invested.

Accordingly, even though working with teachers at another level, Nachmias et al.'s, (2004) research results show that to participating schools, national policy effects can be recognized in staff training plans, in efforts to disseminate innovative ideas, and in infrastructure supply by equipping schools with an "ICT package" (computers, software and

[12] This research was funded by the National Science Foundation under Division of Undergraduate Education Award 08172224 to D.E.-M. and T.L.D.

Internet connection). Participating schools perceived the Ministry of Education actively supporting the establishment of infrastructure and training, yet not interfering in the manner of ICT implementation in pedagogical processes (Nachmias et al.'s, 2004).

At our local level, for example, and as already stated, the Ministry of Education of Quebec (MEES, 2001), aims at responding to global developments and requirements, as most other countries do, by promoting regional ICT-based educational change. This is done through the introduction of the framework specifying the competencies that pre-service teachers should have developed by the end of their teaching training, and which specifically includes one (i.e. Competency 8) regarding ICT competency for pre-service teachers. In terms of students at school level, the official school program contains a cross-curricular competency (i.e. Competency 6), which fosters using ICT in creating stimulating pedagogical environments for students to acquire and develop skills and competencies that will empower them to perform effectively as citizens in a knowledge society.

These expected changes in the teaching practice lead us to exploring suitable models and approaches to support effective teacher training, which are presented in the next section.

2.4. Models, Frameworks and Approaches for Teacher Training

Teacher professional development has long been identified as critical to the successful adoption of ICT in schools. Back in the early 1980s, helping teachers to acquire the skills and knowledge necessary to deal with the technology newly introduced in schools, attracted the attention of those interested in promoting the integration of computers in the classroom (Law, 2008).

It seems though, that the professional development required depends on the kind of adoption targeted for ICT in the curriculum. Law and Plomp (2003) categorized the role of ICT in the curriculum into *learning about ICT* (as a subject), *learning with ICT* (as a medium to support or enhance existing instructional practice), and *learning through ICT* (which involves a full integration of ICT to bring about learning experiences that would otherwise not be possible). With the exception of the first kind of ICT adoption - learning about ICT as a subject- which only includes a very small part of the curriculum focus in most countries, the acquisition of technical knowledge and skills is only one component in the teacher professional development needed (Law and Plomp, 2003).

It appears that “[T]he potential offered by ICT in learning and instruction, combined with the role they play in society, means that they are essential components of today’s schools. Given their threefold mission of instructing, socializing and qualifying, schools must allow students to acquire the ICT-related methodological competencies they will need for their future social and professional lives” (MEES, 2001, p.97).

Therefore, pedagogy which recognises the complex relationship between context, tools for learning and teaching, and content, will not be static or staged. (Loveless, 2011) Educators’ capabilities and competences with ICT tools will be related to both individual and community factors, and learning professionals can be more or less capable in different contexts at different times (Benzie, 2000 as cited in Loveless, 2011). There are concerns that models of professional development which focus on technical competences without pedagogical reasoning are ‘retooling’ teachers for specific tasks, rather than engaging in the more substantial nature of pedagogy (Watson, 2001). Fisher, Higgins, and Loveless (2006) note:

> “An instrumental model of teacher development is limited. It attempts to capture copy and disseminate elements of ‘good practice’, out of the context in which they were developed, in order to refresh the educational process as if retooling an industrial production line. This may appear to meet short-term needs, but does little to develop reflexive professionals capable of intelligent action in fast-changing contexts” (Fisher et al., 2006, p. 39 as cited in Loveless, 2011, p. 12).

Thus, continuing professional development which fosters effective pedagogy and ICT within the education workforce needs to model such pedagogy in action (Loveless, 2011).

Accordingly, Mayes and de Freitas (2007) consider the implications of theories of learning and their expression in pedagogical design. They describe different models of pedagogy according to the priorities emerging from their theoretical basis, and provide teachers with the pedagogical reasoning to back their decisions when designing the learning environments that will facilitate the achievement of desired learning outcomes. We summarize below these theoretical, pedagogical and design implications.

The *associative perspective* highlights for example, task analysis, defining sequences of component–to-composite skills. This perspective provides an extremely focused set of objectives, described as learning competencies resulting from a learning environment emphasizing routines of organized activity, clear goals and feedback, as well as individual pathways and routines- matched to the learner's prior performance (Mayes and de Freitas, 2007).

The *cognitive perspective* emphasises conceptual development, stressing the importance of achieving understanding of the broad unifying principles of a domain. This view also encourages the framing of learning outcomes in meta-cognitive terms, with the educational aim of achieving learning how to learn, and encouraging the development of autonomous learners. Thus, this cognitive view requires interactive environments for construction of understanding, teaching and learning activities that encourage experimentation and the discovery of broad principles, as well as support for reflection (Mayes and de Freitas, 2007).

The *situative perspective* encourages the definition of learning objectives in terms of the development of disciplinary practices of discourse and representation. It also focuses on learning results that are dependent upon the establishment of collaborative learning outcomes, and on learning relationships with peers. This perspective also promotes the formulation of learning outcomes in terms of authentic practices of formulating and solving realistic problems. The emphasis is on environments of participation in social practices of enquiry and learning; on support for development of capable and confident learners; and on dialogue that facilitates the development of learning relationships (Mayes and de Freitas, 2007).

Furthermore, it seems that the above mentioned perspectives can be just viewed as analysing learning at different levels of aggregation (Mayes and de Freitas, 2007). A behaviourist analysis analyzes the observable activities, and the outcomes of these activities, for individual learners. A cognitive analysis undertakes the analysis of detailed structures and processes that underlie individual performance. The situative analysis aggregates at the level of groups of learners, describing activity systems in which individuals participate as members of communities. Besides, there will be few current examples of approaches which derive from taking just one level of analysis, and neglecting the others.

It appears that a learning environment implementing any of these perspectives represents not just a change in approach but a significant expansion of the dimensions of the learning setting (Cooper, 1993). As we will see further in this chapter in the section referring to models, and frameworks for teacher training, the design of these learning environments (whether behaviourist or constructivist), including objectives, type of activities, resources, type of evaluation, etc., is determined by the needs of the learners, to achieve their learning goals in terms of targeted knowledge, not by the desire of the instructor (Cooper, 1993).

Moreover, regarding ICT, selected studies (e.g., Angeli and Valanides, 2009; Law, 2008; Voogt, 2008; Voogt, Shin, Mishra, Koehler, Schmidt, Baran, Thompson, Wang, Alayyar, Fisser, Agyei, Ormel, Velthuis, Tondeur, and Gibson, 2011; Lefebvre and Loiselle, 2010; Jimoyiannis, 2010) suggest that ICT is more than 'just a tool', and contributes disruptive, distinctive relationships in pedagogical activities. As further explained by Angeli and Valanides (2009), ICT can help teachers effectively transform and teach those particular topics which they have difficulty in representing and/or are difficult to be understood by learners. Thus, emphasizing not only the added value of technology but also the view that "technology is not a delivery vehicle that simply delivers information, but a cognitive partner that amplifies or augments student learning" (Angelis and Valanides, 2009*,* p.154).

It appears though, that every classroom teacher should use learning technologies that enhance their student learning in every subject by engaging the thinking, decision making, problem solving and reasoning behaviours of their students (Grabe and Grabe, 2001). In preparing to use ICT, teachers' pedagogical reasoning needs to take into account the wider subject and community contexts for the learning experience, the expertise and roles of all participants, and the affordances of the technologies for particular purposes. Accordingly, models of pedagogy need to be relevant, grounded in teacher experience, flexible, complex and open to reflection and adaptation.

With this discussion in mind we present the TPACK/ICT-TPCK framework, the SAMR, the CBAM, and the IntersTICES models, followed by a synthesis table of their characteristics, strengths and weaknesses. As an illustration of the types of thinking processes that may assist teachers when deciding on the nature of learning outcomes they expect to achieve, we present the two revised versions of Bloom's taxonomy of learning: Anderson and Krathwohl's (2001) and Churches' (2008); as well as the type of pedagogy that can facilitate appropriate learning environments to achieve targeted goals. Finally, the Unified Theory of Acceptance of Use of Technology (UTAUT) and its merger with the E-Learning Culture we propose, will help us better understand the impact of human factors on any pedagogical integration of ICT.

2.4.1. The TPACK/ICT-TPCK FRAMEWORK

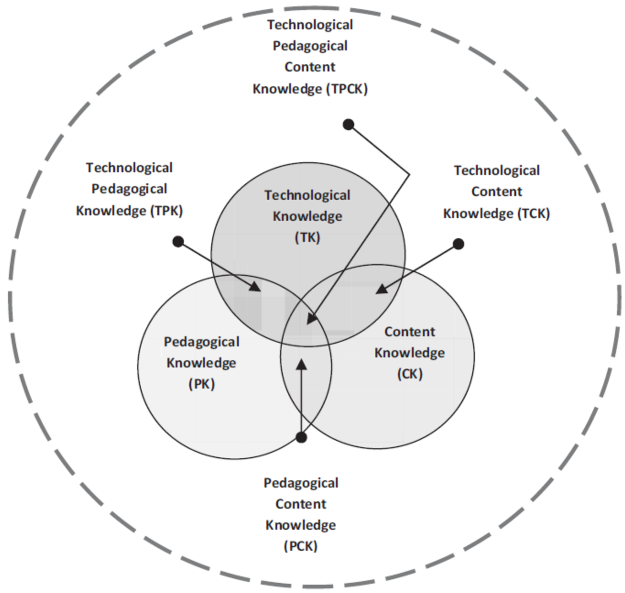

Figure 3 : TPACK (Mishra and Kohler, 2008) adapted from Pierson (2001)

The TPCK has been introduced as a conceptual framework for the knowledge base teachers need to effectively teach with technology. The framework stems from the notion that technology integration in a specific educational context benefits from a careful alignment of content, pedagogy and the potential of technology, and that teachers who want to integrate technology in their teaching practice therefore need to be competent in all three domains (Voogt, Fisser, Pareja, Tondeur and van Braak 2012).

It resulted from the findings of Pierson's 2001 study. Pierson (2001) suggested adding *technological knowledge, as* another main component to the conception of Pedagogy - Content-Knowledge (PCK), proposed by Shulman (1986, 1987), Berliner (1986) and Leinhardt and Greeno (1986). This earlier intersection of content and pedagogy, containing a competent teacher's knowledge, (PCK) became then the TPACK model we know today.

Shulman's PCK blends knowledge from both domains into an understanding of how particular aspects of subject matter can be organized, adapted, and represented for instruction. According to Pierson (2001) "technological knowledge would include not only basic technology competency, but also an understanding of the unique characteristics of particular types of technologies that would lend themselves to particular aspects of the teaching and learning processes" (p.427); that is, a better understanding of the conditions of instruction under which technology can yield better results, as well as its limitations and constraints. Pierson's study also showed that a teacher who effectively integrates technology would be able to draw on extensive content knowledge and pedagogical knowledge, in combination with technological knowledge (Pierson, 2001). Moreover, she presented the intersection of these three knowledge areas, or technological-pedagogical-content knowledge that would define effective technology integration, in a graphic, which illustrates the possible relationships among the types of teacher knowledge.

As reported by Voogt, Fisser, Pareja, Tondeur and van Braak (2012) following Pierson (2001), Niess (2005) used the term TPCK to refer to technology-enhanced PCK. She used the concept to study how a technology integration program impacted student-teachers' use of technology in their classroom practice. Niess (2005) did not consider TPCK as a new definition of teacher technology integration, as Pierson (2001) did, but described it as 'the integration of the development of knowledge of subject matter with the development of technology and of knowledge of teaching and learning' (p. 510). She argued that 'It is this integration of the different domains that supports teachers in teaching their subject matter with technology' (p. 510). Hence, rather than seeing TPCK as an end (Pierson 2001), Niess (2005) saw the integration of the three domains as a means for teaching with technology.

Clearly drawing on previous studies (i.e. Pierson, 2001; Niess, 2005) Mishra and Koehler present "the most complete description of the TPCK framework in Mishra and Koehler (2006) and Koehler and Mishra (2008)" (Mishra and Koehler, 2009, p.42). However, in contrast to Niess (2005), Koehler and Mishra did not present TPCK as an enhancement of PCK but as the development of understanding in three knowledge domains (content, pedagogy and technology) and their intersections [PCK, technological content knowledge, technological pedagogical knowledge (TPK) and TPCK]. Nevertheless, it appeared difficult to reproduce these seven knowledge domains in exploratory factor analysis (EFA) (e.g. Archambault and Barnett 2010), indicating that the TPACK framework as conceptualized by Koehler and

Mishra is problematic (Cox and Graham 2009; Graham 2011; Niess 2011 as cited by Voogt et al. 2012).

The framework emphasizes the situatedness and interactive nature of the development of TCK, TPK, and TPCK. Furthermore, Koehler and Mishra posit that teachers need to take into consideration knowledge about students, the school, and the environment in order to effectively teach with technology. Accordingly, they added *context* to the seven knowledge domains as an essential part of the TPACK framework. The TPACK framework (see Fig 3) as proposed by Koehler and Mishra (2008) has become well-known.

However, in its present form, the TPACK does not address the very important issue of how tool affordances can transform content and pedagogy (Angelis and Valanides, 2009). Moreover, it does not take into consideration other factors beyond content, pedagogy, and technology, such as, for example, teachers' epistemic beliefs and values about teaching and learning, teachers and other participant's e-learning culture that may be also important to take into account (Angeli and Valanides, 2009; Viens, Villa, Stockless, 2015). This simplified view, may lead to possible erroneous, simplistic, and naïve perceptions about the nature of integrating technology in teaching and learning (Angeli and Valanides, 2009).

During the last seven years, Angeli and Valanides have conducted a number of empirical investigations regarding the educational uses of computer technology, and based on their findings they concluded that growth in the related constructs does not automatically mean growth in TPCK (Angeli and Valanides, 2009). In particular, in-service teachers, who had extensive teaching experience and knowledge of several computer programs, but were not specifically trained how to teach with computers, did not perform significantly better on designing computer-mediated lessons for their students than other teachers who had less teaching experience, good computing skills, but no specific training in the educational uses of computers as well. However, after training focusing on how to teach with computers, teachers with stronger pedagogical skills and better knowledge about the content and learners, outperformed other teachers with less knowledge in those areas (Angeli and Valanides, 2009*,* p.158).

When restricting technology to ICT, as Angeli and Valanides, (2009) did, it becomes ICT–TPCK, defined as "knowing how to operate a computer and knowing how to use a multitude of tools/software as well as troubleshoot in problematic situations" (p.161). ICT-TPCK is, according to them, what makes a teacher competent to design technology-enhanced learning, and can be described as the ways knowledge about tools and their affordances, pedagogy, content, learners, and context are synthesized into an understanding of how particular topics that are difficult to be understood by learners or difficult to be presented by teachers can be transformed and taught more effectively with technology in ways that signify its added value.

Moreover, it seems that any approach intending to develop ICT–TPCK should not only be responsive to teachers' beliefs and knowledge, the context with its facilitating conditions and constraints, but it should also be learner-centered (Angeli and Valanides, (2009).

In the literature review conducted on the TPCK by Voogt et al. (2012), when aiming at knowing how a teachers' TPCK is related to their beliefs, it was found that teacher beliefs are discussed from two perspectives: beliefs about technology (Niess 2005; Özgün-Koca 2009; Abbitt 2011) and pedagogical beliefs (Niess 2005; Manfra and Hammond 2006; Valtonen et al. 2006; So and Kim 2009).

In fact, Abbit (2011) showed that teachers' technological knowledge (TK) was a stable predictor of teachers' self-efficacy beliefs towards technology. Similarly, Özgün-Koca (2009) found that beliefs about the functionality of specific technologies affect the way in which teachers integrate technology in their teaching. Niess (2005) provided further evidence about the influence of teacher beliefs, showing that one of the student teachers participating in an educational technology course felt hindered to apply what she had learned in the program to her teaching practice because of her view of technology. In the same study, Niess (2005) also described a teacher who did not feel comfortable with the technology herself but whose pedagogical beliefs facilitated the use of the technology because 'she believed that her students were able to see and understand some concepts better with technology' (p. 520, as cited by Voogt, et al. 2012, p.115) .

Regarding pedagogical beliefs about content and technology, it is they, rather than the affordances of technology, that guide teachers' decisions during lesson preparation and implementation (Manfra and Hammond, 2006). Moreover, when designing online courses, Valtonen et al. (2006) found that the majority of teachers opted for the design of teacher-centred courses. They concluded that although the affordances of technology may easily support a learner-centred approach, teachers tend to choose familiar teacher-centred pedagogical solutions when they design online courses (Voogt et al., 2012). So and Kim (2009) found that student-teachers were not able to make connections between their knowledge about ICT and problem-based learning, their pedagogical beliefs and their actions. They deduced that teachers may have the knowledge and skills to use technology (referred to as espoused TPACK) but are not able to use it in practice (referred to as in use TPACK).

Regarding strategies for (student-)teachers' development of TPACK, Niess (2011), based on Grossman (1990), argued that such development has to be based on four key components:

- an overarching concept about the purposes for incorporating technology in teaching a particular subject;
- knowledge of students' understanding, thinking and learning with technology in that subject;
- knowledge of curriculum; and
- curriculum materials in a particular subject that integrates technology in learning and teaching, and knowledge of instructional strategies and representations for teaching and learning that particular topic with technology.

Other authors (e.g. Bower et al. 2010; Polly et al. 2010a as cited in Voogt, Fisser, Pareja, Tondeur and van Braak, 2012) state that strategies are required to help (student-)teachers to map affordances of technology to representations of content, learners and pedagogy.

To actively involve teachers in their TPACK development, Koehler and Mishra (Mishra and Koehler 2006) introduced 'Learning technology by design', which starts with authentic curriculum problems for which technology-based solutions are collaboratively designed. Furthermore, Niess (2011) realized that the development of TPACK will go through different phases. Following Rogers' (1995) model of the diffusion of innovations, five sequential stages to develop TPACK were conceptualized: recognizing, accepting, adapting, exploring and advancing.

Another study cited by Voogt, Fisser, Pareja, Tondeur and van Braak (2012), and reporting on the evaluation of projects from the Preparing Tomorrow's Teachers for Technology (PT3) programme (Polly, Mims, Shepherd and Inan, 2010) identified three successful strategies:

- Mentoring by experts of teacher education faculty who plan to integrate technology in their teaching;
- Promoting TPACK of both pre- and in-service teachers through linking student-teachers with practicing teachers and supporting both of them, and
- Joint redesign of curriculum materials into technology-enhanced curriculum materials in teams.

Findings from studies focusing on strategies used in developing TPACK in a general educational technology course (e.g. Hardy 2010; Özmantar et al. 2010) showed frequent inclusion of modelling, technology-enhanced lesson design, and enactment of technology-enhanced lessons, either through microteaching or during field experiences. Regarding in-service teachers' TPACK development, it was reported that most of the studies are domain-specific and in-service teachers were asked to implement technology-enhanced lessons or units in their own classroom and to reflect on the experience (e.g. Trautman and Makinster, 2010). School follow-up support was part of the professional development arrangement in one (out of 55) study (Polly 2011). The development of TPACK leadership was also considered by having teachers write mini-grants for follow-up activities (Blocher et al. 2011).

2.4.2. The SAMR Model

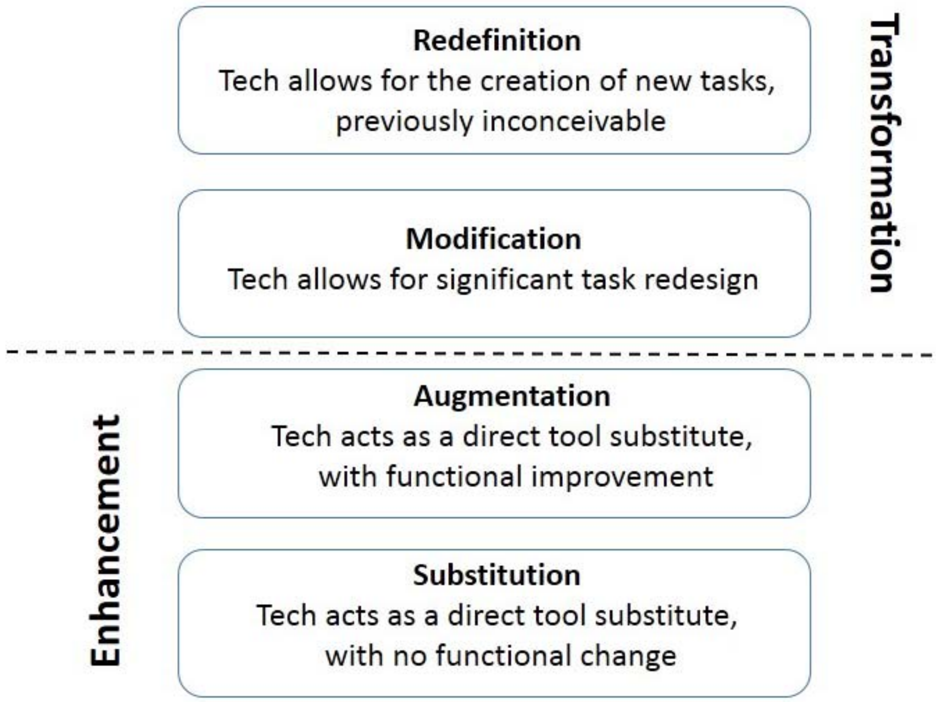

Figure 4 . The SAMR Model, Puentedura (2010). EdTechTeam[13]

The SAMR model was developed by Puentedura (2010) and encompasses four different levels and two different sections (See Figure 3 above).

1. **Substitution**- At this level the technology used acts as a direct substitute of the old one, with no functional change. For example, instead of writing an essay by hand, students can type it using the basic features of a word processing program. Tools are different, the task is the same, and there is no functional change.
2. **Augmentation**- Though it is a different level, the task is still the same but the tech allows for some sort of functional improvement. Therefore, instead of writing the essay on paper students can use Google Docs. With this software the task is still the same but

[13] http://www.educatorstechnology.com/2013/06/samr-model-explained-for-teachers.html

the features of the collaborative working document provide some functional improvement: Commenting, sharing, add-on's

In both these levels, the technology is used to simply enhance a lesson. These technology may make tasks more efficient, but is not likely to make a big difference in future outcomes. According to the model's developer, most learning takes place above the line and starts with modification.

3. **Modification**- Here the technology is used to provide a significant task redesign. "So instead of simply writing an essay, students can publish, for example, a WordPress blog using text, embedded videos, pictures and other web links to convey their argument. The audience is no longer just the teacher either, is the entire world. People from anywhere with an Internet connection could review and comment on their writing allowing for deeper analysis" (Puentedura, 2013).
4. **Redefinition**- At this level the technology allows for the creation of new tasks that were previously inconceivable. Instead of just writing the essay, students can now create and publish a digital storytelling project by using multimedia. Besides, just like the blog, through publishing their production to the world, it allows for other people to comment and analyse their message. So the heart of the assignment is still the same, but the technology allows them to engage in a new more involved task that's otherwise not possible.

These technological levels of use (SAMR) are represented as "transitional levels measured on a scale of months – at the most, at least for the first two levels and skills" (Puentedura, 2010, min.18:05).

In the first two levels (i.e. Substitution and Augmentation), the technology is used to simply enhance a lesson. This technology may make tasks more efficient, but is not likely to make a big difference in future outcomes (Puentedura, 2010). According to the model's developer, most learning takes place above the line and starts with Modification and "at this level learning is transformed by the use of technology, for when students are more involved and engaged, significant improvements in learning are more likely to take place".

Even though we agree with the reason mentioned, neither the author nor does the model include any indication of how to effect this transformation of learning by technology. We have noted, however, that Puentedura presents SAMR along with TPCK, as to provide it with a sounder framework. For example, in his blog (http://www.hippasus.com/rrpweblog/archives/000025.html) we can read "TPCK and SAMR models for enhancing technology integration" along with many examples of SAMR integrating different dimensions of TPCK.

2.4.3. The CBAM Model

The Concerns-Based Adoption Model (CBAM) was developed by Hall (1974), Hall and Hord (1987; 2001); Hord, Rutherford, Huling-Austin and Hall (1987), to represent the highly complex process entailed when educational institutions become implicated in adopting innovations.

It involves measuring, describing, and explaining the process of change experienced by teachers when trying to implement new curriculum materials and instructional practices. It also considers how that process is affected by interventions from persons acting in change-facilitating roles.

The key components of the model include some basic assumptions about this kind of educational change, and the concepts of Stages of Concern[14] (SoC), Levels of Use (LoU), Innovation Configurations (IC), as well as change facilitator styles, and interventions (Anderson, 1997).

CBAM takes into consideration some assumptions about classroom change in curriculum and instruction, such as:

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[14] According to this model, concern is defined as "the composite representation of the feelings, preoccupation, thought, and consideration given to a particular issue or task" (Hall, 1974, p. 5).

- Change is a process, not an event;
- Change is accomplished by individuals;
- Change is a highly personal experience;
- Change involves developmental growth in feelings and skills; and
- Change can be facilitated by interventions directed toward the individuals, innovations, and contexts involved (Anderson, 1997).

The model comprises three diagnostic dimensions for conceptualizing and measuring change in individuals:

1. Stages of Concern
2. Levels of Use, and
3. Innovation Configurations

1. **Stages of Concern**. Stages of concern (SoC) is a framework that describes the feelings and motivations a teacher may have about change in curriculum and/or instructional practices at different points in its implementation.

- At Stage 0, *Awareness,* the teacher has little knowledge about or interest in the change.
- At stage 1, *Informational,* the teacher is interested in learning more about the innovation and the implications of its implementation.
- At Stage 2, *Personal*, teacher concerns usually reflect strong anxieties about the teacher's ability to implement the change, the appropriateness of the change, and the personal costs of getting involved.
- Stage 3, *Management,* is reached when the teacher begins to experiment with implementation. At this stage concerns intensify around the logistics and new behaviours associated with putting the change into practice.
- At stage 4, *Consequence,* teacher concerns focus mainly on the impact of change on their students and on the possibilities for modifying the innovation or their use of it to improve its effects.

- Stage 5, *Collaboration,* reflects teacher interest in working together with other teachers in the school to enhance the benefits of change implementation for students.
- At Stage 6, *Refocusing,* the teacher thinks about making major modifications in the use of the innovation, or even replacing it with something else.

It seems that CBAM theory idealizes the Stages of Concern (SoC) as a developmental progression in which teachers implementing a change have concerns of varying intensity across all seven stages at different points in the change process (Anderson 1997). A teacher who is just learning about a change, but who has not begun to implement it, is likely to have higher Awareness, Informational, and Personal concerns than Management and Consequence concerns. Early stage concerns decrease and Management concerns intensify when the teacher starts trying to implement the change in the classroom. As the teacher gets more skilled in using the change, Management concerns may give way to Consequence concerns about the impact of the change on students and Collaboration and Refocusing concerns about the prospects for improving its implementation (Anderson, (1997) p.334).

The Stages of Concern (SoC) framework presents, therefore, a possible, not a necessary, progression of teacher concerns about a change, since not all teachers evolve in their use of new practices to Consequence, Collaboration, or Refocusing concerns (Anderson, 1997). CBAM studies have often reported that when implementation of new practices becomes routinized in some structure, teachers may experience an overall lessening of concerns about implementation as their attention shifts to other things. That is, the resolution of early stage concerns does not necessarily lead to the arousal of later stage concerns about the impact of those practices on students (Anderson, 1997).

Since stages of Concern (SoC) is one diagnostic dimension of CBAM, it includes tools specifically designed for measuring teacher concerns about a change in curriculum or instruction, namely, Stages of Concern Questionnaire, an Open Ended Concerns Statement procedure, and simple interview tactics. Also, SoC conceptualization provides a potential evaluative framework for considering teachers' attitudes at all stages of implementation. It could be viewed as an extension or refinement of the concept of intervention acceptability.

Furthermore, the SoC allows for comparisons between the behaviors and cognitions of groups of implementers with various concern profiles, facilitating the identification and design of specific consultation and support strategies to address the needs of implementers at different stages of concern.

2. **Levels of Use** (LoU). While stages of concern refers to teacher attitudes about a change, the CBAM Levels of Use framework focuses on general patterns of teacher behavior as they prepare to use, begin to use, and gain experience implementing a classroom change. Progression from one level to the next is marked by key decision points and corresponding behaviors in several domains: acquiring information, assessing, sharing, planning, status reporting, performance, and knowledge (Hall and Hord, 1987; Anderson, 1997)

- Level 0, *Non-use*. The teacher has little knowledge of the change and no plans for its implementation.
- Level I, *Orientation*. The teacher decides to seek more information about the change, but has not made a decision to implement it.
- Level II, *Preparation*. The teacher is actively preparing to put the change into practice, but has not actually begun to implement it in the classroom.
- Level III, *Mechanical*. The teacher begins change implementation. Now he has to deal with the logistics of implementation (e.g., lesson planning, classroom management) and with acquiring new teaching skills. Teacher decision making is oriented toward making the innovation more manageable and easy to implement (innovation is teacher-centered).
- Level IVA, *Routine use*. The teacher establishes a pattern of regular use, and makes few changes and adaptations in use of the innovation. Most teachers settle in at a Routine level of use. Level IVB, *Refinement*. The teacher actively assess the impact of the innovation on their students and initiate changes in the innovation or their use of it on this basis. (Changes in innovation use are student-centered).

- Level V, *Integration.* Teachers collaborate with other teachers to make changes in implementation for the benefit of their students. Teacher actions go beyond their own individual classrooms.
- Level VI, *Renewal.* Eventually, some teachers reach it. They feel the need to make a major change in the innovation and/or to explore alternative practices (Anderson, 1997, p. 336).

As with Stages of Concern, the CBAM Levels of Use schema represents a possible, not a necessary, developmental progression in teacher behaviors focusing on the implementation of a specific change in practice.

Teachers often engage in Orientation behaviors to learn about promising practices, but certainly do not try to implement everything they read or hear about. Teachers may decide to abandon new practices while still at a Mechanical level of use for any number of reasons (e.g., poor curriculum fit, inability to cope with disruption of established routines, lack of good assistance, competing priorities).

Teachers who attain a Routine level of use in implementing new practices often continue using those practices without actively exploring modifications in implementation for the benefit of the students. What level of use a teacher progresses to in implementing a change is dependent on the interaction between numerous factors, for example, teacher norms, innovation characteristics, implementation assistance, time and experience with implementation, and administrative pressure and support (Anderson, 1997*)*.

The original CBAM researchers developed two instruments for measuring a teacher's level of use in implementing a classroom change. One is a Levels of Use Interview (which takes 30–40 minutes) and scoring procedure. The other is a protocol for a brief "branching interview" that focuses on the key decision points and the changes teachers are making in their use of the innovation. With its focus on actual classroom actions, the Levels of Use framework offers a rigorous way to describe the change process that answers decision makers' need for accountability" (Ellsworth, 2000)

3. **Innovation Configurations** (IC). The CBAM concept of Innovation Configurations (IC), resulted from the recognition that teachers rarely implemented the same

innovation in exactly the same way. It was even questionable sometimes whether the practices teachers described were valid examples of the intended innovations.

The CBAM researchers attempted to resolve these two issues with the concept of ICs by introducing an Innovation Configuration Component Checklist. This IC Component Checklist specifies key behavioral components of a change (e.g., question techniques, use of materials, grouping, teacher role, evaluation procedures) and possible variations in the way teachers implement the behaviors associated with each component (e.g., uses teacher-developed materials, uses commercially developed materials, uses a combination of teacher and commercially developed materials).

An IC represents the pattern of practices across all innovation components that describes how the innovation is being implemented by an individual teacher. Different teachers implementing the same innovation will commonly have different configurations of use (Hall and Hord, 1987, Anderson, 1997).

Since Innovation Configurations is the third diagnostic dimension of the Concerns Based Adoption Model, specific procedures have been developed for constructing IC Checklists that can be administered by survey, interview, or observation for the purpose of measuring how teachers are implementing a change.

These beliefs about functionality of specific technologies affect the way in which teachers integrate technology in their teaching (Özgün-Koca, 2009).

The above mentioned stages have major implications for professional development (Loucks-Horsley, 2005). According to Hord and her colleagues, these stages point out the importance of attending to where people are and addressing the questions they are asking when they are asking them. Often, it is required to get to the how-to-do-it before addressing self-concerns. This model suggests the importance of paying attention to implementation for several years, because it may take at least three years for early concerns to be resolved and later ones to emerge. Teachers need to have their self-concerns addressed before they are ready to attend hands-on workshops. Regarding management concerns, they can last at least a year, especially when teachers are implementing a school years' worth of new curricula and also when new approaches to teaching require practice and each topic brings new surprises (Loucks-Horsley, 2005).

Help over time is necessary to address any issues and then to reinforce good teaching once use of the new practice smoothes out (Loucks-Horsley, 2005). Moreover, with all the demands on teachers, it is often the case that once their practice becomes routine, they never have the time and space to focus on whether and in what ways students are learning. This often requires some organizational priority setting, as well as stimulating interest and concern about specific student learning outcomes. Everyone has concerns-for example, administrators, parents, policy makers, professional developers. Acknowledging these concerns and addressing them is critical to progress in a reform effort (Loucks-Horsley, 2005).

2.4.4. The IntersTICES Model

The IntersTICES Model (see Figure 5 below), developed by Peraya and Viens (2005), proposes an instructional design-type perspective. It encompasses three major interrelated dimensions, which are intertwined through a pedagogical engineering approach. These dimensions are:

- The seven indicators of pedagogical added value;
- Spaces of Pedagogical Integration, which encompass the internal and external coherence of the system based on the specific context; and
- The participants' e-learning culture.

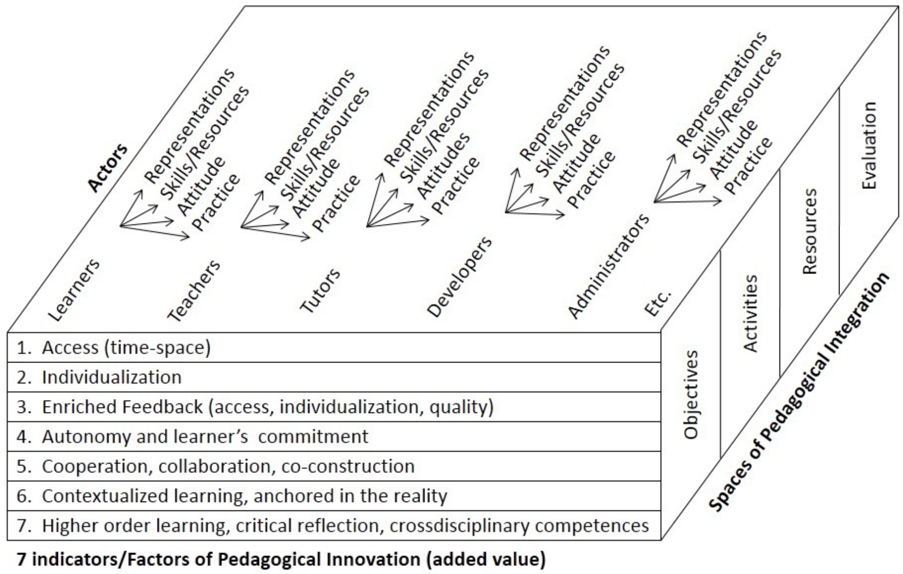

Figure 5: The IntersTICES Model (Peraya and Viens, 2005)

Its seven indicators of pedagogical added value (PAV) are presented below (Table 4). They are defined as: how ICT tools are used to provide an enriched pedagogical environment; how ICT tools are used to foster a richer learning experience to educational interventions to integrate ICT (Peraya and Viens, 2005).

Table 4 : Indicators of pedagogical added value (PAV) (Peraya and Viens, 2005)

	INDICATORS OF PEDAGOGICAL ADDED VALUE (PAV)
1.	Improving access to information, resources and people
2.	Individualization of education
3.	Increasing and enriching feedback-learner-system interactions
4.	Autonomy or learner control for greater learner involvement in their learning
5.	Communication among participants through cooperation, collaboration, co-construction of knowledge and competencies/skills
6.	Contextualization of learning in realistic situations (realistic activities, visualization of phenomena and concepts, simulations, etc.)
7.	Focus on higher order learning, metacognition, individual and collective reflection, critical judgement on both content of learning and learning processes

These indicators are meant to provide a reflective scaffolding to identify in what way ICT may enrich the learning environment.

The first three indicators have been identified since the 1970s, and were related to the educational uses of computers. The first computerized educational systems were already directed towards these three goals for improving education. Although they constitute elements of a technical and instructional planning that reflect a pedagogical approach focused on teaching and the transmission of knowledge, that does not make them any less valuable. The other four indicators are oriented towards a more social constructivist pedagogy that focuses on supporting learners while constructing knowledge (Viens and Peraya, 2004, p.233).

In terms of supporting ICT use by learners, it may seem that Motivation is lacking in this 7-espace frame. However, we argue that motivation[15] is the result of a number of things. For example, the fact of perceiving that the task is relevant, that is not hard, that makes sense for him, that access is easy, etc. Then, when using IntersTICES, motivation to the task, to learning, is the key element, the target that is aimed at without saying. It is scripted in the context, in the learning environment we want to offer our students, which determines the specific contributions of technology, the use of technology in learning. As such, if autonomy is present and feedback is richer, it results in motivation (Viens and Villa, 2012). In the proposed 7-space framework, there are links between each of those items: i.e. between autonomy and the learning environment, between the feedback and motivation, between cooperation -the fact that there are other people involved- and motivation, the individualization and motivation, etc. (Viens and Villa, 2012).

The explanation of these seven dimensions, whose degree of development can be considered as an indicator of innovation is firstly, according to Peraya and Viens (2005), the opportunity to reflect together with the participants on the pedagogical added value of ICT and secondly, to encourage them to integrate these dimensions into their strategies.

[15]Motivation is a need or desire that energizes behaviour and *directs* it toward a goal (Myers, 2003)

Nevertheless, it is not aimed at a maximum inclusion of each of these indicators as they are not educational benefits under all circumstances. Their added value will depend on conditions specific to each educational context and the type of activity/task at hand.

In the analysis and development of an educational activity we must, like the majority of systematic approaches to instructional design do, consider the objectives, the participants' characteristics (learners and teachers), the institutional constraints, etc., before deciding to what degree these dimensions could be developed and integrated.

2.4.4.1. The Innovation Indicators (Pedagogical Added Value-PAV) of ICT

Where is the pedagogical added value of ICT? Regarding the nature of these indicators of pedagogical added value, no definition is proposed in former documents related to the IntersTICES mandate, (e.g. Viens, Peraya, Bullat-Koelliker, 2004) at the origin of the IntersTICES Model (Peraya and Viens, 2005).

Therefore, we decided to conduct a literature review to provide these definitions. By doing this, we also aim at highlighting their actual value and contribution. Following Torraco's (2005) recommendation of using literature reviews as "a distinctive form of research that generates new knowledge about the topic reviewed" (p.356) we undertook then, a search regarding these same or related concepts developed by other researchers for other studies on innovation and ICT acceptance and use/integration in the field of education, which are presented below to further illustrate the indicators of PAV, as follows:

PAV 1: Improving access (time-space) how the use of ICT enhances students' access to activities and resources? Access to the activity itself and resources becomes ubiquitous. Learners who now have Internet mobile or at-home access, can at any time log in and post their contribution wherever they may be.

PAV 2: Individualization of teaching. How the activity allows flexibility and promotes not only adaptation to learners' needs in terms of pace, content and preferences, but also regarding the learning environment?

A learning environment where, for example, we can introduce the appropriate tools to create an individualized learning environment that fits our needs by allowing us to address different profiles of learners and where there may be gradations of difficulty levels. Individualization is therefore, also supported.

ICT facilitates this individualization of instruction by allowing students to learn at their own pace, while showing their strengths and talents (Banes and Walter, 2002; Chalghoumi, 2011; Hasselbring and Glaser, 2002, Karsenti, 2013).

Differentiated instruction is based on the premise that, since students differ significantly in their interests, learning styles, abilities, and prior experiences, then teaching strategies, materials, and pace should vary accordingly. (Student Success and Differentiated Learning Guide, Ontario, 2005). ICT offers suitable prototypes for some flexibility, both in the organization of the space and in group work.

PAV 3: The feedback. Does the use of ICT enhance the feedback in terms of frequency, depth, coherence, ease, resource people (peers, teacher, tutor, and domain experts), etc.? The feedback the learners receive may be a lot richer since it will also be possible, to contact and interact with their peers, when working collaboratively, and also with their teacher, tutor and other experts in the field to complement and deepen their knowledge. Quality of communication is central to this dimension of the pedagogical added value of ICT.

Feedback has been widely cited as an important facilitator of learning and performance (Bandura, 1991). However, quite a few studies have reported that feedback has either no effect or debilitating effects on learning (Mory, 2004, cited by Shute, 2008). Shute (2008) proposes a distinction between prescriptive or normative and facilitative feedback: The first aims at informing the learner about what he has to do, while the latter guides the learner in understanding the content. According to her, it is important to keep in mind, that if feedback is too long or too complicated, many learners will simply not pay attention to it, rendering it useless (Shute, 2008, p.159).

PAV 4: The learner's autonomy. Does the activity performed allow a greater accountability of the learner (choice of content, strategies, etc.) as well as a greater motivation and involvement of this learner? Here, the learner autonomy is seen as being able to make choices, to support his learning, his work strategies. An approach like project-based teaching may give the learner the opportunity to choose the object, the process or the product of the learning activity.

Holec (1981), cited in Benson and Voller, 1997) describes autonomy as “the ability to take charge of one's learning”. In general, the term autonomy has come to be used in at least five ways (Benson and Voller, 1997):

1) For situations in which learners study entirely on their own

2) For a set of skills which can be learned and applied in self-directed learning

3) For an inborn capacity which is suppressed by institutional education

4) For the exercise of learners' responsibility for their own learning

5) For the right of learners to determine the direction of their own learning

ICT offers users opportunities to exercise autonomy. Thus, interacting with technology that provides learners with a rich an immediate feedback, they progress at their own pace in their learning, with less support from the teacher (Chalghoumi, 2011; Angeli and Valanides, 2009).

PAV 5: Communication and collaborative work between participant peers. It is acknowledged that ICT supports collaboration between students (email, forum discussions, etc.) This dimension can be seen gradually in three stages: Cooperation, which implies a sharing of tasks with an isolated work, then a final pooling, represents a minimum exchange among participants. Closer collaboration is possible when students interact throughout the course (higher level of interrelationship and interdependence). Then, they discuss and define the objects, processes and work products (Angeli and Valanides, 2009; Scardamalia and Bereiter, 2003; Viens and Bertrand, 2007).

Besides, the co-construction of knowledge and competencies/skills is developed when exchanges between students focus not only on the work product (research report, for example), but also on deep knowledge and understanding of their objects of study (Peraya and Viens, 2005).

It seems that collaboration between learners will eventually be supported by a peer-comments exchange (Angeli and Valanides, 2005, 2009). It should be noted here, that it appears essential that the teacher organizes the activity in such a way that he supplies and support learners with these exchanges. We may even see some forms of co-development of knowledge if learners are encouraged to discuss and argue in depth about their understanding of the subject being studied (Angeli and Valanides, 2009*)*.

PAV 6: **Contextualization of learning in realistic situations.** The activity carried out, is it located in a meaningful context, in relation to the environments in which the targeted competency will be required? Does the mediated activity allow approaching the real context, simulating a real context, allowing to control or exploring the impact that certain factors may have on studied phenomena such as the simulations? In fact, access to Internet opens the learning activity to many external sources and to approach different environments of practice. The activity takes a touch of realism because it is broadcast and available on the Web.

The degree of fit with reality of the activity or problem to be solved puts learners in a simulation situation that the closer to real life, the more it facilitates transfer while motivating them to get involved and learn (Merriënboer and Kirschner, 2013).

Accordingly, Jonnaert (2002) posits that situated learning, defined as the appropriation by the students of complex and authentic know-how, promotes and enhances contextualization of knowledge as part of the dynamics contextualization-decontextualization-recontextualization, where transfer is the process that links these three phases.

Furthermore, the context would also put the learner in a situation so that he is in contact with several kinds of knowledge, and is able to build one or more representations and formalize them in order to use them in a new task focusing on higher-level learning including metacognition, individual and collective reflection, critical judgement on both content of learning and learning processes (Scardamalia and Bereiter, 2003; Peraya and Viens, 2005; Van Merriënboer and Kirschner, 2013).

PAV 7: Higher-level learning. Does the activity performed with ICT promote complex high-level learning such as critical thinking and other aspects of cross-curricular competencies? High level intellectual activities are at the heart of the educational use of a blog. We ask the student to verbalize his ideas, to challenge them, to reflect on them regularly for a deeper understanding. The computer allows here to keep track of ideas and their true evolution over time.

By using the IntersTICES model we can enable activities proposed to encourage higher-level learning - which refers to metacognition, critical thinking, developing transferable skills, modelling, and visualization of relationships between concepts (concept maps), verbalization and explanation of learning, reasoning and arguments that support them (Nosich, 2012; Peraya and Viens, 2005).

However, it is important to keep in mind that there exist different kinds and degrees of knowledge (Anderson, and Krathwohl, 2001; Gagné, 1985; Merrill, 1983; Reigeluth, 1999). Taking for example the Bloom's Taxonomy, we realize that very often, learning things or facts - even by heart- is OK. It depends on the objectives. Still, this knowledge at the bottom of the scale, may allow the learner to take some steps farther. It may become the prior knowledge to a higher-order one. Therefore, the key here is to make sure that the activity we propose to learners is adapted to the degree of complexity targeted in the objectives we want them to achieve, and that will eventually help them move from basic and simple to more elaborate and complex learning.

Technology can, though, facilitate this process of going towards more explicit representations of this complexity (e.g., concept maps, schemas, and links). It can also allow scaffolding learners and bringing them a little farther in their acquisition of knowledge and skills (i.e. Zone of Proximal Development, Vygotsky, 1978; Angeli and Valanides, 2009; Scardamalia and Bereiter, 2006).

The seven indicators of innovation (pedagogical added value- PAV) proposed here may contribute to the learning conditions. These conditions for learning being what the learner will be asked to do, the activities, the tools offered to him, and the uses they support. Why, for example, asking about access? Because the activity we design will determine the conditions for learning. So, it is not the media, but the activities, the use we make of technology. As Mehan, 1989, p. 19, (cited in Angeli and Valanides 2009, p. 158) explicitly stated ''it is what people do with the machine, not the machine itself that makes a difference".

Anyone can question his ICT educational activities using these seven indicators of pedagogical added value while trying to answer the essential question: "What added value this activity will bring to my teaching practice and to my students' learning conditions?"

2.4.4.2. The Internal and External Coherence

The internal coherence of the IntersTICES model is examined based on four areas of pedagogical integration: objectives, activities, resources and evaluation (Peraya and Viens, 2005).

Each of the seven indicators of pedagogical added value- PAV introduced here, will allow us to have a look at the internal coherence of the activity, based on these indicators of added value, while focusing on the process and on the types of goals. That is, by bringing teachers to look at coherence when designing a course: Is the role given to an indicator explicit? If, for example, when planning for a learning experience the teacher considers that the learner's autonomy is important, he clearly states it in the objectives and makes it explicit. However, this teacher does not explicitly mention the resources he will put in place to allow learners to make choices when doing the tasks to accomplish the stated objectives. He controls all these tasks and activities through which the objectives can be achieved and made much more explicit, or just gives learners small spaces where they can exercise a bit of autonomy. Moreover, during discussions and even at the end of the learning experience, he distorts the learners' ideas to make them mirror his opinions or own perception of how the 'correct' answer should look like. The evaluation will accordingly reflect this attitude, and autonomy will also be absent.

Therefore, if the role given to the indicator *autonomy* was made explicit in the objectives, it should have been present and explicit in the other areas of the pedagogical integration to ensure the internal coherence of the Model.

The external coherence is checked by taking into account the specific context found. i.e., institutional and social context, logistic/time constraints, number of learners, prior knowledge, human and technological resources (Peraya and Viens, 2005).

To illustrate, we will mention a situation encountered in a virtual campus where the board of directors perceived distance education and e-learning as being 'magic objects'.

Therefore, according to their perception, teachers did not need any pedagogical and technical support: “You take this course, you put it online.” Thus, nothing to do about it: Experts could not offer any support to professors since the resources were not in place. They were caught in a system where the social view of e-learning had an impact, and that perception determined the conditions in which courses were developed (Viens and Villa, 2012).

As another example, some parents that do not understand the nature of a students’ exchange activity on Internet. They contacted the school demanding the teacher to put their children to work, and do not have them to ‘waste’ their time (Viens and Villa, 2012).

We have to be aware of the immediate external context, because it determines our context. It does not mean that we can influence it. Very often we cannot change it, but we have to acknowledge it, work with it/ plan accordingly.

2.4.4.3. The Participants’ e-Learning Culture

The central notion of our research, the e-learning culture first introduced by Viens and Renaud (2001) as *a socio-constructivist culture* (p.22) is further developed by Peraya and Viens (2005) through an approach aiming at understanding the factors that may be at play in a training intervention and their impact, instead of focusing mainly on the training tool as a technological object. E-learning culture is therefore, considered as a complex phenomenon that needs to take into account several dimensions, including psycho-social aspects and the real context of the implementation setting.

A review of literature, (i.e. Alter, 2002; Bonami and Garant, 1996; Charlier, Bonamy and Saunders, 2003; Cros, 1996; Glickman, 2002; Greeno, Collins and Resnick, 1996; Reigeluth and Fricks, 1999 as cited in Peraya and Viens, 2005) as well as the interaction with participants in their study, allowed Peraya and Viens (2005) the identification of four sub-dimensions of the e-learning culture characteristics of participants in the integration of ICT: Representations, skills (self-efficacy)/resources, attitudes/affect and habitual practice/use (Peraya and Viens (2005). The articulation of these elements provides a set of indicators to identify areas for development and support that maximize the chances of successful integration of ICT.

Each of these sub-dimensions can be defined in a continuous and progressive development, be tailored to participants, training requirements and learning objectives. Their relevance is not absolute and their level of development within the tool -the IntersTICES model- must take into account the specific context of the project (Peraya and Viens (2005).

In the IntersTICES model, participants' representations, skills - self-efficacy- (and available resources) attitudes (affects) and habitual practice (use) (Viens and Renaud, 2001; Peraya and Viens, 2005) are described as key elements that not only appear to have a great influence on the development of ICT in the field, but are also transformed by their implementation. Moreover, since ICT changes participants' representations and practices, in this sense, they become a training ground whose purpose is the participants' e-learning culture.

Many studies conducted on users' acceptance of utilisation of technology (i.e. Rogers, 1995; Venkatesh, Morris, Davis and Davis, 2003) have confirmed the importance of taking into account these elements of the participants teacher trainers' e-learning culture.

Therefore, to analyze the innovation of a pedagogical practice with ICT from a systemic perspective, we consider it essential, as Peraya and Viens (2005) does, to try to answer first to questions such as:

- How the activities or the tasks carried out by the learner are they richer than before?

- What are the social, institutional and human influences on them?

These elements of the e-learning culture are defined below based on the literature review we conducted for this research, except for that of *representations*, already defined by Viens (2011), as follows:

Representations: Representations have to do with the (pedagogical added) value of ICT. They encompass teachers' perceptions in terms of: 1) How the ICT value is defined; 2) What the actual/precise value of technology is; 3) What the ICT added value for them as teachers is; 4) What the ICT added value for their students is; 5) What facilitating conditions should be in place for it to work; and 6) What constraints to take into account when implementing it (Viens, and Villa, 2012).

Representations may also refer to teachers' epistemological beliefs vis-à-vis teaching and learning, which are found to determine the type of ICT use they make when planning educational activities for their students. For example, teachers who have a traditional teaching approach use ICT tools that allow them to transmit/present content to their students without seeking to promote much interaction or participation from their part. Contrariwise, as Viens and Renaud (2001) found, teachers more socio-constructivist oriented tend to implement pedagogical practices that support a project-based approach, students' autonomy, collaboration and metacognition, which may be facilitated through the pedagogical integration of ICT in class activities.

Skills/Resources. Skills: This element includes what is known as perceived computer **self-efficacy**, which is defined as our belief about our ability to perform a specific task/job using a computer (Simonson et al., 1987, as cited in Venkatesh, Morris, Davis and Davis, 2003). Research (e.g. Bandura, 1994) has shown that self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective and selection processes.

According to Bandura (1994), there exist proven ways of influencing the development and strengthening of people's beliefs about their efficacy:

- Through *mastery experiences* we can create a strong sense of efficacy in teachers. Successes build a robust belief in our personal efficacy. Failures undermine it, especially if failures occur before a sense of efficacy is firmly established. After teachers become convinced they have what it takes to succeed, they persevere in the face of difficulty and quickly recover from setbacks;
- *Vicarious experiences.* Acquisition of better means raises teachers' perceived self-efficacy, i.e. through vicarious experiences provided by modelling. Seeing people similar to us succeed by sustained effort raises our beliefs that we too possess the capabilities to master similar activities required to succeed. People seek proficient models who possess the competencies to which they aspire. Accordingly, through their behavior and expressed ways of thinking, competent models provide teachers with the

knowledge, effective skills and strategies they require for responding to and managing educational demands;

- *Social persuasion* is another way of strengthening people's beliefs that they have what it takes to succeed. Teachers who are persuaded verbally that they possess the capabilities to master given activities are likely to mobilize greater effort and try hard enough to succeed. These persuasive boosts promote teachers' development of skills and a sense of personal efficacy (Bandura (1994).

Resources: Resources may contribute to the feeling of being able to perform a task by having what it takes to do it, not only in terms of full personal ability (Bandura, 1994). They can be human and material resources. Human resources include a technician who is available for just-in-time technical support; a more experienced colleague, an expert, or any other person that may offer personal support/advice when needed. Material resources comprise computer equipment up to date and functional; installed software programs both on teachers' personal computer, and in labs accessible to students; tutorials, videos, etc.

Attitude: Attitude is defined as the overall user's feeling/**affect** toward using the technology. It encompasses also the emotional aspect of technology usage called computer anxiety that is defined as an individual apprehension, or even fear, when he/she is faced with the possibility of using computers (Simonson et al., 1987, as cited in Venkatesh, Morris, Davis and Davis, 2003). Research in information systems (IS) and psychology has highlighted the significant impact computer anxiety has not only on attitudes (e.g. Howard and Smith, 1988 as cited in Venkatesh, 2000) but also on intention (Fishbein and Ajzen, 1975, 1980, Bandura, 1977) behaviour, learning, and performance (as cited in Venkatesh, Morris, Davis and Davis, 2003).

Furthermore, Gill and Dalgarno (2008) report that Sime and Priestley's (2001) study of student teacher views of ICT in teaching found the perception that even when resources were limited and access to computer suites was problematic, the individual teachers' attitude was the vital factor in determining ICT use. Galanouli and McNair (2001 as cited by Gill and Dalgarno, 2008) also found this to be the case, stating that although lack of equipment was considered an important factor, it was clear that teachers' attitudes play the most crucial role.

Furthermore, Villeneuve (2011) whose study on the techno-competency of pre-service teachers in Quebec shows that "it is not only technical problems that affect future teachers to integrate ICT, but that personal factors such as motivation and perceived competence towards ICT also have a role to play." (Our translation, p.29)

Practice/use: The further the new practice is from existing practice, the less likely it will be implemented successfully (Zhao, Pugh, and Byers, 2002). It was suggested that beliefs[16] shape practice (e.g. Cuba, 1986, Ertmer, 2005; Kagan, 1992, Niederhausser and Stoddart, 2001) this does not mean necessarily, that the best way to change teacher practice is by changing their beliefs. In fact, Guskey (1986, 2000) argues that change in beliefs *follows,* rather than *precedes* practice, and that by helping teachers adopt new practices that are successful, i.e. foster change in student learning outcomes, the associated beliefs will also change. Therefore, confidence and competence are foundational to achieving that success.

To sum up, the IntersTICES model provides seven indicators of pedagogical added value that can be used by teachers to enrich any pedagogical intervention integrating technology; spaces of pedagogical integration i.e. objectives, resources, activities and evaluation, along with tools, drawing on its systemic approach, for reflecting on facilitating conditions and constraints for this integration. It also considers the participants' e-learning culture that we can use to explore the impact it has on their teaching practice.

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[16] According to Pajares (1992), teacher belief systems comprise numerous interacting, intersecting, and overlapping beliefs. These beliefs consist of a mix of opinions and values that can influence how teachers use technology in their classrooms (Hermans, Tondeur, van Braak, Valcke, 2008). Kagan (1992) defined teacher beliefs as "tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught" (p. 65). Kagan examined 40 studies (published/presented between 1987 and 1991) and concluded that beliefs about teaching influenced future teaching behaviors. Thus, teachers' beliefs about the role of information communications technologies (ICT) for teaching and learning may influence teachers' decisions to either integrate ICT into their classrooms or to limit their efforts to use it effectively (Ertmer & Ottenbreit-Leftwich, 2010; Hermans et al., 2008).

2.4.5 Summary Table of Characteristics, Strengths and Weaknesses of the Models Presented

We present below a summary table aiming at highlighting the characteristics, as well as the strengths and weaknesses - identified through our review of literature - of the four models we presented, i.e. the TPACK/ICT TPCK Model, the SAMR Model, the Concern Based Adoption Model (CBAM) and the IntersTICES Model.

Table 5: Summary Table of Characteristics, Strengths and Weaknesses of the Models Presented above

MODEL	Characteristics	Strength(s)	Weakness
TPACK Introduced as a conceptual framework for the knowledge base teachers need to effectively teach with technology (Pierson, 2001). […] as a means for teaching with technology (Niess, 2005). **ICT–TPCK** is "knowing how to operate a computer and how to use a multitude of tools/software as well as troubleshoot in problematic situations" (Angeli and Valanides, 2009).	- It emphasizes the situatedness and interactive nature of the development of TCK, TPK, and TPCK. - Needs taking into account the *context* (Koehler and Mishra, 2008).	- Teachers' technological knowledge (TK) is a stable predictor of teachers' self-efficacy beliefs towards technology (Abbit, 2011).	- Context referred to in a rather vague and general way with multiple meanings (e.g. student characteristics, classroom and institutional conditions for learning, situated teaching activities (Porras-Hernandez and Salinas-Amescua, 2013). - It does not address how tool affordances can transform content and pedagogy (Angeli and Valanides, 2009). - It does not consider other factors beyond content, pedagogy, and technology (e.g. Teachers' epistemic beliefs; teachers' teaching/ learning values; teachers and other participant's e-learning culture (Angeli and Valanides, 2009). - Growth in the related constructs does not automatically mean growth in TPCK (Angeli and Valanides, 2009) - Teachers may have the knowledge and skills to use technology (referred to as espoused TPACK) but are not able to use it in practice (referred to as in use TPACK) (So and Kim, 2009). - To actively involve teachers in their TPACK development, it requires using complementing models, as well as strategies not comprised in TPACK (e.g. 'Learning technology by design' (Mishra and Koehler 2006); and the conceptualizations from the Diffusion of Innovations Model -Rogers,1995 (Niess, 2011)

Table 5. Summary Table of Characteristics, Strengths and Weaknesses of the Models Presented above (continued)

MODEL	Characteristics	Strength(s)	Weaknesses
SAMR developed by Puentedura (2010).	It encompasses - Four different levels: Substitution, augmentation, modification, and redefinition. These levels are presented as "transitional levels measured on a scale of months – at the most, at least for the first two levels and skills" (Puentedura, 2010), and -Two different sections: Enhancement and transformation.	- Puentedura presents SAMR along with TPCK, as to provide it with a sounder framework	- Neither the author nor does the model include any indication of how to effect the suggested transformation of learning by technology. - It speaks of degrees of change in pedagogy; of aiming at going to the next level. Nothing else.
The CBAM (Hall 1974; Hall and Hord, 1987; 2001) has been highlighted as a useful framework for describing and evaluating teachers' engagement with and implementation of proposed programmatic changes or innovations (not necessarily dealing with ICT integration).	It comprises three frameworks: 1. Stages of Concern (SoC): Describe the affective dimension of change: how people feel about doing something new or different, and their concerns as they engage with a new program or practice. Stage 0, Awareness Stag1, Informational, Stage 2, Personal, Stage 3, Management, Stage 4, Consequence, Stage 5, Collaboration, Stage 6, Refocusing. 2. Level of use (LoU): Focus on actual classroom actions. It allows demonstrating whether and to what extent new practices have been implemented in the classroom Level 0, Non-use, Level I, Orientation, Level II, Preparation, Level III, Mechanical (innovation is teacher-centered).Level IVA, Routine use. (Changes in innovation use are student-centered). Level V, Integration. Level VI, Renewal. 3. Innovation Configurations (IC): Assumes that individual users' patterns of implementation for an intervention are not identical.	- SoC provides a potential evaluative framework for considering teachers' attitudes at all stages of implementation. - SoC allows ongoing evaluation of users' concerns during the implementation process. - SoC allows identification of various concern profiles, facilitating design of specific consultation and support strategies to address needs of implementers at different SoC. - LoU: with its focus on actual classroom actions, it allows demonstrating whether and to what extent new practices have been implemented in the classroom (accountability) - Provides two instruments for measuring a teacher's LoU in implementing a classroom change: 1. A LoU Interview (which takes 30–40 minutes) and scoring procedure; 2. A protocol for a brief "branching interview" focusing on key decision points and changes teachers are making in their use of the innovation. - Provides specific procedures for constructing IC Checklists that can be administered by survey, interview, or observation to measure how teachers are implementing change.	- Requires help over time to address issues and reinforce good teaching once use of the new practice smoothes out (Loucks-Horsley, 2005). - With all the demands on teachers, often once their practice becomes routine, they never have the time and space to focus on whether and in what ways students are learning. (Acknowledging these concerns and addressing them is critical to progress in a reform effort (Loucks-Horsley, 2005)). - It provides plenty of methodological tools, however it is a little bit "heavy".

Table 5. Summary Table of Characteristics, Strengths and Weaknesses of the Models Presented above (continued)

MODEL	Characteristics	Strength(s)	Weaknesses
InterTICES (Peraya and Viens, 2005) Designed specifically to facilitate ICT integration.	- Proposes an instructional design-type perspective. - It encompasses three major interrelated dimensions, intertwined through a pedagogical engineering approach: 1. Indicators of pedagogical added value: access, individualization, feedback, learner's autonomy, cooperation/collaboration/co-construction, contextualization, higher-order thinking. 2. Spaces of Pedagogical Integration: Objectives, activities, resources, evaluation. Encompass the internal/external coherence of the system based on specific context. 3- Participants' e-learning culture: Representations, skills, attitude, use/practice. - It encompasses two levels of principles (Peraya and Viens, 2005): 1. Comprising a global approach or main steps: A training orientation based on an identified/concrete problem, requiring needs/context analyses, and design of the training intervention itself. 2. Encompassing a reflexive practice on the pedagogical added value; the internal consistency of the process; and the e-learning culture of the people to be trained and of the researcher/trainer herself.	- Since developed through a *recherche-action-formation* (an action-training research type), it is in that kind of milieu that the model is most effective. - It takes a deep approach to intervening and working with people. - It allows placing training interventions within the context where people interact aiming at changing their e-learning culture by trying to enable them to recognize their own needs and supporting them, through reflection, in finding and planning suitable solutions. As such, they can be brought a step further at each stage of the process.	- The description of characteristics of an IntersTICES-type activity are neither operational nor systematic. - There are currently no means that allow to understand how to plan and organize such an activity. Related literature is rather descriptive focusing on the relationship among IntersTICES components i.e. the pedagogical added value; the spaces of pedagogical ICT integration, as well as the internal consistency of the pedagogical activity; and the e-learning culture of actors, from a systemic perspective.

2.5. Convergent Approaches to Be Taken into Account

The characteristics of the IntersTICES model, which seem to us most worth emphasizing, align with Mayes and de Freitas' (2006) suggestion to teachers when seeking for effective pedagogical use of technology affordances. Mayes and de Freitas (2006) posit that it is useful for teachers to consider the types and processes of thinking with which students are required to engage for a specific task. Moreover, they also recommend teachers trying to identify the technology that will best facilitate students engaging in lessons, activities, and instructional strategies that foster thinking skills. This consideration should also be specifically made regarding the nature of the learning outcomes that are sought through educational innovation, including e-learning methods.

As an illustration of these types of thinking processes, which can be fostered by specific activities or tasks, and types of pedagogy that can provide the appropriate learning environments for facilitating achievement of targeted objectives, we present below as convergent approaches to be taken into consideration, the Revised Bloom's Taxonomy (2.5.1), the Digital Taxonomy by A. Churches (2.5.2) and Types of Pedagogy (2.5.3).

2.5.1. Revised Bloom's Taxonomy of Learning (Anderson and Krathwohl, 2001)

As aforementioned in section 2.4, many studies suggest that ICT is more than 'just a tool'. In fact, teachers need to realize that it is the thinking processes triggered by the type of task or activity in which their students engage that determine the quality of their learning.

Anderson and Krathwohl's (2001) Revised Bloom's Taxonomy of Learning, appears adequate to help teachers conceptualizing learning that involves demonstration of any of the basic cognitive competences or dimensions: *knowledge, comprehension, application, analysis, synthesis* and *evaluation* (see Anderson and Krathwohl, 2001 for a full schema). Besides, it seems that using Anderson and Krathwohl's (2001) taxonomy allows teachers to keep focused on the learning rather than the technology. Anderson and Krathwohl's (2001) Knowledge dimension refers to the subject matter content being addressed and involves the following kinds of knowledge (pp. 27–29):

- **Factual knowledge** – discrete pieces of elementary information, required if people are to be acquainted with a discipline and solve problems within it;
- **Conceptual knowledge** – interrelated representations of more complex knowledge forms, including schemas, categorisation hierarchies, and explanations;
- **Procedural knowledge** – the skills to perform processes, to execute algorithms and to know the criteria for their appropriate application; and
- **Metacognitive knowledge** – knowledge and awareness of one's own cognition as well as that of other people.

The Cognitive Process Dimension of Anderson and Krathwohl's (2001) model includes a continuum from lower-order thinking skills to higher-order thinking skills that represents its levels. Each of these levels is presented here accompanied by verbs that teachers may use to define the desired outcomes of the learning session. They are as follows:

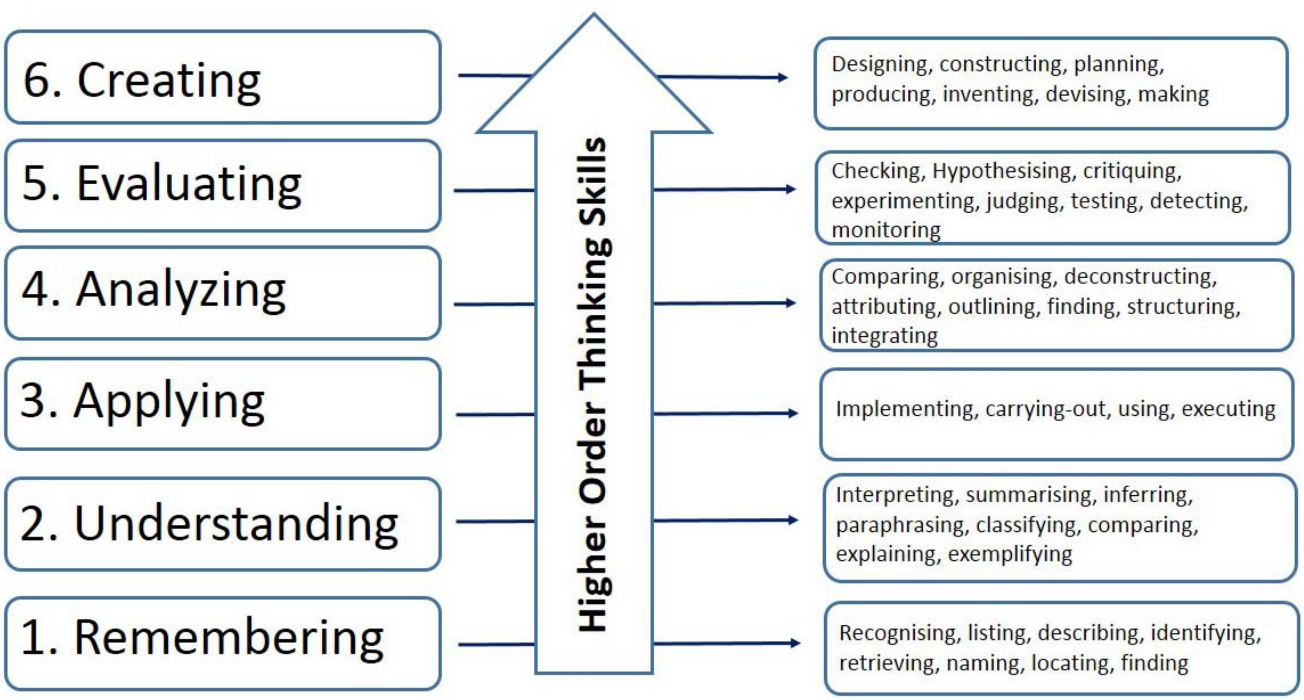

Figure 6: **Anderson and Krathwohl's (2001) Bloom's Revised Taxonomy- Higher Order Thinking Skills**

It appears that these types of knowledge and cognitive processes presented in Anderson and Krathwohl's (2001) Revised Bloom's Taxonomy, serve to bridge the gap between the idea of pedagogical engineering as being the engine of the IntersTICES model, and allowing the practice of engaging in reflection on teaching. e.g. when looking at the objectives, we look at types of knowledge we are aiming at, prior knowledge that people have, whether there is a need to assist, to help them understand or not. This approach puts us in the instructional design perspective.

2.5.2. The Digital Taxonomy by Andrew Churches (2008)

Given the widespread of Web technologies and digital media, a new set of learning needs has emerged, and the revised taxonomy does not address the new skills developed as a direct result of the integration of ICT in education. Therefore, the need for a new classification which accounts for the digital component has become more present, and as a result, Andrew Churches (2008), came up with a list of digital verbs and actions, (See Figure 7 below) that are the equivalent of the verbs of the revised taxonomy by Anderson and Krathwohl (2001).

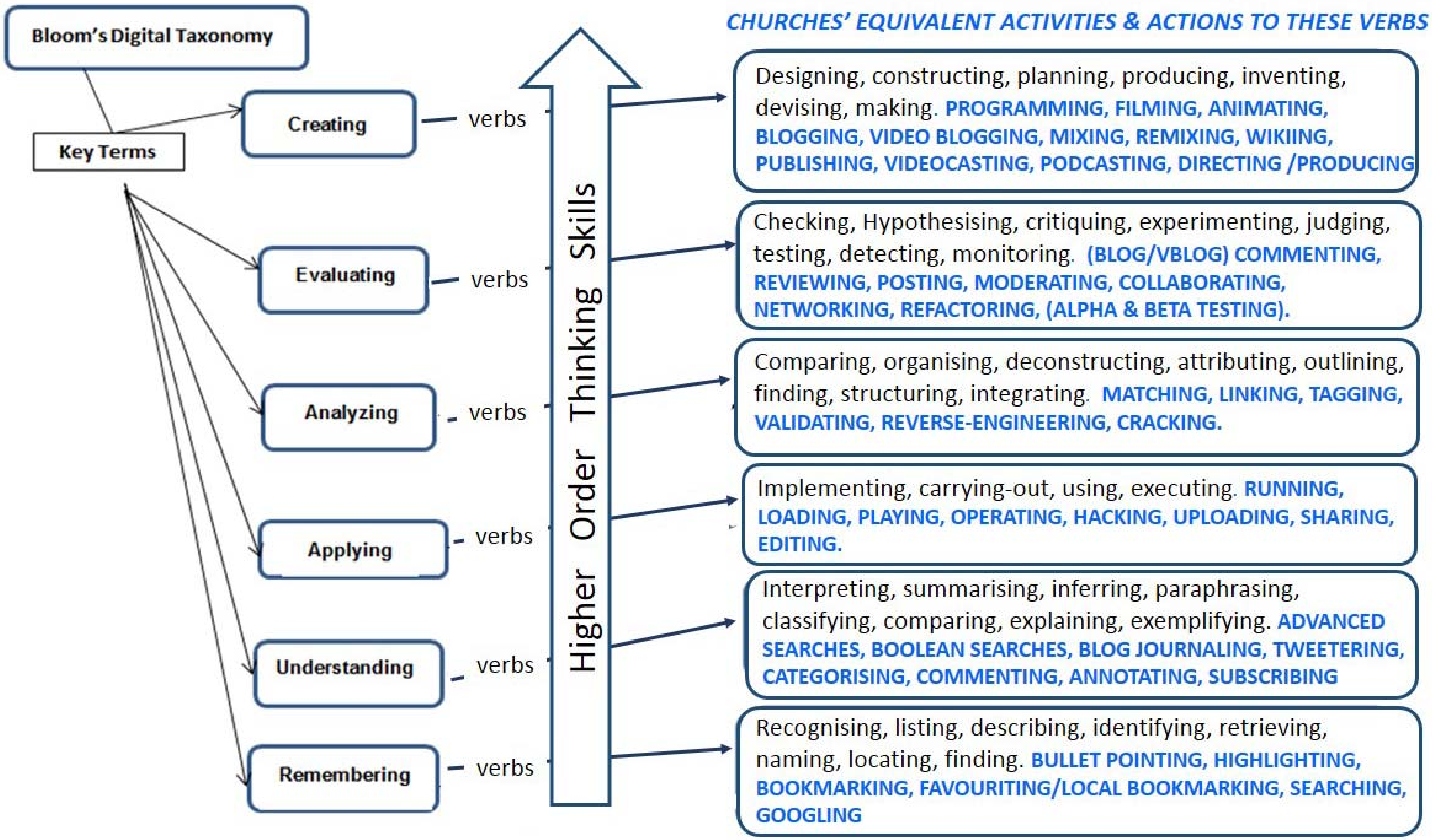

Figure 7: Bloom's Digital Taxonomy- Activities and Actions. Churches, 2008. In Educational Origami, Bloom's ICT Tools

As shown, instead of using, for example, verb-phrases like interpreting, summarizing or explaining, -contained in the Revised Bloom's Taxonomy verbs, and presented in black, in the new Digital Taxonomy, words like *Blogging, Twittering* or *Googling* - presented in **UPPERCASE** and blue- are used. This change in thinking represented by verbs and actions is complemented with equivalent activities and actions that go on all the way up through each cognitive stage of learning.

Churches believes that in order to prepare students for the future, teachers must prepare them for change. Teach them to question and think, to adapt and modify, to synthetize and sort, and foster opportunities for them to create. This new way of thinking was captured in a different type of pyramid. One that displays different ways of Web 2.0 usage, ranking from basic to complex; to respond to the need of teachers struggling with where to place many of the technology tasks within the pyramid of Bloom's Taxonomy.

Thanks to Andrew Churches' (2008) work, teachers have a basis on which to compare digital techniques with the more traditional standards that Bloom created.

The new Bloom's Taxonomy, a Web 2.0 pyramid is a great resource to:

- Support teachers in identifying effective and meaningful web-based applications for content mastering, integration and enhancement.
- Develop lessons and activities that relate to students real world experiences and different learning styles, and
- Provide students with opportunities to create and implement new found experiences.

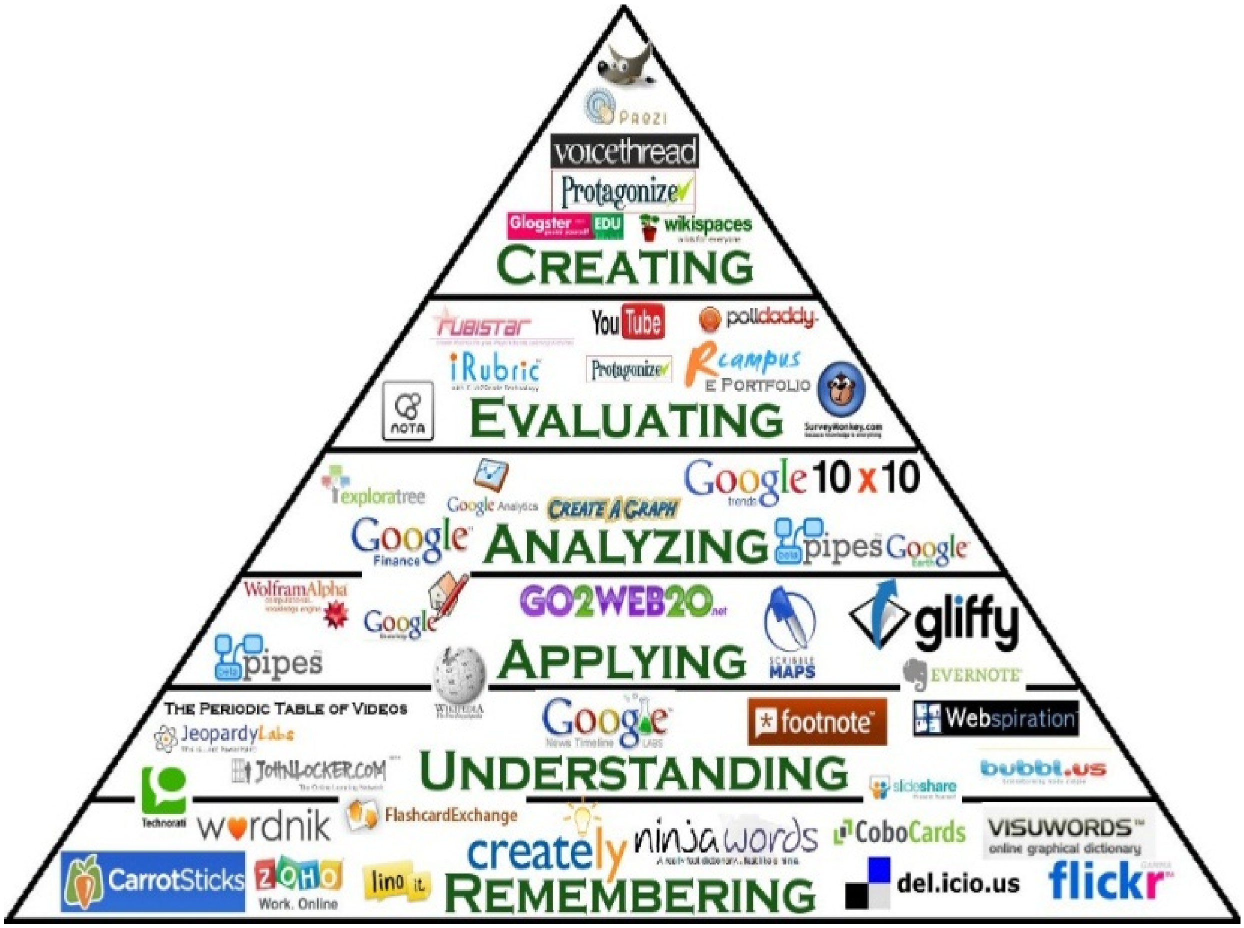

Figure 8: Bloom's Digital Taxonomy. Churches (2008) Educational Origami Bloom's tools

In today's classrooms, no matter the educational level, teachers need to understand that in order to effectively communicate and relate to their students they must be able to adjust to the ever changing world of technology. Churches' (2008) Bloom's Digital Taxonomy may complement the instructional design perspective with activities related to Web 2.0.

Accordingly, and following Vygotsky's definition of *pedagogy* as the interactive process by which a student's learning is mediated by teachers using a range of tools (Vygotsky, 1978, p.27), since achieving a targeted objective may require the implementation of a specific type of pedagogy to carry out the mediating activity, just for illustration purposes we present below some types of pedagogy.

2.5.3. Types of Pedagogy

Success of a learning experience, can be determined by at least one of the many aspects that contribute to making pedagogy effective, such as understanding how to address the needs of a target audience, how to specify tasks clearly and implement rich learning environments (Mishra and Koehler, 2006; Peraya and Viens, 2005). However, many of these pedagogical considerations relate more to the specific context within which learning is occurring. Bower, Hedberg and Kuswara (2010) categorize these environments as:

- **"Transmissive** – transmission-based information delivery approaches, where information is presented to learners;
- **Dialogic** – centred on discourse between participants, and often involving exemplars followed by periods of activity and feedback;
- **Constructionist** – where learning occurs by developing a product; and
- **Co-constructive** – groups of learners complete a series of goal-related tasks to produce an artefact" (p.182).

It is important to keep in mind that depending on the stage of the learning cycle, there are merits to each learning activity design. For example, direct instruction approaches are considered by some teachers to be more appropriate when their students are just starting to form understandings about a particular topic (Magliaro, Lockee, and Burton, 2005, as cited in Bower, Hedberg, and Kuswara, 2010).

Expert modelling can be used as a complementary approach for helping students develop capacity in a domain through what Collins, Brown and Holum (1991) call "cognitive apprenticeship".

As a twofold concept, modelling, is seen as a strategy to support teachers when learning about and how to use the tool, as well as a social resource. Handler (1993, as cited in McDougall, 2008) found that those who frequently saw computers being used in their pre-service methods course felt better-prepared to use the computer as an instructional tool. When tutor modelling is followed by opportunities for them to practice and apply technology tools in the design of lessons, it increased their self-reported confidence level for utilizing these technologies in the classroom (Pope, Hare and Howard 2005).

Therefore, building relationships –as the aforementioned social resource- and modelling effective teaching appear to be important roles played by teacher educators (Marlow and Nass-fukai, 2000 as cited by Tinkler, 2004); Sharp and Turner, 2008). Howitt (2007) found that modelling of effective teaching strategies by the teacher educator was one of the biggest influences on the pre-service teachers' confidence in teaching science. He also found, that pre-service teachers have to trust their educators in order to develop confidence in their own teaching, and gain valuable feedback and encouragement about their development as a teacher. As such, this approach allows teachers to directly convey subject matter content along with a whole range of underlying techniques such as attitudes, thought processes, and problem-solving techniques (Bower, Hedberg, and Kuswara, 2010).

Transmissive approaches, however, generally have to face some criticism regarding the lack of opportunities for students to actively engage in social construction of knowledge in interaction with peers, as more socio-constructivist approaches prone, while dialogic pedagogies allow students to learn beyond what they could have achieved in isolation (Bower, Hedberg, and Kuswara, 2010)

Bower, Hedberg, and Kuswara, (2010) highlight the importance of Laurillard's Conversational Framework for dialogic learning using technology. According to this model, "learners form a complete understanding by apprehending the structure of discourses, interpret types of representation, act on descriptions of the world, apply feedback and reflect upon the goal–action–feedback cycle. Critically, the model highlights the importance of discursive (conversational) flows to enable these processes to occur" (p.183).

Constructionist pedagogy first described by Seymour Papert (1986 as cited in Bower et al. 2010), claims that students learn by reconstruction rather than as a transmission of knowledge, and assumes that learning is most effective when students are constructing a meaningful product.

It is then required that teachers possess a good understanding of how to design and implement learning activities integrating e-learning technologies that encourage students to actively engage in their own learning. In co-constructive pedagogies a learning product is also the responsibility of learners. By implementing learning activities integrating e-learning technologies, e.g. wikis, fora, Google Drive, teachers can foster knowledge and meaning co-construction among their students. These type of activities provide opportunities for students to enrol in social interactions to come up with a common product, while acquiring and developing negotiation skills.

Bower, Hedberg, and Kuswara, (2010) argue that the pedagogies mentioned above can be distinguished by their degree of negotiation and production. Nevertheless, according to what Peraya and Viens, (2005); Viens and Villa (2012) propose via the IntersTICES model, there is also knowledge and understanding as a product. As when people work and elaborate on their ideas and understandings, it is not a product they are working on. It is knowledge co-building, *à la* Scardamalia (1996), as shown in Table 6 below. It is worth noting, however, that these pedagogies do not determine a particular role to be played by teachers or students. Depending on the nature and design of the learning activity, teachers as well as learners may adopt different roles. According to Bower, Hedberg, and Kuswara, (2010) "in terms of technology selection for a type of pedagogy, the important element is the way in which all participants interact" (p.183).

Table 6: Pedagogies categorised according to their degree of negotiation and production (Bower, Hedberg, and Kuswara, 2010, p. 183)

	Non-negotiated	**Negotiated**
No product	Transmissive	Dialogic
Product	Constructionist	Co-constructionist
Knowledge and Understanding		*Knowledge Co-Building*

As a final dimension that determines the nature of pedagogy applied, Bower, Hedberg, and Kuswara, (2010) include the temporal organisation of the activity, either synchronous or asynchronous. Synchronous activities enable real-time access to feedback and troubleshooting support. Asynchronous activities allow anywhere anytime access. Moreover, they can provide more time not only for reflective thinking, but also for allowing students having mother languages different from the language used for teaching, more time for actively participating (e.g. editing their postings, if needed, before submitting them; checkings for accurate meaning of words or expressions).

The type of interaction required will influence the technology that is selected for the task. As it was mentioned in the previous section, Andrew Churches' Digital Bloom's Taxonomy may complement the types of Web 2.0 technologies available to educators, with respect to the types of online content they can represent and the type of activity they facilitate.

Since this research involves teacher trainers as adult learners, the following section presents what is considered as comprising the knowledge base of adult learning.

2.6. Andragogy: Applying Principles of Adult Learning

Adult learning does not occur in a vacuum. What people need or want to learn, what opportunities are available, the way in which people learn, are to a large extent determined by the society in which they live (Marrianm, Caffarella, Baumgartner (2007). It is undeniable that technology has contributed to, if not caused, the shift to an information society. These changes according to Mason, (2003) are more visible in higher education where, due to the increasing global circulation of ideas and particularly Western pedagogical systems and values, it is assumed that those who have access, are ready "to be self-directed, self-motivated and self-resourceful […]learners" (Mason, (2003), in Merriam, Caffarella, Baumgartner (2007), p. 23). Adult learners are therefore expected to respond to a broader notion of learning than the one taking place in schools: Nonformal, informal, self-directed learning.

In 1968, Malcolm Knowles proposed "a new label and a new technology" of adult learning to distinguish it from pre-adult schooling (p. 351), the European concept of andragogy, meaning "the art and science of helping adults learn," was contrasted with pedagogy, the art and science of helping children learn (Knowles, 1.980, p. 43, in Merriam, Caffarella, Baumgartner (2007), p. 84).

Thus, Andragogy became the uniting point for those trying to define the field of adult education as separate from other areas of education. The five assumptions underlying andragogy describe the adult learner as someone who 1) has an independent self-concept and need to be involved in the planning and evaluation of his ⁄her own learning; 2) has accumulated a reservoir of life experiences (including mistakes) that is a rich resource for learning; 3) has learning needs closely related to immediate relevance and impact on his ⁄her job or personal life; 4) is problem-centered and interested in immediate application of knowledge (Knowles, 1984). Kearsley, (2010) restates and adds to this last-mentioned assumption. He considers adult learning as being problem-centered rather than content-oriented.

As such, when teaching adult learners it is important to acknowledge these concepts of the adult learning theory to be able to incorporate them into the teaching situation. Teachers⁄trainers need to become *facilitators*, helping the adult learner to set and achieve goals and guide them in choosing appropriate tools and ways to fulfill these goals. They need to keep in mind that the adult learner needs to know why the training or course is important to their learning and life situation. The adult learner brings into the continuing educational field a rich collection of experiences that will affect the learning situation. They need to be able to apply the acquired knowledge into their life situations.

There is, however, some criticism regarding the extent to which the above mentioned assumptions are characteristic of adult learners only. Merriam, Caffarella, Baumgartner (2007) argue that some adults are highly dependent on a teacher for structure, while some children are independent, self-directed learners. The same is true for motivation; adults may be externally motivated to learn, as in attending training sessions to keep their job, for example, while children may be motivated by curiosity or the internal pleasure of learning. Even the most obvious assumption that adults have more and deeper life experiences may or may not function positively in a learning situation.

According to Merriam, Mott and Lee, (1996) as cited in Merriam, Caffarella, Baumgartner, 2007), certain life experiences can indeed act as barriers to learning, and children in certain situations may have a range of experiences qualitatively richer than some adults. That these assumptions were not necessarily true of all adults led Knowles himself to revise his thinking as to whether andragogy was just for adults and pedagogy just for children.

Between 1970 and 1980 Knowles moved from an andragogy versus pedagogy position to representing them on a continuum ranging from teacher-directed to student-directed learning. He acknowledged that both approaches are appropriate with children and adults, depending on the situation. For example, an adult who knows little or nothing about a topic will be more dependent on the teacher for direction; at the other extreme, children who are naturally curious and who are "very self-directing in their learning *outside of school* . . . could also be more self-directed in school" (Knowles, 1984. p. 13).

This acknowledgment by Knowles resulted in andragogy being defined more by the learning situation than by the learner. As further illustrated by Candy (1991), regarding this relationship between autonomy and self-directedness, educators should not assume that because a person has been self-directed in one situation, "he or she will be able to succeed in a new area: Orientation, support and guidance may all be required in the first stages of a new learning project, since a learner's autonomy is likely to vary from situation to situation." (In Merriam, Caffarella, Baumgartner, 2007, p.123).

Accordingly, being in this situation of *dependency* or need of personal support, very likely, may thus be the scenario where teachers (trainers) often find themselves immersed in, when dealing with ICT integration for the first time, without having received appropriate training or even modelling.

Therefore, focusing on the teaching-learning situation seems to be THE appropriate position when working with adults. As stated by Houle (1996), "education is fundamentally the same wherever and whenever it occurs. It deals with such basic concerns as the nature of the learner, the goals sought, the social and physical milieu in which instruction occurs, and the techniques of learning or teaching used. These and other components may be combined in infinite ways... Andragogy remains as the most learner-centered of all patterns of adult educational programming" (Houle 1996, pp. 29-30). Houle's first and second universal components of education, the nature of the learner, and the goals sought, are very important issues for our research, since teacher trainers taking part in it are over 29 years of age, in fact, 3 participants out of 5 are over 40. We can argue, then, that it behooves this research to have at least a basic understanding of the adult learner; and since teacher trainers tend to be older than the pre-service teachers they train, adult learning theory is even more important when working with teachers in teacher training programs. What is significant, Houle posits, is that andragogy has alerted educators to the fact that they "should involve learners in as many aspects of their education as possible and in the creation of a climate in which they can most fruitfully learn" (p. 30, in Merriam, 2001).

Context-Free Andragogy?

Malcolm Knowles (1984) posited two useful criteria for classifying adulthood. First, an adult is one who is performing social roles normally assigned to adults in their respective cultures, that is, worker, spouse, parent, citizen, and so on. Second, an adult is one who perceives him- or herself as essentially responsible for his or her own life. Such a person, argued Knowles, tends to approach learning in a different fashion than a child or adolescent. As such, based in humanistic psychology, Knowles's version of andragogy presents the individual learner as one who is autonomous, free, and growth-oriented.

As aforementioned, adult learning does not occur in a vacuum. Merriam, Caffarella, Baumgartner, (2007) pointed out that there is little or no acknowledgment that every person has been shaped by his or her culture and society, that every person has a history, and that social institutions and structures define, to a large extent, the learning transaction irrespective of the individual learner. This critical reflection is an "understanding of the historical, cultural, and biographical reasons for one's needs, wants, and interests.... Such self-knowledge is a prerequisite for autonomy in self-directed learning" (Mezirow, 1985, p. 27, in Merriam, Caffarella, Baumgartner, 2007, p.132).). Further, it is our job as adult educators "to assist adults to learn in a way that enhances their capability to function as self-directed learners" (Mezirow, 1981, p. 137 in Merriam, Caffarella, Baumgartner, 2007, p.132).

The earliest models of adult education proposed by Tough (1971) and Knowles (1975) are the most linear, moving from diagnosing needs to identifying resources and instructional formats to evaluating outcomes. Models developed in the late 1980s and the 1990s are less linear and more interactive; in such models not only the learner but the context of the learning and the nature of the learning itself are taken into account. In Danis'(1992) model, for example, learning strategies, phases of the learning process, the content, the learner, and the environmental factors in the context must all be taken into account in mapping the process of self-directed learning (Merriam, Caffarella, Baumgartner, 2007).

Other models of adult education worth mentioning are those named by Merriam and Caffarella (1999) as "instructional" models. In these models the process focus on what instructors can do in the formal classroom setting to foster self-direction and student control of learning. The best known of these is Grow's (1991, 1994) Staged Self-Directed Learning (SSDL) model, encompassing four stages:

"Stage 1: Dependent learner: Learners of low self-direction who need an authority figure (a teacher) to tell them what to do;

Stage 2: Interested learner: Learners of moderate self-direction who are motivated and confident but largely ignorant of the subject matter to be learned;

Stage 3: Involved learner: Learners of intermediate self-direction who have both the skill and the basic knowledge and view themselves as being both ready and able to explore a specific subject area with a good guide;

Stage 4: Self-directed learner: Learners of high self-direction who are both willing and able to plan, execute and evaluate their own learning with or without the help of an expert." (Merriam, Caffarella, Baumgartner, 2007, p.117).

It is in this matrix where learners can locate themselves in terms of their readiness for and comfort with being self-directed, and instructors can match the learners' stage with appropriate instructional strategies. For example, while a dependent learner needs more introductory material and appreciates lecture, drill, and immediate correction, a self-directed learner can engage in independent projects, student-directed discussions, and discover or co-construct learning.

We thought not only relevant, but also interesting to present Edwards and Usher's (1994), "deconstruct" of adult education's understanding of *–competence* to close this section about adult learning-Andragogy. "Competence is defined by most as not only performance of a particular job but the "skills, knowledge and understanding which go into that performance"

(p. 7). Knowledge and understanding that do not have anything to do with the performance of a particular job are excluded from discourses of competence. At the same time, there is increasing demand for a flexible workforce with diverse skills, knowledge, and understandings. Thus, a paradox in meaning exists. The discourse of competence in adult education excludes all that is not necessary for the performance of a particular job, yet the discourse in the current workplace requires inclusion of skills, knowledge, and understanding that go beyond particular jobs. In this case, how can we identify what is normal, right, or good? (In Merriam, Caffarella, and Baumgartner, 2007).

Our research also considers innovative pedagogical uses of technology, the Unified Theory of Acceptance and Use of Technology (UTAUT) that we present below, provides us with an appropriate framework to better understand essential human factors and aspects related to teachers' technology acceptance.

2.7. The Unified Theory of Acceptance and Use of Technology (UTAUT)

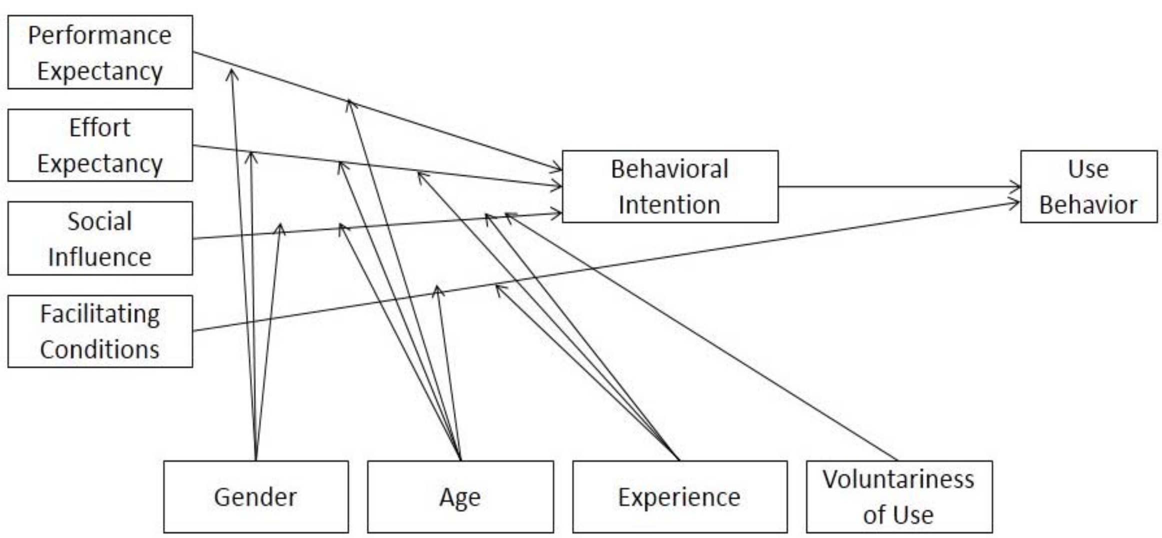

Figure 9: UTAUT (Venkatesh, Morris, Davis and Davis, (2003) "User acceptance of information technology: Toward a unified view", MIS Quarterly, 2003, 27, 3, 425-478)

Numerous models (see Venkatesh, Morris, Davis, and Davis (2003) for an overview) have been developed to explain and predict technology acceptance. Drawing on social psychology and sociology theories like the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), Social Cognitive Theory (SCT) (Bandura,1986), Motivational Model (MM) (Davis, Bagozzi, and Warshaw, 1992), Innovation Diffusion Theory (IDT) (Rogers and Shoemaker, 1971; Rogers, 1995), or the Theory of Interpersonal Behaviour (TIB) (Triandis, 1980), several models were developed, the Model of PC Utilization (MPCU) (Thompson, Higgins, and Howell, 1991), and the Technology Acceptance Model (TAM) (Davis, Bagozzi, and Warshaw, 1989) as the most prominent ones. TAM, building on the Theory of Reasoned Action, states that the acceptance of a technology depends on two types of beliefs: the technology's perceived usefulness and its perceived ease of use. TAM has been applied in several hundreds of studies in a wide range of settings, also in the field of education (e.g. Sanchez-Franco, 2010; Teo, Lee, and Chai, 2008). Typically no more than 40% of the variance in the dependent variable is explained, leaving room for additional antecedents of acceptance (Legris, Ingham, and Collerette, 2003), resulting in many follow-up studies focusing on model expansion or refinement. Ultimately, this led to a field of research in which the knowledge was dispersed and lacked structure, until Venkatesh, Morris, Davis, and Davis (2003) synthesized the available body of evidence. The UTAUT survey was tested by Venkatesh et al. and found to have an R2 of 70%, indicating that the model explains 70% of the variance in user intentions to use information technology. Eight widespread (technology) acceptance theories were taken into account, and through an empirical study, four recurrent constructs, which are presented below, were withheld and form the base of the development of the Unified Theory of Acceptance and Use of Technology (UTAUT), (see Figure 6 above).

Performance expectancy (PE): Defined as the degree to which an individual believes that using the technology will help him or her to attain gains in job performance (Venkatesh, Morris, Davis, and Davis, 2003). It encompasses five constructs from the previous developed models, regarding the usefulness of the technology: Perceived usefulness (TAM), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT), and outcome expectancies

(SCT). The influence of positive performance expectations will lead to a positive attitude toward using the technology.

Effort expectancy (EE): Defined as the degree of ease associated with the use of the technology (Venkatesh, Morris, Davis, and Davis, 2003). It includes constructs concerning the ease of use of the technology, such as perceived ease of use (TAM), complexity (MPCU) and ease of use (IDT). Teachers who believe that there will likely be a relatively high degree of effort required to utilize the technology may develop a negative attitude toward using the technology.

Social influence (SI): Defined as the degree to which an individual perceives that important others believe he or she should use the new technology (Venkatesh, Morris, Davis, and Davis, 2003). It includes constructs relating to norms in the social environment of the individual on his/her use of the technology, e.g. Subjective norms (TRA), social factors (MPCU) and image (IDT). It is therefore a function of both the beliefs of expectations of important others and the user's motivation to comply with these expectations. The important others in the case of teacher trainers will include primarily two groups: personal (colleagues, friends, family, etc.) and professional (administrators, faculty, staff, etc.)

Facilitating conditions (FC): Defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the technology (Venkatesh, Morris, Davis, and Davis, 2003). This construct is very broad as it involves training, support, infrastructure, and knowledge. It contains perceived behavioural control (TRA), facilitating conditions (MPCU) and compatibility (IDT).

Self-efficacy and anxiety were determined by Venkatesh et al. (2003) to be indirect determinants, and therefore unnecessary in the model.

The UTAUT also includes four variables that have been identified as moderators of the relationship between the predictors and intention or use:

Gender: Venkatesh, Morris, Davis, and Davis, (2003) used some pieces of previous research (Minton and Schneider, 1985, in Leroy, Jr. 2006), which posits that men are more task-oriented. Moreover, men, more than women, are willing to spend more effort to overcome different constraints and difficulties to pursue their goals, with women tending to focus more on the magnitude of effort involved and the process to achieve their objectives (Henning and Jardim 1977; Rotter and Portugal 1969; Venkatesh and Morris 2000). Thus, men tend to rely less on facilitating conditions when considering use of a new technology whereas women tend to place greater emphasis on external supporting factors.

As Performance Expectancy (PE) focuses on task accomplishment, they concluded that PE is likely to have a greater impact on men than women. Besides, theory in the area of gender differences suggests that gender roles are the result of socialization processes (Kirchmeyer, 2002 and Lynott and Candless, 2000, in Leroy, Jr., 2006). Therefore, the UTAUT theoretically justify and include gender as a moderating variable on the effort expectancy relationship (Venkatesh, Morris, Davis, and Davis, 2003). They find effort to be more significant for women due to gender differences that may be influenced by expectancies of gender roles. Besides, the UTAUT suggests that women may be impacted by social influence to a greater extent. The suggestion is that women are more sensitive to others' opinions (Venkatesh, Morris, and Ackerman, 2000). Venkatesh, Morris, Davis, and Davis (2003) state that as a result of socially constructed gender roles, performance expectancies, effort expectancies, and social influence may all be impacted by gender effects.

Age: Older users of technology tend to face more difficulty in processing new or complex information, thus affecting their learning of new technologies (Morris et al. 2005; Plude and Hoyer 1985, In Venkatesh, Thong, and Xu, 2012). This difficulty may be attributed to the decline in cognitive and memory capabilities associated with the aging process (Posner 1996, as cited in Venkatesh, Thong, and Xu, 2012). Hence, compared to younger users, older users tend to place greater importance on the availability of adequate support (Hall and Mansfield 1975 as cited in Venkatesh, Morris, Davis, and Davis (2003).

Experience with technology: Experience, reflects an opportunity to use a target technology and is typically operationalized as the passage of time from the initial use of a technology by an individual (Venkatesh, Morris, Davis, and Davis, 2003). For instance, Venkatesh, Morris, Davis, and Davis, (2003) operationalized experience as three levels based on passage of time: post-training was when the system was initially available for use; 1 month later; and 3 months later.

In concert with age and gender, experience can further moderate the relationship between facilitating conditions and behavioral intention. This is because when users have not developed their knowledge and skills (i.e., when they have less experience), the impacts of age and gender on technology user learning will be more significant than when they have acquired enough knowledge or expertise about the technology (i.e., when they have more experience). The dependence on facilitating conditions is of greater importance to older women in the early stages of technology use because, as discussed earlier, they place greater emphasis on reducing the learning effort required in using new technology (Venkatesh, Morris, Davis, and Davis (2003).

Voluntary use: Refers to objective factors that facilitate the use of the technology (Venkatesh, Morris, Davis, and Davis, 2003)

UTAUT was found to explain up to 70% of the variance in behavioural intention, thereby outperforming its originating models (Venkatesh, Morris, Davis, and Davis, 2003).

Attitude: Defined as the overall user's feeling/affect toward using the technology, is a possible fifth determinant that can serve both as a dependent and an independent variable.

Wang (2002, p.152) asserts that "pre-service teachers' beliefs and perceptions play a crucial Role in shaping their future teaching behaviours." With a view to increasing the preparedness of pre-service teachers to use ICT, Brownlee, Purdie, and Boulton-Lewis (2001) suggest that "teacher educators need to focus on teacher thinking and teacher beliefs to facilitate changes in the teaching-learning process" (p. 248). From these findings it would seem clear that human factors such as attitudes and beliefs have a significant influence on teacher behaviours, and consequently on their preparedness to use ICT for learning and teaching.

In Quebec universities, for example, the use of PowerPoint, associated with expository teaching by most university instructors (professors, lecturers and supervisors) is far ahead of other types of uses of ICT (Karsenti, 2005). This privileged use of ICT as a vehicle for educational messages could explain, in large part, the fear experienced by some to see the professor, considered here as the main, if not the only transmitter of knowledge, replaced by ICT within the educational act (Basque, 2004, our translation).There is work to do to assist teacher trainers to perceive ICT not as their substitutes but as real "educational partners". (Basque, 2004)

It seems, though, that teacher trainers who use ICT innovatively in their learning process are interested in their own professional development, keep extensive contacts with colleagues and experts in the area of ICT, see and experience the advantages of the innovative use of ICT in education and their pedagogical approach can be described as student-oriented (Ertmer, 2005).

To conduct our research we chose the UTAUT as THE theory that helps us understand how and why people accept or do not accept to use the technology. This awareness allows us to design our training intervention taking into account where the emphasis should be. It is to note that our training intervention focuses mainly on two aspects:

1) Participant teacher trainers' understanding of the pedagogical added value of ICT both for their students and themselves, and

2) The individual sense of competence participant teacher trainers will have regarding the fulfillment of a task integrating ICT under reasonable conditions with a reasonable output.

2.8. Merger of the UTAUT and the IntersTICES Model Via Its E-Learning Culture

Given the stated importance of human factors in the integration of ICT in pedagogy- and andragogy-, we chose to utilize the UTAUT, since it appropriately complements the IntersTICES model when training teachers for pedagogical use of ICT.

Bearing in mind, though, that UTAUT has been specifically developed to explain and predict technology acceptance, and that it was tested in the business context where employees introduced to a new system begin with no experience with the technology. Contrariwise, in education if technology is used as a general term, it is difficult to measure the participants' entrance level of experience, as each teacher's experience level will range from a limited use of some office software, email and Internet, (Larose et al. 2004, 2011) to a more advanced integration of educational software applications in their practice. Moreover, the nature of their experience or practice with technology is typically coloured by their representations, their abilities, their attitudes, their affects, in other words, by their e-learning culture (Peraya and Viens, 2005).

As such, the UTAUT affords elements that allow to better identify, explain, and illustrate the ones that IntersTICES takes into account, but does not delve in particular, while providing us with indicators on which to work and that might account for change in the e-learning culture.

We consider then, appropriate to bring together UTAUT's constructs and moderating variables and teachers' e-learning culture and its constituent elements, to show their equivalence and also their complementariness (e.g. considering teachers' self-efficacy beliefs as direct determinants, and therefore essential for the pedagogical use of ICT), resulting in a comprehensive and integrated model.

This model will be used during the implementation of our training intervention aiming at helping teacher trainers to become aware of the myriad of factors at play when integrating ICT in their teaching practice.

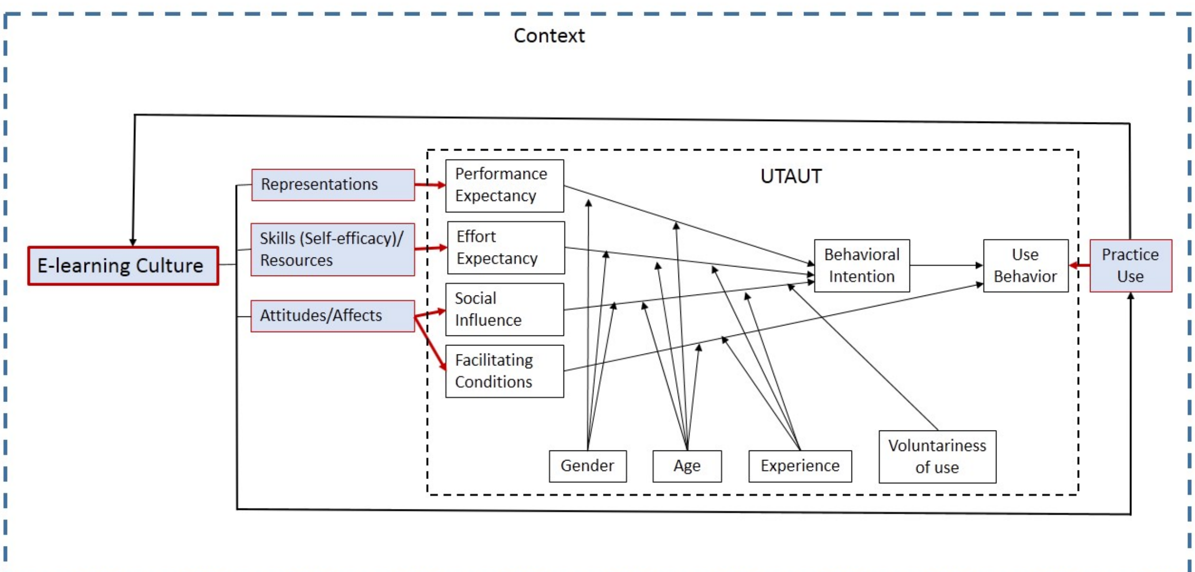

Figure 10: Instantiation of the IntersTICES' e-Learning Culture Dimension for ICT Adoption/Use

Figure 10 above, illustrates the equivalence and complementariness of this integrated model. It is worth mentioning that when merging two models, we usually have to deal with conflicting definitions. In this case, however, the new model not only does have similar semantic information, but it also hosts all instances from the original merging parts: the UTAUT's Constructs and Moderating Variables and the E-Learning Culture's sub-dimensions.

2.9. Schematic Synthesis of our Conceptual Framework

We present below (Figure 11) a holistic and comprehensive view of the conceptual framework we implemented for the deployment of the IntersTICES' dimensions for ICT use and integration.

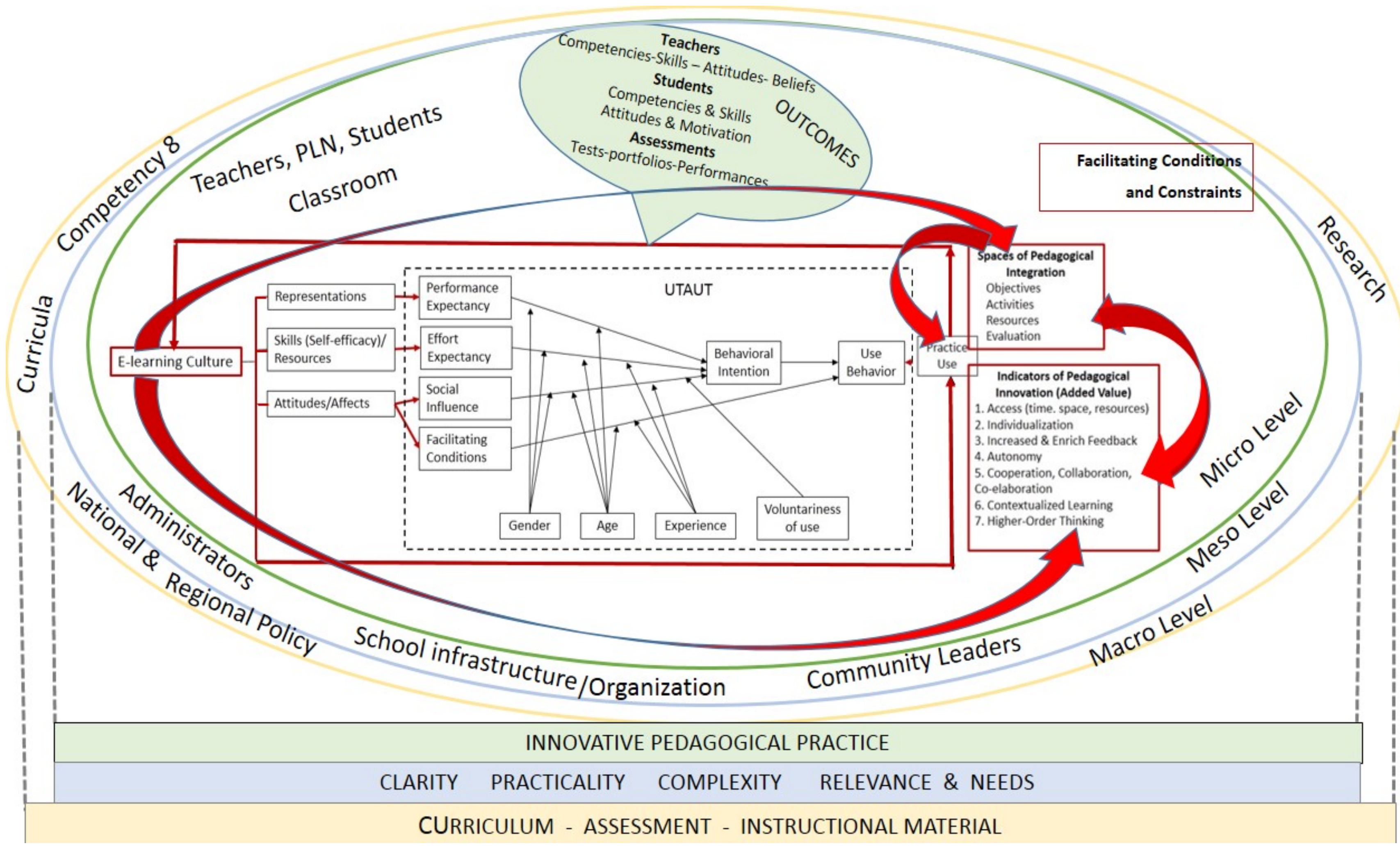

Figure 11: **Conceptual framework implemented for the deployment of the IntersTICES' dimensions for ICT use and integration. (Based on Bronfenbrenner, 1979; Fullan, 2001; Peraya & Viens, 2005; Venkatesh, Morris, Davis & Davis, 2005)**

At a glance, it allows to position the elements having an impact on the integration of ICT in the teaching practice. The three levels, having an influence, however, our focus is on the micro level, since it is at this level that takes place any actual integration. The teacher when it closes the door, embarks (or not) in any innovation endeavour.

The red lines represent the IntersTICES model's connections. The red thin arrows indicate the relationship of the e-learning culture dimension with each one of its sub-dimensions, as well as with the UTAUT constructs. The red curved thick arrows indicate a relationship among the three dimensions of the IntersTICES model AND the ICT use or integration, which is sought.

The square delimited by dotted black lines, frames the UTAUT, its constructs and variables.

The *innovative pedagogical practice* as illustrated here, results from a successful interrelationship among certain identified factors, which affect ICT adoption and effect classroom learning. As such, it is influenced by the school infrastructure and organization, administrators, and community leaders.

Regarding *Clarity, practicality, complexity, and relevance and needs, a*s aforementioned, and according to Fullan (2001), innovations are likely to be more successful when they aim at *addressing a need or problem* articulated in the environment. It has to be *clear* that the innovation can be implemented within these contexts, its *complexity* is manageable and its implementation is *practical.*

In terms of *Curriculum, assessment, instructional material,* we want to highlight along with Kozma (2003) that practices are more likely to be changed when teachers not only perceive certain coherence among curriculum, assessment, instructional materials, and instructional guidance, but also when they are given opportunities to learn these policies and international trends in connection with specific, and practice- oriented materials, strategies, and activities.

Facilitating conditions and constraints are present and need to be considered at every level.

Chapter 3: Method

3.1. Introduction and Contextual Setting

This research aims at contributing to the enrichment of the teaching practice of teacher trainers working on initial teacher training programs, by proposing them a prototype of a training-accompanying intervention based on the IntersTICES model, which should allow the development of participant teacher trainers' e-learning culture and support their intention to integrate ICT in their teaching practice.

The two specific objectives of this research are: 1) To operationalize the IntersTICES model through an intervention; and 2) To analyze the impact of the training intervention on participant teacher trainers' e-learning culture and on their intention to integrate ICT in their teaching practice.

In this chapter, we first describe the type of research we chose to conduct. Then, we present the methodological steps required to achieve each one of our research objectives. We will explain how we proceed to construct and validate the instruments for our data collection, followed by the description of the statistical analyses to be conducted to illustrate the standpoint from which the results will be viewed. We end the chapter with the ethical and deontological considerations taken into account.

3.2. What is at Stake[17] and Type of Research

This research focuses on the e-learning culture that is at the core of the IntersTICES model and, which as defined earlier, encompasses participants' representations of ICT, their skills (self-efficacy beliefs) and resources, as well as their attitudes regarding ICT use in their teaching practice. Our research draws on socio-cultural theory, which assumes that teachers' beliefs and attitudes, and their confidence and competence with ICT, remain centrally

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important in the pedagogical adoption of ICT, but teachers are not "free agents" and their use of ICT for teaching and learning depends on the inter-locking cultural, social and organisational contexts in which they live and work (Somekh, 2008).

Action Research (AR). This research adopts the action research approach framed within the perspective of innovation-led growth in the field of teacher education. Action Research (AR) considers researchers as participants in change processes that bring to the table certain skills and knowledge, while other actors do the same, bringing their own capacities and experiences to bear on the problems (Greenwood and Levin, 1998, p.12).

Accordingly, Action Research (AR) provides teacher trainers with opportunities for situated learning, trying things-out and evaluating the outcomes on the basis of evidence (Somekh, 2008). Moreover, since Action Research focuses on pedagogical innovative practices, as a methodology, it aims to "change three things: practitioners' practices, their understandings of their practices, and the conditions in which they practise" (Kemmis, 2009, p. 463). Action Research allows practitioners to change existing configurations of knowledge and practice and critically examine the practices that are accepted and normalized. The fundamental aspects of action research are, therefore, to critically inspect a practice aimed at transforming that practice by enabling and implementing a process where self-critique and reflection can affect change (Kemmis, 2009).

IntersTICES was developed through a *recherche-action-formation* (an action-training research type). Thus, it is in that kind of milieu that the model is most effective. IntersTICES takes a deep approach to intervening and working with people. It allows placing our training intervention within the context where people interact aiming at changing their e-learning culture by trying to enable them to recognize their own needs and supporting them, through reflection, in finding and planning suitable solutions. As such, we can bring them a step further at each stage of the process. This dynamic process of interaction with the people facilitated by IntersTICES is consistent with the innovative practices of AR just mentioned above. It follows, then, clearly that IntersTICES is the appropriate model, as well as AR is the appropriate type of approach to conduct our research with participant teacher trainers.

Relevance and Benefits of Using an Action Research Approach to Conduct Our Research

Greenwood and Levin (1998) present Action Research (AR) as a form of research having the following characteristics (presented as the introductory statement, in italics, in the descriptive text below), which provide us with an adequate framework to conduct our research considering its close alignment with the requirements of our object of study:

- *AR is context bound and addresses real-life problems.* AR can refer to untangling and interpreting the complexities of a particular set of local conditions that lie at the center of the project (Greenwood and Levin, 1998). Involvement in action research provides participant teacher trainers with the opportunity not only for situated learning (Lave, 1994, Wenger, 1998), but also to become partners, or at least, active participants in the research process (Somekh, 2008; McDougall, 2008). The focus of our inquiry is determined by what the participants consider important, what affects their daily lives (Greenwood and Levin, 1998). The inquiry process is thus, linked to actions taken to empower participants to collaboratively find a solution to an identified need/problem.

- *AR is inquiry where participants and researchers cogenerate knowledge through collaborative communicative processes in which all participants' contributions are taken seriously.* AR fosters in participants, thought-action process cycles as well as checking ups for understandings collaboratively generated through actions, which they – participants- can then use as part of the next cycle of thought and planning when aiming at addressing an identified need/problem (Greenwood and Levin, 1998). It is at this point that AR is described as being *responsive* (Kemmis and McTaggart, 1992).

- *In AR participants and researcher join in a mutual learning process.* Moreover, since its inquiry process aims at addressing a need important to the participants, the knowledge produced by this inquiry process increases participants' control over their own situation (Greenwood and Levin, 1998; Somekh, 2008). AR can also allow participants to respond not only to their already identified need/problem, but also to any emerging need(s) of the situation, during the whole process of responding to this need (Greenwood and Levin, 1998). Since this process takes place gradually, AR is also considered as being *emergent* (Kemmis and McTaggart, 1992). Furthermore, its cyclic nature promotes responsiveness, as well as rigour: The early cycles (e.g. design/strategies/actions to address their need(s) based on analysis/reflection on specific existing facilitating conditions and constraints) are used to decide how to conduct the later cycles, where the interpretations developed in the early cycles can be tested, challenged and refined (Greenwood and Levin, 1998). We consider this, as being one of the main benefits of using the AR approach in our research. The critical reflection component embedded in this approach becomes as well, a crucial step in each cycle, since the increased understanding that is fostered through it, is then used in designing the later steps (*ibid)*. The complementariness of its cyclic nature and critical reflection, with the engineering pedagogical approach and the concrete steps for reflection facilitated by the IntersTICES model becomes key, as already mentioned, to promote rigour.

- AR *treats the diversity of experience and capacities within the group of participants as an opportunity for the enrichment of the research-action process* (Greenwood and Levin, 1998). The collective meeting scheduled five weeks after the implementation of the training intervention aims at fostering also opportunities for personal/professional development of participant teacher trainers through interchanges of best practices/experiences among them.

- *The meanings constructed in the inquiry process lead to social action, or these reflections on action lead to the construction of new meanings* (Greenwood and Levin, 1998) as well as new representations regarding the object of study. Researchers (e.g. Downes, 2001; McDougall, 2008; Somekh, 2008) emphasize that change is a form of learning and, like students, teachers need to learn actively and have opportunities to reflect on, try things out and evaluate the outcomes on the basis of evidence, with the support of strong leadership and a community of peers. Kemmis (1997) suggests that "action research is an improvement to professional practice at the local, perhaps classroom level, within the capacities of individuals and the situations in which they are working" (p. 300), and that it develops through the self-reflective spiral: a spiral of cycles of planning, acting (implementing plans), observing (systematically), reflecting [. . .] and then re-planning, further implementation, observing and reflecting [. . .] focusing on practical issues that have been identified by participants and, which are somehow both problematic yet capable of being changed, while contributing to make educational practice more reflective (Elliott 1991, as cited in Kemmis, 1997). In AR, knowledge is therefore expressed, analyzed, and tested in action by the participants (Greenwood and Levin, 1998). This, according to Noffke and Zeichner (1987, as cited in Greenwood and Levin, 1998) not only brings about changes in teachers' definitions of their professional skills and roles, but also increases their feelings of self-worth and confidence.

- *The credibility-validity*[18] *of AR knowledge is measured according to whether actions that arise from it solve problems (workability) and increase participants' control over their own situation* (Greenwood and Levin, 1998). In this research credibility-validity is established during the whole process. Since some change in the participants' representations and actions regarding their activities integrating ICT is expected to occur, in order to keep track of this evolution, we need to observe and note any change in their e-learning culture taking place. Data from a pre- and post-intervention surveys, notes from the researcher journal, and information from participants' interviews are applied providing for data triangulation and validation.

To conduct our research, we follow the steps suggested by Kemmis and McTaggart's (1981) Plan, Act, Observe and Reflect, and Sagor's (2005) 4-step model of AR, i.e. 1) Clarify

[18] Credibility is defined here as "the arguments and the processes necessary for having someone trust research results" (Greenwood and Levin, 1998, p.80). Greenwood and Levin (1998), distinguish two different types of credible knowledge. First, there is knowledge that has *internal credibility* to the group generating it. This kind of knowledge is fundamentally important to AR because of the collaborative character of the research process. Its direct consequences in altered patterns of social action constitute a clear test of credibility. "Members of a community or organization are unlikely to accept as credible the "objective" theories of outsiders if they cannot recognize the connection to the local situation, or because local knowledge makes it clear that the frameworks are either too abstract or simply wrong for the specific context" (*ibid,* p.81). A second kind of credibility involves external judgements. *External credibility* is knowledge capable of convincing someone who did not participate in the inquiry that the results are believable. Considering that AR depends on the conjugation of reflection and action and the co-generation of new knowledge in specific contexts, conveying effectively the credibility of this knowledge to outsiders is a difficult challenge (Greenwood and Levin, 1998). Individual AR cases can and should however, have powerful general effects. Whereas the conventional social research community believes that credibility is created through generalizing and universalizing propositions of the universal hypothetical, universal disjunctive, and generic types, AR believes that only knowledge generated and tested in practice is credible (Greenwood and Levin, 1998).

vision and targets; 2) Articulate appropriate theory; 3) Implement action and collect data, and 4) Reflect on the data and plan informed action; and apply them to each of our two objectives. As such, these steps are:

Step 1: Plan - Clarify vision and targets;
Step 2: Act- Articulate appropriate theory;
Step 3: Observe- Implement action and collect data; and
Step 4: Reflect- Reflect on the data and plan informed action.

This description of AR steps by Kemmis and McTaggart (1981) that we labelled according to Sagor's (2005) 4-step model of AR, may further illustrate how AR guided our research, as follows:

> "In practice, the process begins with a general idea that some kind of improvement or change is desirable. In deciding just where to begin in making improvements, one decides on a field of action where the battle (not the whole war) should be fought. It is a decision on where it is possible to have an impact [*Step 1: Clarify vision and targets*]. The general idea prompts a 'reconnaissance' of the circumstances of the field, and fact-finding about them. Having decided on the field and made a preliminary reconnaissance, the action researcher decides on a general plan of action. Breaking the general plan down into achievable steps, the action researcher settles on the first action step. Before taking this first step the action researcher becomes more circumspect, and devises a way of monitoring the effects of the first action step [*Step 2:* A*rticulate appropriate theory*]. When it is possible to maintain fact-finding by monitoring the action, the first step is taken. As the step is implemented, new data start coming in and the effect of the action can be described and evaluated [*Step 3: Implement action and collect data*]. The general plan is then revised in the light of the new information about the field of action and the second action step can be planned along with appropriate monitoring procedures [*Step 4*: *Reflect on the data and plan informed action*]. The second step is then implemented, monitored and evaluated; and the spiral of action, monitoring, evaluation and replanning continues" (Kemmis and McTaggart 1981, p. 96).

Action Research allows us to have clearer objectives, a strategic view of what we want to achieve, articulate various theoretical elements and better coordinate the actions to be undertaken. This is further explained in Section 3.3., How We Proceed to Achieve Our Targeted Objectives.

3.3. How We Proceed to Achieve Our Targeted Objectives

3.3.1. Objective 1: To operationalize the IntersTICES model through a training intervention

As aforementioned, to develop a training intervention aiming at achieving our specific objective 1, we follow the steps of Action Research. Kemmis and McTaggart (1981) developed a simple model of the cyclical nature of the typical action research process. Each cycle encompasses the four steps: plan, act, observe, and reflect that we labelled according to Sagor's (2005) 4-step model of AR, i.e. 1) Clarify vision and targets, 2) Articulate appropriate theory; 3) Implement action and collect data; 4) Reflect on data and plan informed action, as follows:

Step 1: Plan

Clarify vision and targets (Sagor, 2005)

AR starts with a general idea and data are sought about the giving situation. The successful outcome of this examination is the production of a plan of action to reach an identified objective, together with a decision on the first steps to be taken (Kemmis and McTaggart, 1981).

In this research we explore ways of operationalizing the IntersTICES model and developing a methodology to intervening in order to achieve our first specific objective. We have the IntersTICES model presented during the introductory 3-hour meeting along with its characteristics and basic concepts based on its three main axes or dimensions, namely: 1) A reflexive practice focusing on the pedagogical added value- the 7 indicators; 2) Four spaces of pedagogical integration with a focus on concrete activities, on concrete training needs and on concrete examples, allow to question the internal consistency of the process; and 3) the participants' e-learning culture being taken into consideration.

We make explicit the pedagogical engineering approach (PEA) that articulates these three dimensions to foster a thorough understanding of the model by participants. The PEA also allows to highlight the systemic and systematic analyses of participants' needs and of their context (i.e. their course and its objectives), as well as the reflective practice involved in seeking the pedagogical added value and the taking into account of participants' e-learning culture.

It can be stated that the IntersTICES model encompasses two levels of principles (Peraya and Viens, 2005): A first level, comprising a global approach or main steps: The type of orientation given to a training intervention based on an identified and concrete problem, requiring a needs analysis and a context analysis to be undertaken, and the design of the training intervention itself. A second level immediately following and which encompasses a reflexive practice on the pedagogical added value; the internal consistency of the process; and the e-learning culture of the people to be trained and of the researcher/trainer herself.

Furthermore, we need to identify the characteristics the training intervention requires to have for it to match the principles and requirements in terms of effective ways of intervening with teachers/adult learners aiming at using ICT, according to the IntersTICES model, adult learning theory-andragogy and the UTAUT. We elaborated then a list of these characteristics and principles (see Table 8 further below), based on the literature review we conducted, which was initially validated by experts and, as mentioned below, further validated by participants during the process.

Participants. To achieve our research objectives we decided to try-out the training intervention, with a population responding to the following characteristics:

1) Being pre-service teacher trainers/lecturers working in initial teacher training programs;

2) Teaching subjects different from ICT at the undergraduate level; and

3) Not having experience integrating ICT systematically into their teaching practice.

They were prompted to participate in this research via posting of an invitation through the Vice- Dean's Office for undergraduate studies at the University of Montreal. This invitation also informed participants about the research, its goal, as well as the methodology to be used for the training intervention, and possible/expected benefits for participants in terms of professional development. The tool (The IntersTICES Model), however, was not mentioned. This omission aimed at preventing any possibility of having them reading about the model, and altering their representation of ICT integration in education, prior to the pre-intervention survey.

The profile of all the participants correspond to the above-mentioned characteristics required to take part in this research. (See Table 7 below). Even though, one of them is a pedagogical consultant working with in-service teachers, we considered her profile to match the specified requirements.

Table 7: Participant teacher trainers' demographics information

Demographics Info	PTT 1	PTT 2	PTT 3	PTT 4	PTT 5
Degree of Education		PhD Candidate	Masters	PhD Candidate	PhD
Affiliation Status	Contractual-Lecturer	Contractual-Lecturer	Permanent-Consultant	Permanent-Professor	Contractual-Lecturer
Subject Taught	School Adaptation to Special-Needs Students	School Adaptation to Special-Needs Students	French as 2nd language	Biochemistry	School Adaptation to Special-Needs Students
Training on ICT in Initial Teacher Education	A course on introduction to ICT	-	-	-	-
Use of Moodle/ StudiUM to create a course	Not to create a course	✓	✓	✓	-

Step 2: Act

Articulate appropriate theory (Sagor, 2005): Taking into consideration the type of participants targeted in this research, the training intervention, as well as the activity to be developed afterwards with them on an individual basis, are designed acknowledging the principles that characterize adult learning theory- andragogy (Knowles, 1984; Kearsley, 2010), which state that 1) Adults need to be involved in the planning and evaluation of their instruction; 2) Experience (including mistakes) provides the basis for the learning activities; 3)

Adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life; 4) Adult learning is problem-centered rather than content-oriented (Kearsley, 2010), as well as some principles also identified in our review of literature regarding the IntersTICES model, and the UTAUT, as the theoretical framework that takes into consideration some identified human factors that have an impact on users' acceptance of utilizing ICT, and therefore, on their e-learning culture.

Based on these principles and constructs, we dress an unedited list of characteristics (see Table 8 below) to be considered when designing this type of training intervention.

Table 8: Guiding Principles to be considered when working with teachers/adult learners based on Knowles, 1984; Kearsley, 2010; IntersTICES model, Viens, Peraya, Bullat-Koelliker, 2004; Viens, Peraya, Bullat-Koelliker, 2005, and the UTAUT, Venkatesh, Morris, Davis and Davis, 2003

Adult Education Theory- Andragogy- Knowles, 1984; Kearsley, 2010	IntersTICES model, Viens, Peraya, Bullat-Koelliker, 2004, Viens, Peraya, Bullat-Koelliker, 2005	The UTAUT, Venkatesh, Morris, Davis and Davis, 2003
1. Need of being involved in planning and design of any process of instruction	5. Identification of immediate needs and the actions arising	13. Acceptance of a technology depending on two types of beliefs: the technology's perceived usefulness and its perceived ease of use
	6. Needs analysis and action plan implemented–characteristics and operating conditions of each project determining courses of action	
2. Experience (including mistakes) as basis for learning activities; "learning through reflection on doing".	7. Facilitating conditions and constraints being identified	14. Using of the technology perceived as help to attain gains in job performance
3. Learning having immediate relevance and impact on job/personal life	8. Personal support being provided	15. Organizational and technical infrastructure perceived as support to use of the technology (Facilitating conditions)
	9. Meetings responding to specific requirements of teams	16. Human factors (such as attitudes and beliefs) having a significant influence on teacher behaviours, and consequently on

	10. Activities being addressed from their own perspective as practitioners/professor-researcher	their preparedness to use ICT for learning and teaching.
4. Learning more problem-centered than content-oriented	11. Focus on developing their e-learning culture not on the tool itself	
	12. Reflective practice	

By following these steps, we have a clear outline of the key aspects to take into consideration to design and implement the first phase of our training intervention namely, having a clear understanding of the IntersTICES model, its sub-dimensions and the process to articulate them.

Step 3: Observe

Implement action and collect data (Sagor, 2005): In this research, at this step, once the above- mentioned guiding principles have been identified, we develop and implement the planned training intervention including the presentation of the IntersTICES model dimensions.

This step involves two types of action: 1) the production process or design of the training intervention taking into consideration and respecting the identified guiding principles, and 2) the implementation of this training intervention - with ongoing data collection during the whole process-.

To proceed, we use then the IntersTICES model that proposes an instructional design/systemic approach, which underlies any interaction undertaken with and by participant teacher trainers, and fosters reflection on the pedagogical added value of ICT, and the 4 spaces of pedagogical integration, while considering their students' e-learning culture, their own e-learning culture, as well as the context at a micro, meso and macro levels.

The data gathered in the researcher's journal -see below for a detailed description- is intended to keep track of and document the process and procedures we follow to operationalize the model and achieve objective 1. Furthermore, the input from findings regarding the spaces of pedagogical integration and the pedagogical added value, as well as how participant teacher trainers organize them, facilitates assessing this operationalization from an empirical perspective, while fostering insight of the system.

This *implement action* step is accompanied, as aforementioned, by ongoing fact-finding to also monitor and evaluate how things are going, and act as formative evaluation. This feeds forward into a revised plan of procedures for implementation, themselves accompanied by monitoring and evaluation (Kemmis and McTaggart, 1981). In this research, some items identified in advance as requiring to be observed and questioning participants about are recorded in the researcher's journal. These items address, for example, participants' perception regarding whether the training intervention works or not, appropriateness of its duration, etc. The expected feedback refers then to their appreciation in terms of the training intervention itself, not to their e-learning culture. These insights become useful data in form of notes for further planning and refining of this type of intervention. Furthermore, to implement this training intervention, we take into account the guiding principles of adult learning and the IntersTICES model's mentioned above as well as notes taken while discussion and exchange of ideas with experts regarding appropriate strategies to do so.

Since we are working in a AR context, there are certain elements that have to be considered and respected, namely: 1) documenting, and keep track in the researcher's journal, any process and procedures for further access, e.g. to better understand the implementation and results; 2) being both participant/actor AND researcher requires ongoing validation – with expert(s) and literature review- of any decision regarding, for example, the key items shaping the design of the training intervention, the training intervention itself, and its implementation. These iterations for appropriateness of decisions taken, facilitate refining and monitoring of any (planned) action, while the pedagogical engineering approach we implement ensures systematic rigor of the whole process.

For the training intervention to be effectively implemented, as already mentioned, it is also important to consider the facilitating conditions and constraints related to the context i.e. their course and its objectives; participants' characteristics and type of activity chosen, to plan for and allocate the appropriate resources.

The Researcher's Journal. The researcher's journal is our main source of information and data for objective 1. It contains notes taken by the researcher, following meetings held with experts as well as observations made while interacting with participant teacher trainers, during the whole process, on a collective and individual basis.

These notes serve different purposes:

- Allow the researcher to keep track of comments, suggestions, key points discussed with experts when validating the planning, design, and implementation of the training intervention;
- Help the researcher to keep track of participant teacher trainers' perception of the training intervention regarding design issues, e.g. duration, which have to be considered for further implementations;
- Inform on how the implemented approach supports the guidelines of steps to be undertaken, whether (and in which way) the use of the IntersTICES model following the intervention was facilitating the integration of ICT in participant teacher trainers' chosen activity.

Keeping a *Journal* allows the researcher to keep track of issues, events or just minor things and considerations that prompt the reengineering of some activities, the reorganization of supporting resources, the reformulation of objectives or any other aspect (e.g. vulgarisation, ICT basic skills) that contribute to the successful achievement of the objectives of this research. Information gathered through these notes serve to complement and cross-check the data collected with the other instruments. The researcher's journal takes the form of a pen/pencil paper agenda for the field notes, which are afterwards, sorted and organized.

Step 4: Reflect

Reflect on data and plan informed action (Sagor, 2005): Feedback within and between each cycle is important facilitating reflection (Ebburr, 1985 as cited in Greenwood and Levin, 1998). This research requires having more than one personal encounter with participant teacher trainers –three times, as a minimum requirement- to be effective:

The first one, for attending the collective introductory training meeting in which they learn about and take ownership of the IntersTICES model and its dimensions; decide on an activity including a pedagogical added value (PAV) that will address an identified need of their own course/students through the integration of ICT.

The second one, individual meetings, including follow-up and personal support to start exploring the ICT tool to be integrated into the activity they chose, to achieve their targeted objective(s) and address their needs; to support them in their attempts to take ownership of the tool and of the appropriate strategy associated with their activity; they are led through an examination of the facilitating conditions and constraints this integration involves. Moreover, the approach to be implemented encompasses allotting time for maturation of processes and reflection.

The third one, to get together with the researcher and the other participants to exchange on their actual experience during the design of their activity integrating an ICT tool. This final collective meeting allows to refine the interview questions to be asked individually, looking for clarification and in-depth information.

As stated above, the goal of the individual meetings is multifold and aiming mainly at supporting and accompanying participant teacher trainers while exploring, learning and taking ownership of the ICT tool suggested to be integrated into their chosen activity. Data is therefore recorded in the researcher's journal and inform on customized action required to provide each participant with appropriate strategies and or resources to address their course(s)/students' identified needs and help them achieve their targeted objectives.

We aim at supporting and scaffolding participant teacher trainers, while they are available, hoping they go further forward in the appropriation of the ICT tool and the pedagogical strategy. Nevertheless, these meetings are determined by their e-learning culture, their interest and how much time they actually have for this type of activity. We need then, to be flexible in our interaction with them.

3.3.2. Objective 2: Analyze the Impact of the Training Intervention on Participant Teacher Trainers' e-Learning Culture and on Their Intention to Integrate ICT in Their Teaching Practice

To address our objective 2, i.e. *analyze the impact of the intervention on teacher trainer's e-learning culture,* we focus on identifying any change(s) regarding the sub-dimensions of their e-learning culture referring to their representations of ICT, their attitude in terms of potential use of ICT tools, the skills they would like to acquire and develop, and the activities and practice they want to develop and implement.

Following the AR steps that guide our research, we proceed by acknowledging that **Step 1: Plan - Clarify vision and targets** (Sagor, 2005), and part of **Step 2: Act - Articulate appropriate theory** (Sagor, 2005) for addressing our objective 2, are the same as for our objective 1 (see Section 3.3.1). However, it is clear that we need to focus now on what the problem is regarding participants' e-learning culture, how to intertwine adult learning theory, the UTAUT and the IntersTICES model's sub-dimensions to address this matter.

The planning of these second phase of our training intervention, called *Follow-Up and Personal Support*, which is developed through four main stages, is presented below. It requires a structured approach, as well as a reflective and critical attitude that are undertaken based on the engineering pedagogical approach facilitated by IntersTICES. It also requires an explanation of what is involved in the *Choice of Activities* step that takes place in this phase, in terms of related targeted objectives, characteristics inherent to the chosen activity, procedures and strategies to be undertaken to ensure its achievement. This choice of activities is to be conducted on an individual basis by each one of the participants. Moreover, it is brought about and, as aforementioned, clearly introduced during the first collective meeting.

The 4 stages of the *Follow-Up and Personal Support* phase encompass the following:

1. Stage 1: Undertake the analysis of the needs and context (e.g. know the objectives; know the constraints);
2. Stage 2: Focus on the pedagogical added value of certain uses of ICT;
3. Stage 3: Consider the actors' e-learning culture;

4. Stage 4: Foster internal consistency. This stage encompasses the pedagogical choice/ pedagogical design.

Two other considerations need to be acknowledged:

- Focus on actors' own projects and

- Avoid long, drawn-out activities

Furthermore, we need to have a keen understanding of what the e-learning culture is and entails; we also need to pay particular attention to the nuance the seven indicators of pedagogical added value -PAV bring about to participants' e-learning culture.

This awareness will guide our decisions in terms of the type of data we need to gather, as well as the procedure and tools to be put into place to collect this information.

Accordingly, we developed three data-gathering instruments: Two surveys (Pre- and Post-Intervention), and an In-Depth Interview.

Pre- Intervention Survey. The Pre-Intervention Survey consists of 10 open-ended and 6 closed questions conveyed through a 1-to-5 Likert Scale of measurement. The closed questions aim at:

- Exploring participant teacher trainers' ICT knowledge regarding existence of tools and specific use they make of (some of) them to prepare/plan, and deliver their courses, as well as in their teaching activities to request their students to use and produce with them (e.g. : a) Word-processing software (Word, etc.); b) Presentation software (PPT, etc.); c) Quiz creator software (Google Form, etc.) etc.; d) Web page creation software (Weebly, Google Sites, etc.); e) Videoconferencing (Skype, etc.); f) Blog (Blogger, etc.)).
- Giving us an account of at what level participant teacher trainers assess their competency to integrate ICT into their course (i.e. beginner, intermediate, good, very good, expert)
- Getting to know what their perception is regarding ICT resources they have at their disposal when planning and delivering their teaching (e.g. Networks (of

practice/friends) to exchange tips and tricks, examples transferable to their practice; software installed (by a technician or by them) in their computer; software installed in the lab and available to their students; and expert technical help (a technician) available for troubleshooting).

The open-ended questions also allow us to explore:

- Whether they know about or have used the tools presented to them in the list;
- Their opinion regarding these tools;
- (some) Impact on the development of participant teacher trainers' ICT knowledge/competencies, and also on their motivation;

Moreover, these open-ended questions allow participant teacher trainers to provide input regarding the facilitating conditions required to benefit from the pedagogical potential of ICT.

We constructed a first version of this pre-intervention survey, which was then validated by a team of three experts acting in the educational technology field. Their feedback facilitated the reformulation of the scales of measurement for the questions regarding use of ICT tools, as well as inclusion of the section related to *resources* available to participant teacher trainers and their students. By considering the emerging modifications prompted by these trials, we reformulated the survey. This procedure as well as the use of a *control checking list* facilitates building a coherent and comprehensive survey aiming at obtaining information about the participants' e-learning culture before the intervention, which, as stated before, determines their intentions of and actual teaching practice. We can therefore have some input about:

- Their level of initial actual or planned pedagogical ICT use in their practice
- The kind of strategies that are to be designed, illustrated/modelled and implemented to facilitate the integration of ICT in specific activities for their course(s).

During the first meeting, and before the actual intervention taking place, participants are asked to answer the *pre-intervention survey*, which aims at providing an account of the participant teacher trainers' e-learning culture and level of initial actual or planned pedagogical ICT use in their teaching practice.

The Post-Intervention Survey. During the final collective meeting, participants are asked to answer a *post-intervention survey*, consisting of 10 open-ended and 6 closed questions, same as those of the pre-intervention survey, except for an introductory expression, i.e. *After having participated…* as illustrated below. Their answers provide valuable feedback in terms of the impact of the intervention on their e-learning culture, and accordingly, on their level of awareness regarding the pedagogical potential of ICT; the different conditions to be put into place to ensure effective pedagogical ICT use/integration; their intentions to make use of ICT in their teaching practice;

The Post-Intervention Survey questions consist of a 1-to-5 Likert Scale. To emphasize the need for specific input regarding changes in participant teacher trainers' e-learning culture, (e.g. their representations of ICT; their level of competency regarding ICT integration into their teaching practice, their perceptions[19] in terms of this integration; their actual intention to integrate ICT; the facilitating conditions and constraints, etc.) we start by introducing the questions using the expression "*after having participated in this training intervention,…"* For example: After having participated in this intervention, how do you feel regarding ICT integration in your teaching activities?[20]

To create this post-intervention survey, and in order to ensure its validity, we followed the same procedure undertaken to create the pre-intervention survey. This procedure did facilitate, as well, building a coherent and comprehensive survey aiming at obtaining valuable

[19] Representations, as aforesaid in chapter 2, have to do with the (pedagogical added) value of ICT. They encompass teachers' perceptions in terms of: 1) How the ICT value is defined; 2) What the actual/precise value of technology is; 3) What the ICT added value for them as teachers is; 4) What the ICT added value for their students is; 5) What facilitating conditions should be in place for it to work; and 6) What constraints to take into account when implementing it (Viens, 2011). Perception is defined as "*awareness of the elements of the environment through physical sensation*" (Webster Collegiate Dictionary, 2005.) *e.g. eyes, ear, nose, etc., give you awareness of what is going on.*

[20] Après avoir suivi l'activité de formation, Quelle émotion ressentez-vous face à l'intégration des TIC dans vos activités ? a) Cela me rend inquiète; b) Cela me motive; c) J'ai des craintes; d) J'ai eu des mauvaises expériences avec les TIC; e) Je me sens à l'aise; f) Autre

feedback/information about the impact of the intervention on the participants' e-learning culture and on their intentions to integrate ICT in their teaching practice.

The Semi-Structured In-Depth Interview. The Semi-Structured In-Depth Interview is our main source of information and data for objective 2.

We constructed the semi-structured in-depth interview consisting of a set of 4 to 5 open-ended questions, which encourage description and depth. e.g. "W*hat would be any pedagogical use of ICT that you would like to integrate in your teaching practice, different from the one you already mentioned? Is there any other pedagogical use of ICT that you would like to integrate?"*[21] Moreover, this semi-structured in-depth interview allows to elaborate, cross-check and better understand some of the answers already given through the pre- and post-intervention surveys. e.g. *After participating in this research, what would be any change or changes (if any) you have noticed in your perception regarding the use of ICT in your teaching practice?*[22]

Respecting the participant's convenience regarding place and time for meeting, only one of these interviews of about 40-minute duration took place face to face at the University of Montreal at the researcher's office. Three of the participants opted for a phone interview and the fifth one was conducted via Skype. All five interviews were recorded with permission of the interviewee.

The researcher starts by setting an appropriate atmosphere that facilitates the communication between her and the participant teacher trainer. To achieve this, the interviewer follows a validated interview protocol that ensures the smooth unfolding of the activity.

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[21] *Quels seraient quelques usages pédagogiques des TIC que tu aimerais faire, différents de ceux que tu as mentionnés avant. Est-ce qu'il y aurait d'autres usages pédagogiques des TIC que tu aimerais faire?*

[22] *Suite à ta participation à cette étude quel serait quelque changement que tu as observé dans ta perception de l'utilisation des TIC dans ta pratique enseignante?*

The Researcher's Journal. As already explained when discussing tools for data collection concerning objective 1, the researcher's journal contains notes taken by the researcher following meetings held with experts. It also keeps record of observations made while interacting with participant teacher trainers during the whole process, on a collective and individual basis.

In terms of our objective 2, these notes serve different purposes:

- Provide information regarding whether the training intervention has promoted (or not) some change in the participants' e-learning culture and had an impact on their intentions to use ICT pedagogically
- Inform on how the implementation of the training intervention and use of the IntersTICES model are facilitating (or not) the integration of ICT in their activities, promoting (or not) some change in their e-learning culture and having an impact (or not) on their intentions to use ICT pedagogically;
- Provide valuable information for facilitating tailored follow-up and assistance, and determine the number of support interventions required;
- Help to identify important considerations and design questions (This awareness promotes a better understanding of the issues and concerns associated with the pedagogical integration of ICT in pre-service teacher training programs);
- Cross-check what participants report during the pre- and post-intervention surveys (This information is complemented and further discussed during the *in-depth interview* with the pre-service teacher trainer on an individual basis);
- Become aware of whether (and in which way) the use of IntersTICES following the training intervention was promoting some change in their intentions of or actual practices integrating ICT, and in their e-learning culture.

All this, in alignment with the specific question guiding this study: *How can the IntersTICES model be used in an intervention to support teacher trainers in the design of activities to successfully integrate ICT into their teaching practice and enable them to get the very most out of the pedagogical added value of ICT?*

Moreover, the information gathered using these tools helps to keep a record of identified issues regarding effective ways of approaching participant teacher trainers' needs, in terms of instantiation of an operational activity in the process of their acquiring pedagogical ICT skills. These awareness and understanding of the key aspects associated with the pedagogical integration of ICT, may further facilitate future interventions in pre-service teacher training programs.

The researcher's journal is mainly used to note *Suggestions and Comments*, which would provide the participants via the researcher with accurate and on-time feedback for improvements and/or modifications regarding the activity to which they want to integrate some ICT component. It seems important to us, to include in this journal, a section regarding the researcher's perception of the impact of her personal support not only on the pre-service teacher trainer's intentions to integrate ICT in their teaching practice, but also on their e-learning culture. We proceed mainly through self-questioning and prompting (e.g. "Is it mainly helpful and encouraging?", "What can be other ways of better supporting participants without becoming invasive?").

The notes recorded in the researcher's journal, as aforementioned, serve different purposes. They allow, by adopting Schön's (1987) perspective, to record the results of the reflexive approach of the researcher/trainer (and participants) involved in the research study.

These notes are taken on the spot or as reflective remarks, and categorized under different labels depending on their further use or the action to be taken. For example, *points for further clarification-* could refer to the need of looking for availability of videos to better illustrate specific use of a suggested tool; or to prepare a pedagogical strategy. *Points to be considered for improving design, etc.,* as the design, development and implementation processes require the researcher/trainer to take an important set of decisions, it is in the researcher's journal where the nature of the decisions taken, as well as related discussions are recorded throughout the training intervention. The researcher journal is also useful during the exploration-of-the-tool phase to record the researcher's observations and reflections during the process.

A summary table to provide the reader with a better overview of the consistency among the instruments for the collection of data, and the specific objectives of our research is presented further below as Table 9.

Step 3: Observe

Implement action and collect data (Sagor, 2005)

As this step is taken, we embark on the actual process of going to see the impact of the training intervention on participant teacher trainers' e-learning culture. To do this, we implement the *IntersTICES-Type Activity* (resulting from our procedure to address and achieve objective 1, (see Table 13, page 157) with the 5 participant teacher trainers. We provide participant teacher trainers with the *Guidelines* we created for them to work on their chosen activity integrating ICT (see Table 11, page 147), as well as follow-up, (optional) personal support, and just-in-time scaffolding, to foster growth and empower them to act.

The whole process of implementation of their *IntersTICES-Type Activity* is documented before, during and after it taking place. We make use of appropriate research tools such as a pre- and a post-intervention survey, as well as semi-structured in-depth interviews, whose data allow us to have a portrait of their e-learning culture, and identify any further change in it. Field data recorded in the researcher's journal, complement and can be used to cross-check data gathered from the other mentioned sources.

Step 4: Reflect

Reflect on the data and plan informed action (Sagor, 2005)

Our tools for data collection, i.e. a pre-and a post-intervention survey, as well as semi-structured in-depth interviews and notes from the researcher's journal, provide us with the means to assess[23], reflect on and identify any impact on: 1) participant teacher trainers' intentions to integrate ICT in their teaching practice, and on 2) their e-learning culture, and

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[23] Assessment: "A set of processes designed to improve, demonstrate, and inquire about, for example, student learning" (Mentkowski, M. quoted in Palomba, C. A., and Banta, T. W. (1999). Assessment essentials: Planning, implementing, and improving assessment in higher education. San Francisco, CA: Jossey-Bass).

determine any change in it.

We proceed by directly establishing a dialogue with the participant teacher trainer. Our notes/observations are accompanied by ongoing fact-finding to evaluate the quality, relevance and effectiveness of the training intervention for participants on a one-to-one basis.

Based mainly on these notes from the researcher's journal and the individual interviews, we can try then to identify any key words/terms/expressions referring specifically to: 1) The IntersTICES model and (any of) its 7 indicators of pedagogical added value- PAV; 2) Its dimensions, and more specifically, its e-learning culture sub-dimensions, whose occurrences and inference may further be organized and graphically represented using a software application, -Inspiration-; and 3) The facilitating conditions/constraints they may encounter when planning for and designing their *IntersTICES-Type Activity.* Comments expressed during collective and individual meetings also offer an account of the impact of the follow-up and personal support on them.

This feeds forward into a revised plan of procedures for future implementation. The information gathered using the post-intervention survey and the researcher's journal help to keep a record of: 1) identified issues regarding effective ways of approaching participants' needs; 2) instantiation of an operational activity in participants' process of acquiring the pedagogical ICT skills.

We planned a collective meeting five weeks after the training intervention taking place. This meeting is designed to allow participants to have an exchange of ideas, discuss their experiences and best practices regarding the activities they chose to address, and share their awareness and newly adopted position in terms of their e-learning culture, how they feel about integrating ICT in their practice after participating in this research e.g. They can elaborate on the answers they gave in the post-intervention survey regarding their emotions, for example, when choosing among the following items: a) It motivates me; b) It makes me nervous; c) I am concerned about this; d) I feel comfortable; e) I've had bad experience with ICT; f) Other.

All participant teacher trainers are invited to attend. During this meeting they are asked to answer a post-intervention survey and their availability for a final individual interview within the three following days. Appointments are then made.

At this point, it seems appropriate to present a summary table to give an overview of the consistency and coherence among the instruments for the collection of data, and the specific objectives of our research.

The alignment among these items as well as the relationship among them is shown in Table 9 below.

Table 9: Alignment among specific research objectives, type of data collected, and instruments of data collection

	Specific Research Question: How can the IntersTICES model be used to support student teacher trainers in the design of activities to successfully integrate ICT into their teaching practice, and enable them to get the very most out of the pedagogical added value of ICT?	
	Goal: To help teacher trainers develop their e-learning culture	
Specific Objectives	**Type of Data Collected**	**Tool for Data Collection**
1. To operationalize the IntersTICES model through a training intervention to foster the development of participant teacher trainers' e-learning culture.	Specific data/information drawn from experts and the literature, to be considered when planning for, designing and further implementing this type of training intervention, in terms of: Guiding principles and characteristics Process and procedure(s) to be undertaken Facilitating conditions and constraints related to the context Refining and monitoring of any (planned) action	Researcher's Journal
2. To analyze the impact of the intervention on participant pre-service teacher trainers' e-learning culture, and on their intention to integrate ICT in their teaching practice	Participants' characteristics and type of activity chosen Participants' needs regarding production of activities integrating ICT Observations; any changes or modifications of lesson plans/activities; reflections; inclusions, and procedures as it was implemented Report of activities planned/carried out and confirmation by participants Identification of aspects requiring further explanation or clarification Notes about how the intervention and its operationalization actually went: observations, reflections, modifications, changes, inclusions, procedures	Researcher's Journal
	Participants' e-learning culture in terms of: Their representations of pedagogical potential of ICT; Facilitating conditions and Constraints (Resources); Participants' skills to integrate ICT; Participants' ICT needs and attitude; Participants' current usual practice	Pre-Intervention Survey Q2.1; Q2.2.; Q2.3 Q2.5.1 and Q2.5.2 Q2.5.3; Q2.5.4 and Q2.6 Q2.8 Q2.9
	Participants' needs regarding production of activities integrating ICT	Researcher's Journal
	Changes in participants' e-learning culture in terms of: Their representations of pedagogical potential of ICT; Facilitating conditions and Constraints (Resources); Participants' skills to integrate ICT; Participants' ICT needs and attitude; Changes in their e-learning culture; practice and intention of use (before, during and after the intervention)	Post-Intervention Survey Q2.5.1 and Q2.5.2 Q2.5.3; Q2.5.4 and Q2.6 Q2.8 Q2.9 In-Depth Interview
	Any change in participants' e-learning culture in terms of: Their intention to use ICT; Uses they would like to do; Practice they would like to implement (before, during and after training intervention). List of variables to be observed and taken into account	In-Depth Interview Researcher's Journal
	Report of activities carried out and confirmation by participants. Identification of aspects requiring further explanation or clarification.	In-Depth Interview Researcher's Journal
	Any change regarding ICT use; intention of use; impact on e-learning culture and on practice	In-Depth Interview Researcher's Journal
	Cross-validation of the information gathered; additional information on any changes; impact on practice and intention of (future) use	Researcher's Journal In-Depth Interview

3.4. Data Analysis Method

To analyze our data, we opted for a qualitative analysis method, which as Creswell (2009, 2014) posits, allows exploring, understanding and representing experiences lived by people. Therefore, we have to find meaning and interpret the actions, the experiences, and the social phenomena of these lived experiences (Creswell, 2014) to be able, as in our case, to compile valuable information for designing effective interventions regarding the pedagogical integration of ICT in initial teacher training programs.

Our study involves three types of qualitative data. These data are collected by using the instruments already presented: 1) open questions from our pre- and post-intervention surveys; 2) interviews with participants; and 3) notes from the researcher's journal.

Qualitative Analysis Procedure. As already mentioned, the semi-structured interviews we conducted with participant teacher trainers, allowed to explain and validate some of their answers already given through the pre- and post-intervention surveys. Interviewees were asked 4 to 5 open-ended questions, which encouraged description and depth from their part.

To analyse these interviews we used Inspiration 9, a software that allows graphic representation of data, and QDA Miner (version 4.1.16.), a software for qualitative analysis, and chose the Content Analysis Procedure. Van der Maren (1995) defines Content Analysis as "being interested in the information in a message" (p.406). Content analysis can address two types of content, either latent content or the manifest content. For this research, we used the manifest content which "presupposes that statements of a discourse are complete units in themselves on which operations can be made" (Van der Maren (1995*,* p. 414).

Five interviews were conducted for this research. The following steps were undertaken to carry out the content analysis.

Step 1. Transcription of interviews

Step 2. Reading and rereading the transcript to identify significant passages

Step 3. Creation of the coding grid to establish a comprehensive set of themes

Step 4. Coding of segments containing the identified themes

Step 5. Reversed codification

Step 6. Comparison of codes among interviews' transcripts (condensation)

Step 7. Crosscheck-coding procedure aiming at ensuring inter and intra coder reliability (Van der Maren, 1996).

The first of these seven steps encompassed transcribing to Word the recorded interviews with each one of the participants. Participants' input was recorded after obtaining their agreement to this procedure. The Word file containing their answers was then uploaded to the QDA Miner Software. The second step has allowed to make a first reading to identify significant passages in the transcript.

The third step has then allowed to reread the transcripts and further identify all passages that could be attached to the categories e-learning culture and its sub-dimensions, impact of the intervention, impact of follow-up and personal support, (as illustrated in Fig. 12, Fig. 13, and Fig. 14, below). The intention was to eliminate passages, which had no relation to the identified categories (Miles and Huberman, 1994).

At this step we worked with *Inspiration 9*, a software that allowed building up the visual representations of established categories and the key words and ideas associated with them, while exploring the results in the form of diagrams. This exercise supported the creation of the coding grid with emergence of new codes following an inductive process by working back and forth between the themes and the database to establish a comprehensive set of themes.

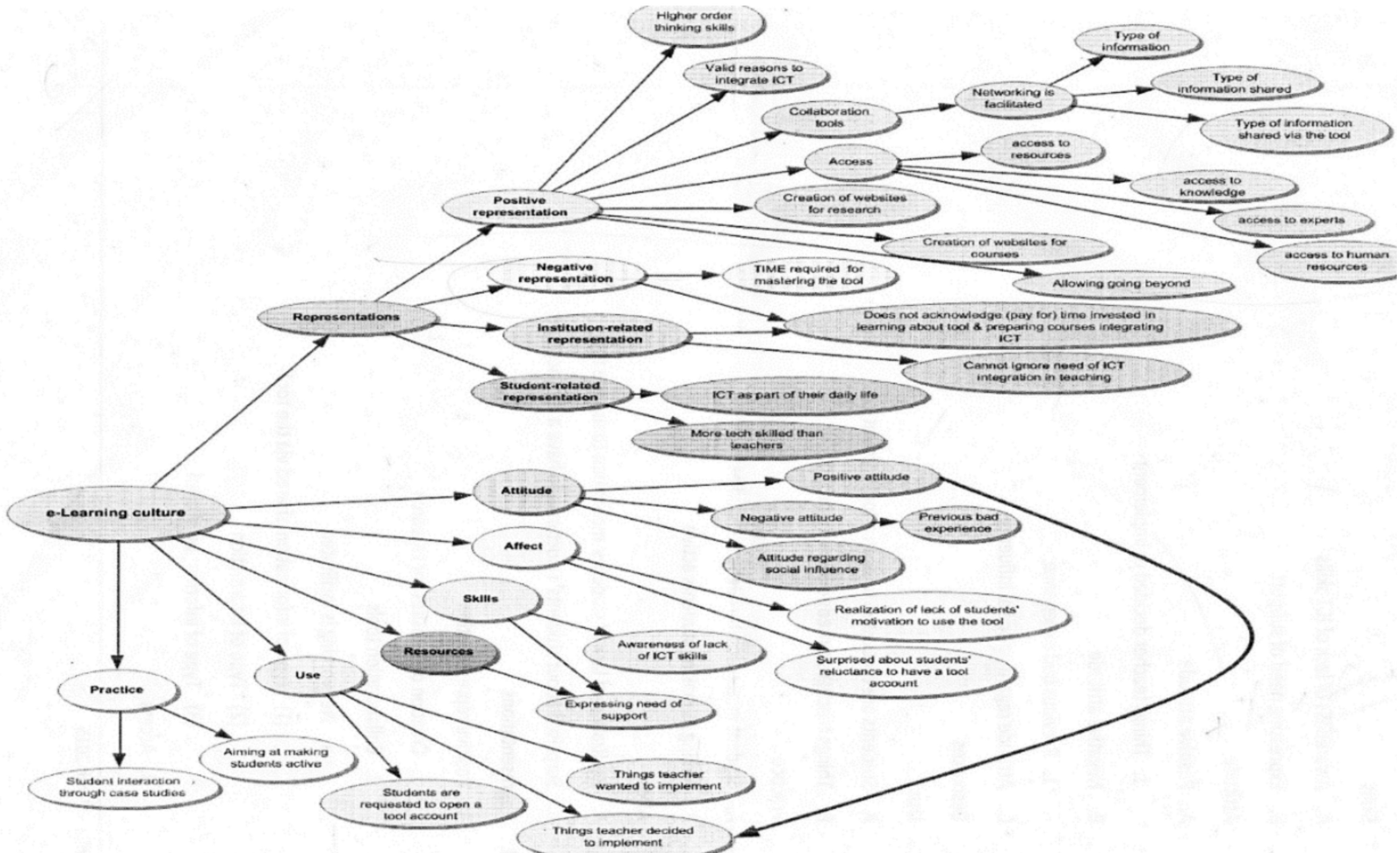


Figure 12: Graphic representation of passages attached to the category *e-learning culture and its sub-dimensions*

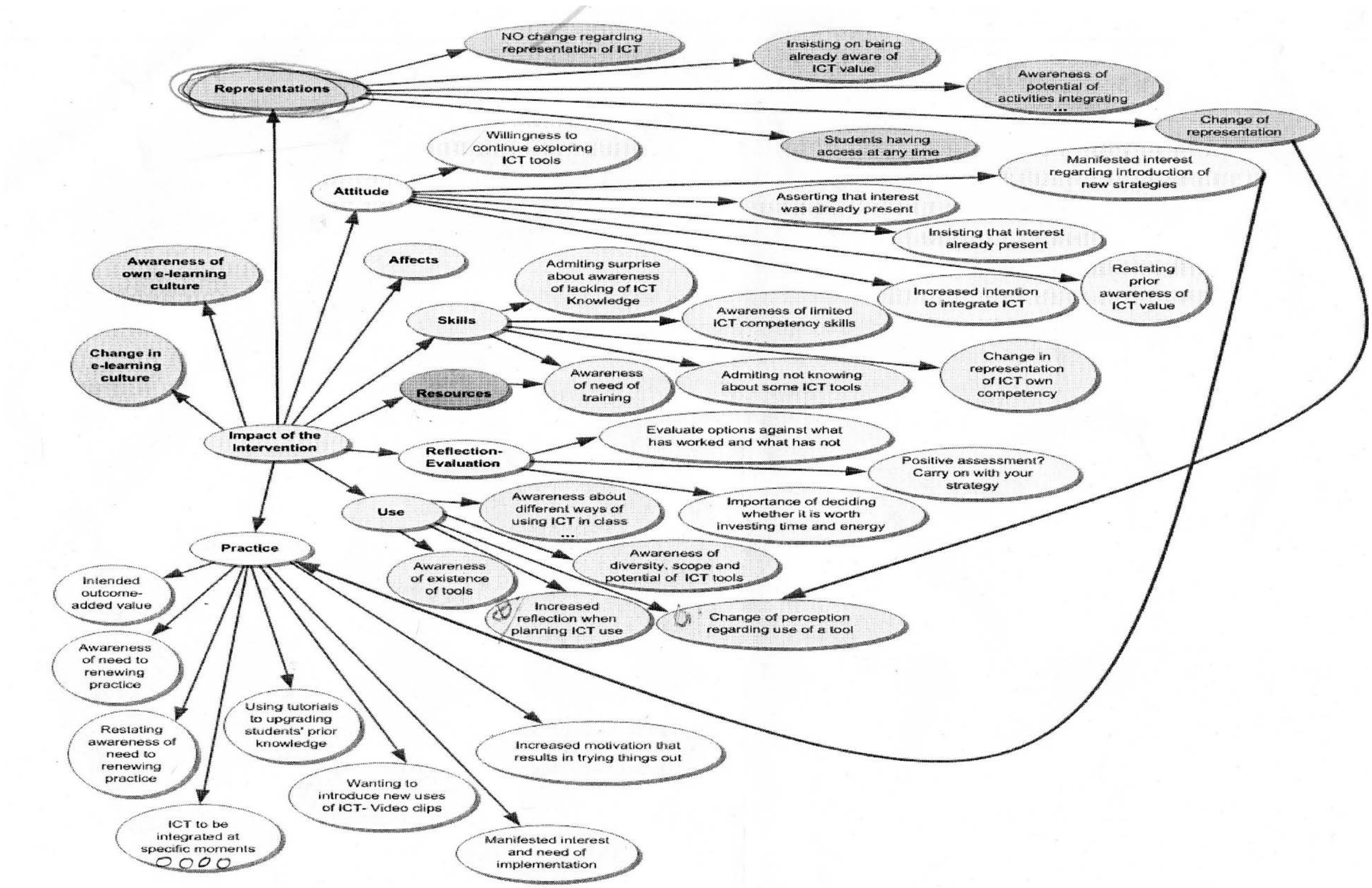


Figure 13: Graphic representation of passages attached to the category *Impact of the Intervention*

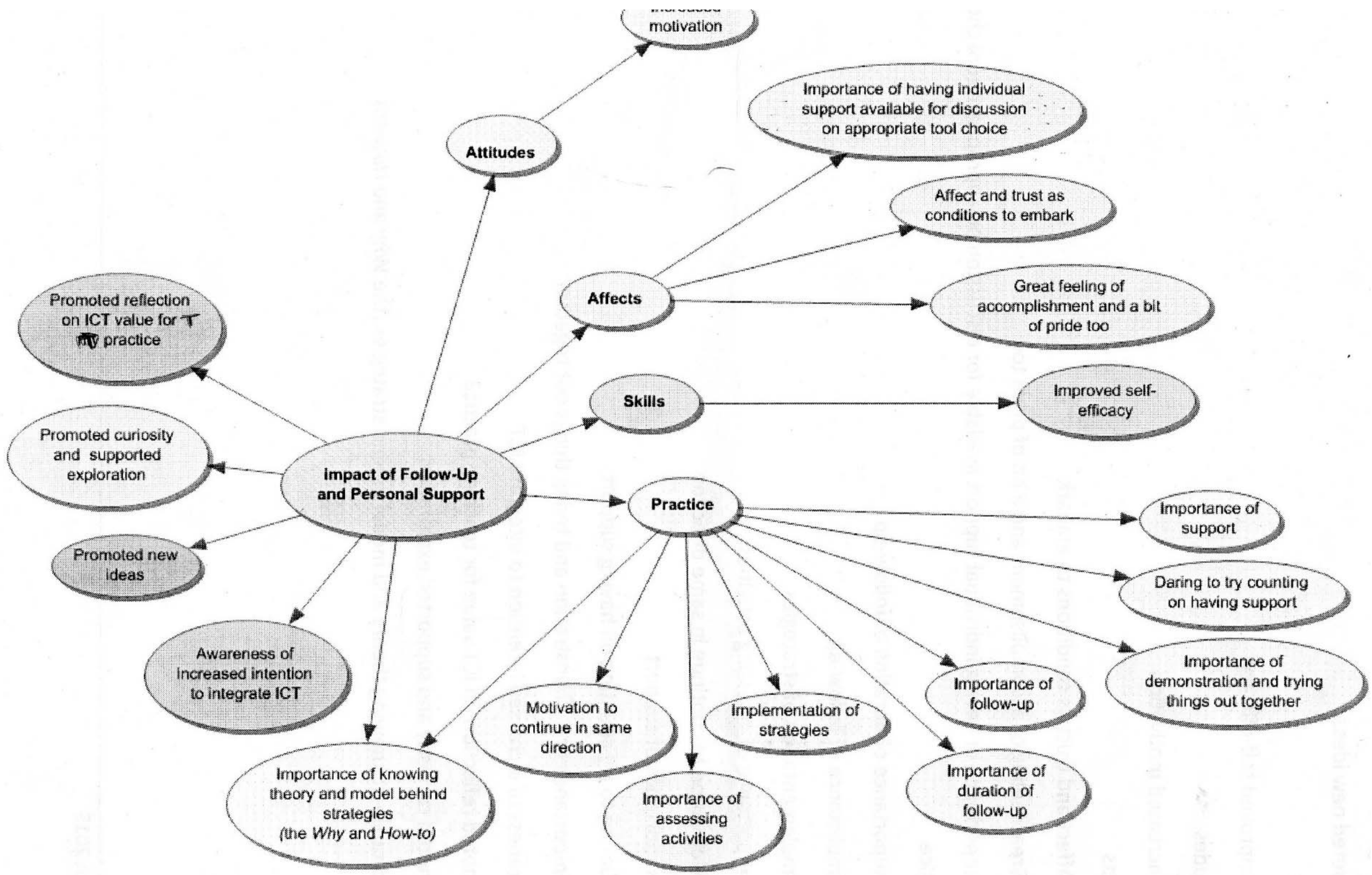


Figure 14: Graphic representation of passages attached to the category *Impact of Follow-up and Personal Support*

Once a comprehensive set of themes was established during the fourth step, the coding of segments containing them was needed, and it was then carried out using the QDA Miner software. This software allowed creating reports under table format, in which its word frequency function - QDA Miner's WordStat module- made possible to present and count groups of words occurring together in the data.

After carrying out this coding of segments, a reverse coding was undertaken, as the fifth step. This reversed codification- by deductively looking back at data from the themes-, was aimed at not only ensuring that the codes were clearly identified, but also to determine if more evidence could support each theme or whether they needed to gather additional information. Moreover, it allowed to verify whether: 1) the text passages belonged to the categories to which they were attached; 2) the codes related to one another in coherent, research study-important ways, and were part of the governing structure (Miles and Huberman, 1994).

The sixth step encompassed the comparison of codes among interviews' transcripts and its condensation. The condensation of the data takes place throughout the qualitative analysis, and it is defined as the process through which data are selected, centralized, simplified and transformed (Miles and Huberman, 1994).

In the last step, a crosscheck-coding procedure aiming at ensuring inter and intra coder reliability (Van der Maren, 1996) was undertaken. To check for common understanding, many people may need to codify a list of statements or the same text, this procedure is called "inter-rater agreement" or "agreement between coders" (Miles and Huberman, 1994). According to these authors, the following equation:

Reliability = (number of agreements) / (total number of agreements + disagreements)

allows to verify the minimum threshold of reliability, which was set at 80%. Also, to check for internal consistency, these authors suggest that we can codify ourselves more than once the same text every few days, which means that depending on the size and the extent of the coding scheme, agreements inter and intra "coders" should reach 90% (Miles and Huberman, 1994).

To ensure reliability of the coding process, a subset of data was coded and analyzed independently by two external coders. They were given the list of codes and two interviews –the same ones. Inter-coder reliability was established through percentage agreement (82%). The transcripts were then compared for consensus in codes and categorization within the e-learning culture sub-dimensions, impact of the intervention, the follow-up and personal support. After validating the coding scheme, the researcher independently coded the rest of the interviews.

Guba and Lincoln (1989) recommended that qualitative results be evaluated using the standard of "trustworthiness," as established by credibility and confirmability. In this research, credibility was gained though triangulation of multiple data sources (e.g., pre- and post-intervention surveys, interviews, and researcher's journal, group and individual discussions). Finally, after tentative results were drafted, member checks were completed with the participants. It is important to note that there were no disagreements with our interpretation of their assertions.

3.5. Ethical Considerations

Ethical issues in studies incorporating qualitative approaches are often very delicate and subtle. In these types of studies, participants are asked to "grant access to their lives, their minds, and their emotions" (Lofland and Lofland, 1984, p.25). Important issues such as probable harm, confidentiality, anonymity, possible benefits, purpose of research etc. need to be addressed as clearly as possible. Moreover, since the researcher will spend some weeks with the participants and, during this time there will be a continuous interaction among them, the development of some sort of personal involvement during the interviewing and participants' observation phase will be inevitable.

For this reason, it has to be explained to respondents how important it is to us to protect their identity and privacy. This is important both ethically and also because it allows them to be even more open and honest with us during the interview.

Before starting the field work, an *informed consent form* is prepared by the researcher and signed by the participants. This document informs the participants about the overall purpose of the study and its main features. It ensures research participants that their personal anonymity and confidentiality with regards to the data they provide will be maintained (Karsenti, Savoie-Zjac, 2004). Potential benefits to the participants are also mentioned, in terms of awareness and pedagogical ICT-skills acquisition, regarding the integration of ICT into their teaching practices. Some possible inconvenience concerning time allotted to participate in this study is also mentioned not only in the invitation letter, but also in the *consent form* since their participation requires considerable investment of time - two 3-hour meetings.

An important issue in the context of *participant observation* is the protection of privacy. The participants' identity will be protected by ascribing codes (e.g. PTT1, PTT2) to them whenever they are cited or quoted within the text. The final data will be presented as a result of coding, which further removes any possibility of the participants' identity being discovered. Similarly, providing any details that might lead participants to any sort of identification will also be avoided. (Karsenti, Savoie-Zjac, 2004).

Chapter 4: Data Analysis and Results

4.1. Introduction

In this chapter we present the data analyses and results of our research. To address our Objective 1: *To operationalize the IntersTICES model through a training intervention*, we followed the steps suggested by Action Research (AR) that guides our research. As such, we started by identifying the characteristics our training intervention needed to have to respond to the principles and requirements regarding appropriate ways of approaching adult learners aiming at using ICT, according to the IntersTICES model, adult learning theory - andragogy and the UTAUT. In Table 10 below, we present the principles we identified through our review of the literature. Once these principles identified, we integrated them in our design, development and implementation of the IntersTICES-Type Activity, which is presented in section 4.2. How we planned for and conducted the Introductory Training Intervention is detailed in Section 4.2.1. It is during the second phase of the training intervention, i.e. Follow-up and (optional) personal support, that the guiding principles were fully and explicitly put into action, as illustrated in section 4.2.2. In Section 4.2.3. we discuss the Final collective meeting of our research. In Section 4.2.4. we present the synthesis of the resulting IntersTICES-Type Activity.

Regarding our *Objective 2: To analyze the impact of the intervention on participant pre-service teacher trainers' e-learning culture, and on their intention to integrate ICT in their teaching practice,* in Section 4.3. we present the impact of our intervention on their e-learning culture. Section 4.4. illustrates the impact of our intervention on their intention to integrate ICT in their teaching practice.

4.2. Objective 1. Design, Development and Implementation of a Training Intervention to Operationalize the IntersTICES Model

The Identified Guiding Principles

As already mentioned, it was through the literature review we conducted that we identified the characteristics and principles regarding how to design, develop and implement training interventions for teachers/adult learners aiming at integrating ICT in their practice. These adult learner theory- andragogy's principles and the UTAUT's constructs enrich and validate the principles proposed by the IntersTICES model. The principles of adult learning theory – andragogy and IntersTICES, as well as the UTAUT's constructs, are presented below, as a recall, since already presented in Chapter 3.

Table 10: Guiding Principles to be considered when working with adult learners based on Knowles, 1984; Kearsley, 2010; IntersTICES model, Viens, Peraya, Bullat-Koelliker, 2004; Viens, Peraya, Bullat-Koelliker, 2005, UTAUT, Venkatesh et al. 2003

<table>
<tr><th>Adult Education Theory- Andragogy- Knowles, 1984; Kearsley, 2010</th><th>IntersTICES model, Viens, Peraya, Bullat-Koelliker, 2004, Viens, Peraya, Bullat-Koelliker, 2005</th><th>The UTAUT, Venkatesh, Morris, Davis and Davis, 2003</th></tr>
<tr><td rowspan="2">1. Need of being involved in planning and design of any process of instruction</td><td>5. Identification of immediate needs and the actions arising</td><td rowspan="2">13. Acceptance of a technology depending on two types of beliefs: the technology's perceived usefulness and its perceived ease of use</td></tr>
<tr><td>6. Needs analysis, characteristics of action plans implemented, and operating conditions of each project determine courses of action</td></tr>
<tr><td>2. Experience (including mistakes) as basis for learning activities; "learning through reflection on doing".</td><td>7. Identification of Facilitating conditions and constraints</td><td>14. Using of the technology perceived as help to attain gains in job performance</td></tr>
<tr><td rowspan="3">3. Learning having immediate relevance and impact on job/personal life</td><td>8. Personal support provided when required

9. Meetings responding to specific requirements [/needs] of [teachers]</td><td>15. Organizational and technical infrastructure perceived as support to use of the technology (Facilitating Conditions)</td></tr>
<tr><td>10. Activities being addressed from their own perspective as practitioners/professor-researcher</td><td rowspan="3">16. Human factors (such as attitudes and beliefs) having a significant influence on teacher behaviours, and consequently on their preparedness to use ICT for learning and teaching</td></tr>
<tr><td>11. Focus on developing their e-learning culture not on the tool itself</td></tr>
<tr><td>4. Learning being more problem-centered than content-oriented</td><td>12. Reflective practice</td></tr>
</table>

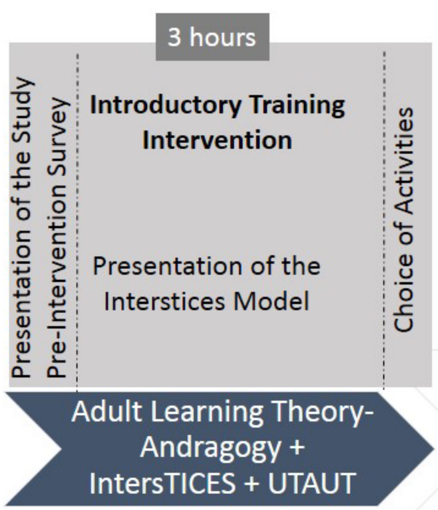
In order for us to have a better understanding of the procedures to be undertaken we considered important to allocate at least 6 weeks to work with participant teacher trainers so that the full benefits of our training intervention could be achieved. We have worked out a planning to maximize the operationalization of the IntersTICES model. This planning was consistent with the steps suggested by AR that guided our research, and encompassed the following:

4.2.1. Introductory Training Intervention

An introductory 3-hour meeting carried out with all the participants was planned taking into consideration the characteristics identified through our literature review in terms of the principles and requirements of effective ways of intervening with teachers/adult learners aiming at using ICT.

This meeting aimed at: 1) facilitating the appropriation of the IntersTICES model by participant teacher trainers; 2) helping them to become aware of their own e-learning culture, and of the potentiality of ICT to address their needs by using the IntersTICES model that initiated our research.

As such, this introductory training intervention with a duration of about 3 hours, that justified taking the time for teacher trainers to attend and participate, included:



1. Presentation of the IntersTICES model and its three dimensions. Embedded in this presentation we had the introduction of the UTAUT through the merge we proposed with one of the dimensions of the IntersTICES model.

2. Introduction and explanation of what is involved in the *Choice of Activities* step in terms of objectives; characteristics, procedures, and strategies focusing on developing their e-learning culture and supporting them to ensure achievement of targeted objectives.

4.2.1.1. Presentation of the IntersTICES Model and Its Three Dimensions

To operationalize the IntersTICES model and develop a methodology to intervening in order to achieve our first specific objective, we started by presenting the IntersTICES model as a dynamic process of interaction with the people that matches the steps of our action research (AR) approach. As already mentioned, this AR approach encompasses four steps: 1) Plan- Clarify vision and targets; 2) Act- Articulate appropriate theory; 3) Observe - Implement action and collect data; and 4) Reflect -Reflect on data and plan informed action.

We highlighted the IntersTICES model's characteristics and basic concepts based on its three dimensions, and made explicit the pedagogical engineering approach that articulates these three dimensions aiming at fostering an appropriation of the model by the participant teacher trainers. The systemic and systematic analyses of participant teacher trainers' needs and of their context (i.e. their course and its objectives) were emphasized. By doing this we were acknowledging the guiding principles -presented in parenthesis- (4), (5), and (6). The reflective practice (12) involved in deciding on a pedagogical added value to be sought and integrated in an activity of their own (3) and (4) as well as the taking into account of their e-learning culture (11) were also considered and facilitated.

The Indicators of Pedagogical Added Value Dimension: To present the IntersTICES model, we started with the description of its dimension comprising the 7 indicators of pedagogical added value (PAV). As a recall, and according to Peraya and Viens (2005), the Pedagogical Added Value (PAV) encompasses how ICT tools (are going to) enrich the learner's pedagogical environment, and or, how ICT tools foster a richer learning experience.

We asked the participants to share with the group what their definitions/understanding for each indicator was (1), before being presented with the definition by the model, along with some examples and illustrations (3) to clarify its meaning, potential and scope. This strategy allowed participant teacher trainers to become aware of what specific added value they would like to look for and integrate into their activity, which ICT tool would facilitate this (13), (14) and assessed their investment in terms of time, ease of use and learning how to implement it.

The Spaces of Pedagogical Integration Dimension: This dimension referring to spaces of pedagogical integration, i.e. objectives, activities, resources and evaluation, comprises also considering facilitating conditions and constrains of the context, i.e. their course and its objectives.

Working with this dimension encompasses: 1) some questioning based on the concrete activity the participant teacher trainer needs to resolve, experiment, and address; 2) taking into account the e-learning culture of all people involved (e.g. teachers, students, school's staff) since for example, teachers willing to integrate ICT in their practice may find themselves unsupported by principals and or parents (7), (15) who do not see the pedagogical potential of ICT, and hence do not allocate the resources required for teachers to be able to do so, and the context.

The awareness resulting from this questioning is fostered by the pedagogical engineering approach, facilitated by IntersTICES. By following this approach, we question the relevance of any decision/action to be taken, the pedagogical added value sought, the internal and external coherence, and conduct needs and context analyses. Participants are, therefore, encouraged to talk.

This dimension was briefly presented and further elaborated during the next meeting for follow-up and personal support, held on an individual basis with each one of the participants. During these individual meetings, they worked with the researcher on the activity they chose and into which they wanted to integrate an ICT tool.

The dimension of the IntersTICES model including the participants' e-learning culture was presented next.

The e-Learning Culture Dimension: Since integrating ICT implied a change in their practice or their intentions to practice -depending on where they were in the process (Viens and Villa, 2012), we needed to focus our work with them on three aspects of the participants' e-learning culture:

1) Their previous teaching practice integrating (or not) ICT;

2) Their representations of facilitating conditions and constraints (7) for effectiveness of ICT use (i.e. Teachers may think that integrating ICT in their practice is very good (16);

that there is potential in their use (13), (14) but they may also wonder under what conditions and constraints it can be done (7). Thus, in line with their feelings (16) they decide whether or not to embark on this training activity;

3) Their skills and resources.

Their perception of ease of use (e-learning culture, in terms of self-efficacy beliefs), and of resources available to support them in the change process (i.e. time, training, a technician) as well as their attitudes toward technology integration in their teaching practice were taken into consideration.

Furthermore, as we also aimed to have an impact regarding developing awareness of how teachers (in general), not only teacher trainers, (may) feel about accepting to work with and using technology, we aligned our intervention with our proposed merge of UTAUT and the IntersTICES model via the e-learning culture (See section 2.8, Fig. 10). It seems that teachers' intended use is highly dependent on the combination of the three above-mentioned aspects, which may mirror their particular e-learning culture (Viens and Villa, 2012).

4.2.1.2. Choice of Activities

We introduced and explained what is involved in the *Choice of Activities* in terms of:

1) *Objective*(s). To address an identified need of their own course/students. This aligned with principles (4) and (5) (see Table 10 above as a recall).

2) *Characteristics* inherent to the chosen activity that were aligned with most (if not all) of the 16 enounced identified guiding principles.

3) *Procedure.* Focusing on developing their e-learning culture- principle (11), integrating principles (1), (6), (7), and (9); and

4) *Strategies* provided to support participants and ensure achievement of targeted objectives were aligned with principles (8), (9), and (12) and supported by the UTAUT's constructs (13), (14), (15), and (16).

To proceed, teacher trainers were asked to choose an activity of their own courses - principles (4) and (5) - into which they would like to integrate ICT. Participant teacher trainers were provided with the *Guidelines* presented in Table 11 below, that we designed for supporting them when implementing their activity.

They were informed that during the first individual meeting of follow-up with the researcher/trainer, they were going to work together on their activities using these guidelines that specify the whole procedure step by step.

Afterwards, notes taken in the researcher's journal and the interviews, show that all of them selected appropriate activities- into which they would like to integrate some ICT- that were aligned with the objectives they have stated to respond to the program/students' needs. This selection was undertaken through a more conscious process of reflection and analysis - facilitated by the *Guidelines* (see Table 11 below) and supported by the pedagogical engineering approach we implemented, covering and interrelating the relevant conditions and actors.

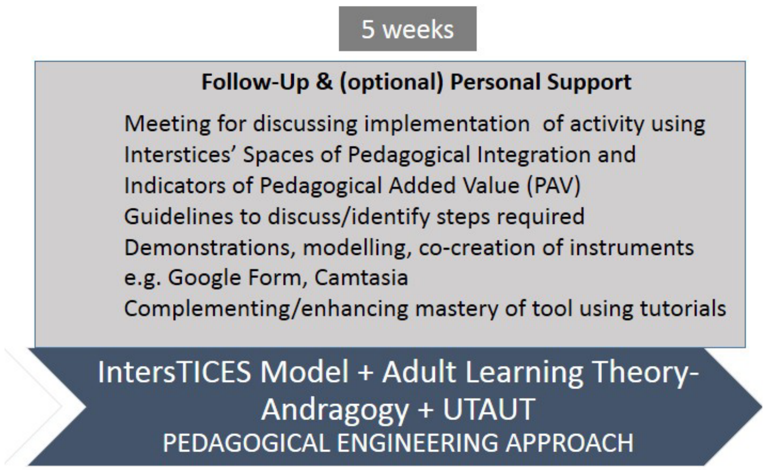
For example, all participant teacher trainers explicitly referred to particular facilitating conditions and constrains, principle (7), to be considered when planning for integrating ICT into their pedagogical activities, e.g. is the tool they would like to integrate into their activity available for free download? What kind of tutorial, personal support and scaffolding are available to them (and their students) while taking ownership and learning to master the tool? How much time is required for them to learn the tool; how some pedagogical strategies are to be explored and could be used to support enhanced learning activities, ensure richer learning environments, provide for higher student involvement and bring about effective teaching interventions?

Thus, participant teacher trainers were doing this planning to use the tools in a more informed and pedagogically powerful way than before. They were also bearing in mind the distinct added value and the potential of the ICT tool in making their selected activities more interesting and relevant, while helping their students acquire the targeted skills and knowledge.

Table 11: *Guidelines* Suggested for Working on Participant Teacher Trainers' Activity Integrating ICT

Choosing an activity into which you would like to incorporate elements of pedagogical innovation (added value- PAV), from the concepts discussed during the training intervention	
ITEMS	**Comments**
1. Among the activities of the different themes of your course, choose an activity in which you would like to integrate ICT. State it.	
2. If there is an already existing activity in which you would like to integrate ICT, which aspect do you want to change / improve?	
3. What new ways of doing things that would help achieve your goal would you like to explore using ICT?	
4. What is *the* pedagogical added value (PAV) you would look for? To what degree? Why? What would be other related added values? - PAV refers to: How ICT tools are going to enrich the learner's pedagogical environment; how ICT tools foster a richer learning experience (Peraya and Viens, 2005)	
5. State the objective you would like to attain for this activity	
6. What are the resources needed to carry out this activity and achieve this objective? 1) Resources set up for you (the teacher trainer)	
2) For your students. How do you identify needs?	
7. What are the facilitating conditions?	
8. What are the constraints?	
9. Regarding the evaluation, what (new) forms of assessment would you like to explore?	
1) Have you already thought about this kind of assessment? Why haven't you done it before?	
2) How would ICT allow you to do so?	
10. What are the advantages? 1) For you (the teacher trainer)	
2) For your students	
11. What are the facilitating conditions?	
12. What are the constraints?	

4.2.2. Follow-up and Personal Support



To develop this second phase of the intervention we planned (see Fig. 15, below), we also needed to acknowledge the IntersTICES model's principles, as well as those that characterize adult learning theory-andragogy, and the UTAUT, as illustrated below. Applied principles corresponding to specific phases of the activity are presented in parenthesis.

To start, we asked participant teacher trainers to choose an activity into which they wanted to integrate some ICT tools aiming at responding to an identified actual need of their own. By doing this we were acknowledging the guiding principles (5), (6) (see Table 10, above for a recall), followed by another principle: identification of facilitating conditions and constraints (7), which were also taken into consideration according to the context, i.e. their course and its objectives, to plan for and allocating the appropriate resources (13) for the activity to be effectively implemented (5) - arising action. To do this, we acted more as a coach, guide or pedagogical interlocutor facilitating discussion and exchange of ideas (9), providing just in time scaffolding to foster growth and empower them to act (11).

Using the IntersTICES model, we implemented the engineering pedagogical approach, which promoted and facilitated participant teacher trainers' reflection through questioning of their targeted objectives (2), (12), the specific facilitating conditions and constraints of the context they were working in (7), as well as on the benefit of looking for some ICT pedagogical added value (13). By promoting exchange of ideas and reflective practice (12) both individually and collectively, we were also prompting social construction of knowledge. Moreover, as already mentioned, this approach included allotting time for maturation processes and reflection (12). This implied having more than one personal encounter with participants (9) -three times, as a minimum requirement- to be effective:

- The first one, for carrying out the introductory training meeting where they chose the pedagogical added value (PAV) they wanted to look for (10) through the integration of an ICT tool into their activity (13).
- The second one, to start exploring the ICT tool (13) to be integrated into the activity they chose, to achieve their targeted objective(s) (3), (14) and meet their needs (5).
- The third one, to reinforce and support them (8) in their attempts to take ownership of the tool and of the appropriate strategy associated with their activity (16), (9), (14).

As aforementioned, during these individual meetings, a systemic and pedagogical engineering approach was put into place to support participant teacher trainers (8) through the whole process of integrating ICT in one of their course's activities, according to the identified needs in each case (3), (4), (5), (6). They were offered optional personal support: from the very beginning when they selected the activity into which they would like to integrate ICT to look for a specific pedagogical added value, to discussions regarding alternative forms of evaluation, advantages and implications for them and their students, during the individual meetings. Data started being collected via notes in the researcher's journal taken during these individual meetings with participant teacher trainers.

Following Creswell's (2014) suggestion of considering Miles and Huberman's (1994) recommendation on including a discussion not only about "the setting (i.e. where the research will take place), the actors (i.e. who will be observed or interviewed); the events (i.e. what the actors will be observed or interviewed doing, but also about the *process (i.e.* evolving nature of events undertaken by and with the actors within a setting)" (p.189), we prepared a thorough description (see below) of the 7 main steps undertaken during these meetings for personal support to make the development of the intervention more systematic and clearer in terms of presentation of the procedure to be undertaken.

Also, in Table 13 below, we summarize the stages and strategies we considered when developing and implementing the training intervention using the IntersTICES model.

Systematic Approach Implemented to Support Participant Teacher Trainers

The seven main steps undertaken to support and guide participant teacher trainers during the process involving the utilization of ICT and coaching for the production of activities integrating ICT, were implemented as follows:

1) Once their activity and targeted ICT pedagogical added value chosen, each participant met with the researcher/trainer to reflect on and have a pedagogical discussion about every aspect conducive to its implementation. This discussion was facilitated by exploring in detail each one of the aspects involved in the dimension of the IntersTICES model referring to *Spaces of pedagogical integration* (i.e. objectives, activities, resources and evaluation), presented during the initial training intervention, (see Fig. 15) and that takes into account their specific contexts, and checkings for internal and external coherence.

2) Identification of facilitating conditions as well as of constraints, as an essential requirement to ensure allocation of required resources, successful implementation of the activity and achievement of their targeted objective(s).

3) Identification of appropriate tool(s) that would facilitate achievement of their activity's targeted objective(s).

4) Demonstration/modelling and co-creation of tool(s)/instruments e.g. Using *Google Form*, design of a diagnostic test to identify students' prior knowledge about a school subject matter; using *screencast-O-matic* or *Camtasia* to create on-screen videos for remedial tutorials that would allow students to acquire identified lacking pre-requisites autonomously.

5) Complementing and enhancing mastering of the tool(s) by using video tutorials.

6) Further discussion and reflection to try out and refine the resulting instrument(s).

7) Discussion regarding alternative forms of evaluation, along with benefits, advantages and implications for teacher trainers and their students. e.g. Tips for designing peer evaluations by using rubrics.

The *Guidelines* we prepared for the reflection process followed to start working with the participant teacher trainers on the activity they chose, was presented before as Table 11.

Pedagogical Added Value (PAV) Targeted through Activities Chosen from Participant Teacher Trainers' Own Courses

As already mentioned, participant teacher trainers were asked to choose an activity from their own courses into which they would like to integrate ICT, following the suggested guidelines presented in Table 11 above. Having the 7 indicators of innovation (pedagogical added value- PAV) already presented to them, they were prompted to decide on what PAV they would like to look for and integrate into their activity.

Afterwards, together with the researcher they selected an ICT tool that would facilitate achieving their targeted PAV (see Table 12 below). They also considered the required investment in terms of time for them to learn how to use the tool, and discuss the pedagogical approach to be implemented.

By using the IntersTICES model, and more specifically, the spaces of pedagogical integration, we prompted and facilitated pedagogical conversations and discussions about and/or actually preparing some necessary instruments, as well as running some trials on how to implement the activity. (See annex #3 –diagnostic test -as a product).

Table 12: Activities Chosen by Participant Teacher Trainers with Targeted Pedagogical Added Value (PAV)

Chosen Activity + *Targeted* Pedagogical *Added Value (PAV)*	**ICT Tool(s) Suggested for Participant Teacher Trainer (PTT) to Use**				
	PTT 1	**PTT 2**	**PTT 3**	**PTT 4**	**PTT 5**
Flipped class- Case Study: Activate prior knowledge; diagnostic evaluation, Rubrics *Individualization, Higher order thinking (Analysis, creativity)*	Google Form				
Video clip- modelling to develop children's counting skills and ability to use money; blog creation. - *Collaboration*, *Higher order thinking (Analysis, creativity)*		Blog Software Video-creation			
Photo-story creation/telling inserting voice, sounds and pictures. - *Higher order thinking (Creativity)*			Audacity-Digital Photography		
Design of diagnostic evaluation to Identify students' needs regarding course prerequisites; Video clips. - *Autonomy, Collaboration, Contextualised learning.*				Google Form Software Video-creation	
Refining Intervention plans collaboratively to improve their quality/scope, keeping track of evolution and participation – *Collaboration*					Google Drive

4.2.3 Final Collective Meeting

Participants in this research got together with the researcher to share and discuss experiences, aspects, situations, etc., they encountered during the design of their activity integrating an ICT tool and, in some cases, during the actual exploration and use of the tool chosen to address the identified need of their course/students. The aim of this sharing was to take the pulse of the actual experience they lived, to refine the interview questions to be asked individually, looking for clarification and in-depth information. Also, considering that learning is a social process, this was an opportunity for participants to share and exchange tips, best practices and experiences.

Our tools for data collection allowed us to reflect on and identify any changes on their e-learning culture. As such, the notes taken on the researcher's journal during the individual meetings for follow-up and personal support, as well as the individual interviews, helped in the identification of the key words, terms and expressions denoting a more in-depth understanding regarding the IntersTICES model and its dimensions, and more specifically, a more assured awareness of the impact of this activity using IntersTICES not only on their e-learning culture, but also on their intentions of integrating ICT in their teaching practice.

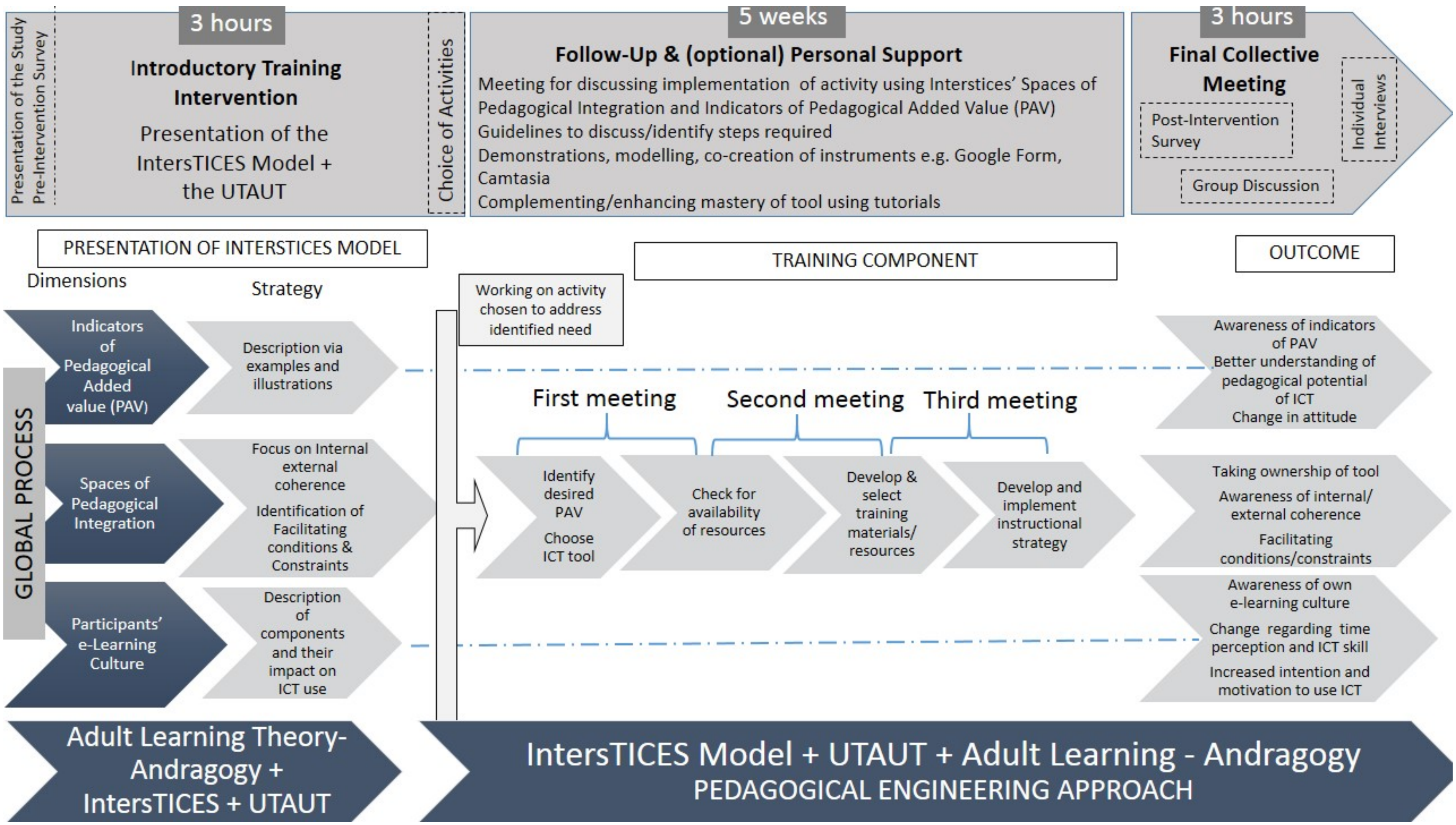


Figure 15: ***InterSTICES–Type Activity*: Overview of the training intervention put into place to operationalize the InterSTICES Model**

4.2.4. Synthesis of the Resulting IntersTICES-Type Activity

We clearly identified two general and overarching principles, which have to be considered when implementing an IntersTICES-Type Activity. These principles, supported by the pedagogical engineering approach facilitated by IntersTICES, are as follows:

1. Undertake a systemic and systematic procedure that supports carrying out more specific analyses of the needs and context;
2. Take into account the actors' e-learning culture. For example, when aiming at integrating an ICT tool into a teaching activity, one can wonder whether the teachers have a good understanding regarding what it takes in terms of knowledge, skills, and resources to do so, or whether they require some personal support. Do they take a positive attitude towards this integration? If not, which resources should be incorporated into the pedagogical strategy when planning the training intervention?

As aforementioned, (section, 3.3.2.) two other considerations need to be acknowledged:

1) Focus on teachers' own projects; and

2) Avoid long, drawn-out activities.

By creating Table 13 below, we embarked on a reflective and critical exercise regarding the training intervention procedure that takes place over four main stages encompassed in the Follow-Up and Personal Support Phase:

Stage 1: Undertake the analyses of the needs and context (e.g. know the objectives; know the constraints);

Stage 2: Focus on the pedagogical added value of certain uses of ICT;

Stage 3: Consider the actors' e-learning culture. (See aforementioned example in 2. above)

Stage 4: Foster internal consistency. This stage encompasses the pedagogical choice, a kind of pedagogical design. This involves identifying a goal; getting things implemented; handling resources carefully and according to identified needs; and adapting.

In short, we strongly recommend making explicit the pedagogical added value sought; questioning the actors' e-learning culture and, only then, undertaking the pedagogical design.

Often, instructional designers/teachers conduct the analyses of needs and context, as a first step, followed by the preparation of the pedagogical design (see stage 4 above) without considering the above mentioned stages 2 and 3.

Using IntersTICES, however, we can explicitly incorporate and implement these two stages, which are missing from other models and/or approaches. i.e. the pedagogical added value: What I am seeking to achieve considering the facilitating conditions and constraints? And regarding the e-learning culture: how the e-learning culture might nuance what we do and how we do it? Will it require supplying other resources?

The following emerging guiding principles explicitly resulting from the training intervention we implemented to operationalize the IntersTICES model, prompted the outline of the strategies (See table below) that would facilitate any pedagogical intervention for ICT integration, which from now on will be called an *IntersTICES-Type Activity*:

1) training focusing on addressing own identified needs;
2) facilitating conditions and constraints being taken into consideration;
3) trainer acting as a coach and guide;
4) approach fostering reflection on benefit of seeking some ICT pedagogical added value;
5) approach promoting social co-construction of knowledge (Via exchange of ideas as well as individual and collective reflective practice);
6) training approach allowing time for maturation of processes and reflection.

Based on these guiding principles, we proceed to the training, applying the suggested strategies i.e. strategies 3 to 15 (Table 13). These steps may be followed/repeated every time there is a pedagogical need to be addressed aiming at achieving a targeted objective.

The ICT tool introduced, learned and integrated -following the strategy suggested in the *IntersTICES-Type Activity* in Table 13- to respond to a specific need may have a (noticeable) impact on the teacher trainers' e-learner culture while facilitating its development taking into account on which level they may be. Every time teacher trainers need to learn about a new ICT tool –one at a time- to address a specific need, they are developing their ICT competency. Moreover, being supported while having to learn about and being able to use the ICT tool in an activity of their own, fosters in them growing feelings of self-efficacy, which in turn can nurture a positive attitude towards ICT use, and increase their intentions to (actually) integrate ICT in their teaching practice. This whole process resulting in a developed and more comprehensive e-learning culture.

Results suggest that the *interstices-type activity* is the set of strategies more closely related to the field we are interested in: Empowering teacher trainers to develop their e-learning culture, while helping them integrating ICT in their teaching practice. It may provide educators with a sound pedagogical foundation, as well as practical skills to meaningfully integrate ICT into their teaching practice. Even though follow-up and personal support were considered as essential by participant teacher trainers themselves, nevertheless, and always regarding our population, these strategies are to be handle with care, since depending on teacher trainers' needs and profile, some of these strategies may not be appropriate. Therefore, it is possible that the IntersTICES-Type Activity will be subject to improvements.

The identification of the stages of the training intervention as well as the training ⁄ implementation strategies at this phase, aims at anticipating pre-service teacher trainers' possible anxiety and low self-efficacy beliefs regarding the process of ICT integration. This identification would allow to provide pre-service teacher trainers' with the means to overcome them, while facilitating the development of their e-learning culture. These strategies could influence the search for solutions for ICT integration in initial teacher training programs. It should also be stressed that these training⁄ implementation strategies are not exhaustive and that other implementation strategies may emerge throughout the development process.

Table 13: An IntersTICES-Type Activity: Stages and Training Strategies that Facilitate the Development of Teacher Trainers' e-Learning Culture

TRAINING INTERVENTION	TRAINING STRATEGIES	CHECK (✓) WHEN DONE
Introductory Training Intervention (group or individual)	- Design and implement the training intervention based on identified principles. - Present the three dimensions of IntersTICES and make explicit the pedagogical engineering approach that articulates these three dimensions aiming at fostering appropriation of the model by users. - Ask participants to select activity into which they want to integrate ICT tool, and decide on what PAV to look for to address an identified need or achieve a targeted objective	
Follow-up and Personal Support - Customized to respond to particular needs *N.B. Keep in mind that teacher (trainers) are willing to learn about and use a tool that respond to one (one need at a time) of their identified needs, as well as one tool at a time*	1. Discuss about pedagogical added value (PAV) sought, explore tool that allows addressing need - using videos/tutorials available on YouTube	
	2. Assess ease of use of tool, based on participants' e-learning culture and its feasibility to address specific identified need	
	3. Introduce (another) ICT tool e.g. *Google Form*, to the already most-used three basic ones (i.e. Word, PPT, email)	
	4. Explain pedagogical added value (PAV) of suggested new tool e.g. *Google Form*, and encourage reflection about PAV	
	5. Foster awareness of facilitating conditions and/or constraints regarding specific ICT tool(s) integration	
	6. Support first steps toward learning about and mastering of the tool	
	7. Present, show and demonstrate step by step how to use the tool through a specific and simple example of application. e.g. build a short survey from scratch, including at least two or three types of questions; choice of background or theme; sharing options	
	8. Foster awareness of the teaching/learning context	
	9. Encourage reflection on benefit of including some ICT PAV (initiation)	
	10. Promote ability to link content, pedagogy and technology	
	11. Encourage in-depth reflection on benefit of seeking specific ICT PAV to enhance teaching approach designed to achieve targeted objectives	
	12. Foster awareness of specificities of the tool, its suitability and potential for integration in a chosen activity and context	
	13. Provide scaffolding during actual design of activity integrating ICT tool. e.g. Use IntersTICES (Indicators of PAV+ Spaces of Pedagogical Integration) and the *Guidelines* designed for backing the choice of activities to support this design and implementation	
	14. Enhance the capacity to transfer	
	15. Foster actual practice presenting some form of (internalized) adoption of activities integrating the ICT tool looking for PAV	
Post-intervention (group) **Interview (individual)**	- Share experiences / best practices	
	- Share useful tips and clues	
	- Provide/receive further insight regarding (impact of) intervention	

Also, data from the pre- and post-intervention surveys, contributed to the building up of the List of Facilitating Conditions⁄ Constraints (Resources) that are presented below in Table 14. It is suggested to take them into account for the corresponding consideration and allocation of resources, when planning for ICT integration and use.

Table 14: List Facilitating Conditions ⁄ Constraints (Resources) to be considered when planning for ICT Use

FACILITATING CONDITIONS (Resources)	Yes	No	FACILITATING CONDITIONS (Resources)	Yes	No
Access to (formal) pedagogical ICT training - teacher			(Full and Free) access to the tool ⁄ program (for teachers)		
Access to (formal) pedagogical ICT training -student			Tool ⁄ program installed in teachers' personal computer		
Assigned recognized time for attending pedagogical ICT training - teacher			(Full and Free) access to the tool⁄ program (for students)		
Assigned opportunities to discuss ⁄ exchange and learn with ⁄ from colleagues			Tool ⁄ program installed in Lab for students		
Access to optional personal support⁄ mentor - student			ICT skills⁄self-trained - teacher		
(Individual) access to a pedagogical interlocutor - teacher			ICT skills ⁄ self-trained - student		
Access to a technician - teacher			Time to learn the tool⁄ training - teacher		
Access to a technician - student			Teacher's availability (workload ⁄ schedule)		
Guidelines⁄ tutorial available in (language)			Student's availability (workload ⁄ schedule)		

Finally, we proposed a modification to the model used for our intervention, which is presented below as Figure 16.

We found that this presentation of the IntersTICES model allows to highlight, at a glance, the relationships among its three different dimensions, which are facilitated by the pedagogical engineering approach, and determined by the facilitating conditions and constraints of a specific educational context. In short, it clearly illustrates the aspects at play and, which have to be taken into account when aiming at an effective pedagogical integration of ICT in the teaching practice.

This presentation may also provide a useful reference and starting point for those seeking such tools, or who have a responsibility to act as teacher trainers or instructional developers.

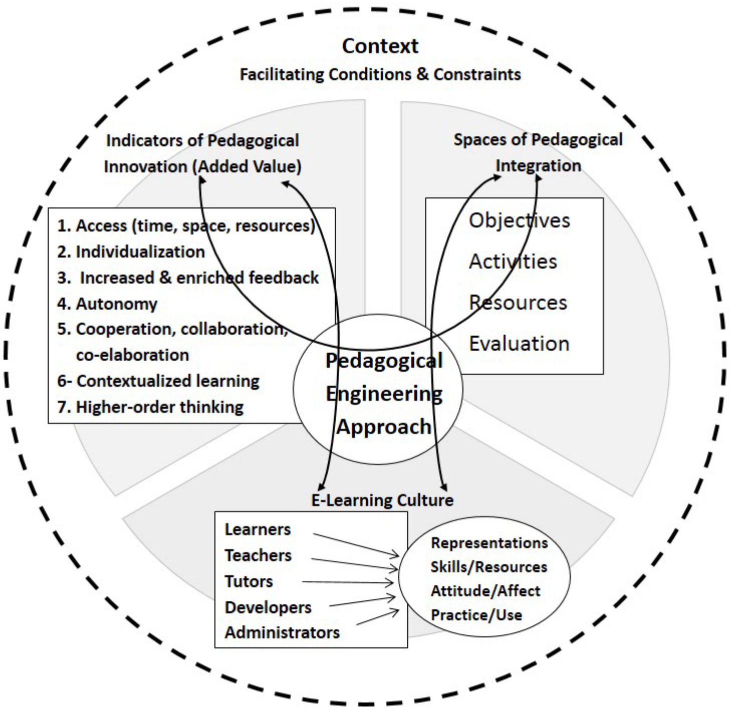


Figure 16: The IntersTICES Model adapted from Peraya and Viens (2012)

4.3. Objective 2. Impact of the Training Intervention on the Participant Teacher Trainers' e-Learning Culture

4.3.1. Participants' e-Learning Culture before the Training Intervention

To address *Objective 2: To analyze the impact of the training intervention on participant teacher trainers' e-learning culture,* we needed to have a portrait of the participant teacher trainers' e-learning culture before any training intervention taking place. Then, we asked participant teacher trainers to fill in a 20-minute pre-intervention survey. The first section of this pre-intervention survey aimed at gathering Information about: 1) participant teacher trainers' demographics (e.g. age, status as a professor at the university; main subject being taught), and 2) specific ICT training they have had within the last five years (e.g. specific ICT courses taken during (initial) teacher training courses, during continuous education or professional development ICT courses).

Results from the pre-intervention survey show (see Table 15 below) that participant teacher trainers in the last five years have not received specific training regarding pedagogical use of ICT/computers. Two of them have attended the training activity on *how to create your course with Moodle/StudiUM*, which is the platform used at Université de Montreal.

Table 15: ICT training activities participant teacher trainers (PTT) have had during the last five years

ICT Field	PTT 1	PTT 2	PTT 3	PTT 4	PTT 5
Search of information on Internet					X
Management/creation of web sites		X	X		
Pedagogical use of computers					X
Use of communication functions of ICT (forum, blog, chat, etc.)		X			X
Use of Moodle/StudiUM to create a course	Not to create a course	X		X	

The second section of the pre-intervention survey aimed at collecting information regarding participant teacher trainers' e-learning culture, in terms of: 1) which ICT tools they have already used in their teaching: a) to prepare their courses; b) to deliver their classes; c) to ask their students to use or to produce with; 2) Impact the use of these ICT tools may have on their own knowledge, their students' knowledge, their own motivation and that of their students; 3) their level of ICT skill; 4) their representations regarding the pedagogical added value technology may have (or not) for them and for their students; 5) under which conditions; 6) having access (or not) to which resources; 7) having to overcome (or not) which constraints and limitations; and 8) how they felt regarding ICT integration to their teaching activities.

ICT Basic Tools. Results from this second section of the pre-intervention survey confirmed *Word, PPT* and *email* as the basic tools used by participant teacher trainers for preparing and delivering their courses followed by Moodle and Drive/Dropbox. When asking their students to use and or produce for their courses, we observe a slight change in the ranking order of the basic tools, besides the inclusion of some others (e.g. CMAP, Moviemaker, Skype, Audacity). These results corroborate those of Bullen et al. (2011) who found that [teachers] regardless of their generation, tend to make use of a rather limited set of technologies based on three key issues: familiarity with the tools, financial cost of the technology, and immediacy of access.

Facilitating Conditions. Results also show that participant teacher trainers consider *training* not only for them but also for their students, as well as *having access to resources* (human e.g. mentoring, and material e.g. software, tools) as essential facilitating conditions for ICT integration in the teaching/learning process.

Feelings about integration of ICT in their teaching practice. Regarding their *feelings* in terms of ICT integration in their teaching practice, Table 15 shows that all five participant teacher trainers were motivated. Results also show that our intervention did not discourage them. Moreover, the teacher trainer who did not state in the pre-intervention survey being motivated, declared being motivated in the post-intervention survey, after the training intervention.

The items-creation step regarding this question, i.e. *Motivated, Worried, Afraid, Comfortable, Prior bad experience, and Other,* was undertaken by ourselves –with the expert-.

Based on our understanding of the subject matter, we used our judgement about which items were to be most sensibly retained.

Table 16: Teacher trainers' feelings regarding ICT integration into their teaching practice

Feelings	Number of people having chosen an answer in:	
	Pre-intervention Questionnaire	Post-intervention Questionnaire
Motivated	**4**	**5**
Worried	0	0
Afraid	0	0
Comfortable	4	3
Prior bad experience	1	0
Other	1	1

It seems, however, that we started our study with a bias. Participant teacher trainers initially were not actually interested in participating in this study motivated by some desire of integrating ICT in their teaching practice. Their participation in this study was mostly driven by "solidarity and willingness to help". Nevertheless, when three of them were asked individually about it, each one of them confirmed this assumption. But, the unanimous answer they gave was that they became interested and saw the personal benefit of participating in this research, right from the beginning, during the 3-hour introductory intervention. It was during this activity that they actually became motivated to integrate ICT in their practice.

> "*It's a pity that you don't have more participants, because it is very rich. We have the impression that we leave with something. It's like a gift that you give to us. Usually, we go as a favor to the person collecting data, in this case it is you doing us a favor." (*PTT1)[24]

[24] « *C'est dommage que tu n'aies pas plus de participants, parce que c'est très riche. On a l'impression de sortir avec quelque chose. C'est comme un cadeau que tu nous fais. Habituellement on va pour rendre un service à la personne qui fait sa cueillette des données, alors que c'est toi qui nous rends un service. » (PTT1)*

4.3.2. Participants' e-Learning Culture after the Training Intervention

Participant teacher trainers taking part in this research, responded, as required, to the following characteristics: 1) Being pre-service teacher trainers/lecturers working in initial teacher training programs; 2) Teaching subjects different from ICT at the undergraduate level; and 3) Not having experience integrating ICT systematically into their teaching practice.

To give a portrait of the five teacher trainers participating in this research, we present in this section an illustration of their profiles, the pedagogical added value (PAV) sought and their chosen activities, the stage they reached as self-directed learners based of Grow's (1991-1994) adult learner model, the level of development of their e-learning culture, as well as the need that prompted them to undertake some ICT integration in their teaching practice (See Table 17 below), based on data from the pre- and post-intervention surveys, and notes from the researcher's journal taken during meetings for follow-up and personal support. More in-depth, detailed and exemplified information regarding changes in participant teacher trainers' e-learning culture, is presented throughout this and the next section, based on data from the pre- and post-intervention surveys, excerpts from individual interviews and notes from the researcher's journal.

Comparison of actual participants' need of integrating ICT is difficult, because we rely on self-reported data and observation. However, the professional context of the participants' need of integrating ICT might have influenced the degree of development of their activity. For example, being a newly-hired lecturer, PTT1's interest and willingness to demonstrate innovative teaching and ICT skills competence, was perhaps higher than to the other participant teacher trainers. PTT2 and PTT5' interest to integrate ICT in their teaching was possibly less constrained by traditional course evaluation, and thus, taken as optional. PTT4 and PTT3 were employed as permanent full professor and pedagogical consultant, respectively. For them, teaching students and training teachers are formal responsibilities and part of annual evaluation. Their interest and willingness aroused perhaps from the opportunity to fully address an identified need of their own, being individually coached and supported. This was shown through their availability to meet and eagerness to put time (PTT3 = 9 hours; PTT4= 21 hours) and effort to completing their task.

Our results suggest that participant teacher trainers' readiness for and comfort with being self-directed to integrate ICT in their teaching practice, matched the aforementioned professional context of the participants' need of integrating ICT, as well as the level of development of their e-learning culture (see Figure 17, p. 169), as shown in Table 17 below. For instance, both PTT1 and PTT4 reached Stage 4: Self-directed learner, and Level 4: Comprehensive e-learning culture. We may assume that because of their higher motivation to meet their needs, they attained the highest level of achievement of their goals, followed closely by PTT3 who reached Stage 3: Involved Learner, and Level 4: Comprehensive e-learning culture, whereas PTT2 and PTT5 reached Stage 2: Interested Learner, and Level 3: Awareness of facilitating conditions and constraints when integrating ICT.

We present here as a recall (since already presented in section 2.6, p.97), the model of adult education by Grow's (1991, 1994) Staged Self-Directed Learning (SSDL) model, encompassing four stages: "Stage 1: Depended learner: Learners of low self-direction who need an authority figure (a teacher) to tell them what to do; Stage 2: Interested learner: Learners of moderate self-direction who are motivated and confident but largely ignorant of the subject matter to be learned; Stage 3: Involved learner: Learners of intermediate self-direction who have both the skill and the basic knowledge and view themselves as being both ready and able to explore a specific subject area with a good guide; Stage 4: Self-directed learner: Learners of high self-direction who are both willing and able to plan, execute and evaluate their own learning with or without the help of an expert." (Merriam, Caffarella, Baumgartner, 2007, p.117).

As illustrated in Table 17 below, four participants in this research had a PhD or were PhD candidates and one had a Master's degree. Comparing these participants with intervening teachers holding a Bachelor's degree, it is recommended to take into consideration that even though undergraduate teachers have developed the required concepts, they have not necessarily developed the complex abstract skills and competences graduate teachers possess. Eventually, these competences might have an important role to play.

Table 17: Participant Teacher Trainers' Profiles, Chosen Activities, Immediacy of Needs, and Levels of SSDL and e-Learning Culture Reached

	PTT1	PTT2	PTT3	PTT4	PTT5
Age	Between 31 and 40 years old	Under 30 years old	Over 50 years old	Over 50 years old	Between 45 and 50 years old
Degree of Education	Ph.D. candidate	Ph.D. candidate	Master's	Ph.D. Candidate	Ph.D.
Prior ICT Training	-	Creation of websites; Use communication functions of ICT (forum); Use of StudiUM to create a course	Management/Creation of websites	Use of Moodle to create a course	Search info on Internet; Pedagogical use of ICT; Use of communication functions of ICT (Forum)
Employee Status & Subject	Contractual employee in the role of lecturer in Special Education	Contractual employee in the role of lecturer in Special Education	Permanent employee in the role of French language pedagogical consultant	Permanent employee in the role of full professor of Biochemistry	Contractual employee in the role of lecturer in Intervention Plan SpecEd
PAV sought & Activity	Individualization, higher order thinking (analysis-creativity) Google Form & ScreenCast	Creativity Video-Clip Modelling and Blog Creation	Creativity Photo-Story Creation/ Telling, inserting voice, sound and pictures	Autonomy Diagnostic evaluation to identify students' needs about course prerequisites	Collaboration Refining intervention plans collaboratively
Meetings for Follow-up /Personal Support	Two meetings: Face-to-face. Duration: 2 hours each. Immediate integration and use of tool in professional practice. Evidence of this integration via polls and surveys using Google Form, showing mastery of the tool resulting from purposeful and continuous use.	Two meetings: One face-to-face and another via Skype. They lasted 90 minutes and forty minutes respectively. Not having immediate application in her course for the activity, it didn't go further.	Five meetings: Three Face-to-face. Duration: 2 and a half hours each. Two for additional support via telephone. 30-40 minutes each. Immediate integration and use of tool to achieve objective.	Seven meetings: Face-to-face. Duration: 3 hours each. Resulting in mastery of chosen tools; the students' prerequisite-knowledge diagnostic test; some pedagogical strategies to solve problem; the design outline of a proposed solution using PPT, screencast-O-Matic. Immediate integration and use of tools to achieve objective.	Two meetings: One face-to-face. Duration 30 minutes, and another one on the phone. Duration: 10 minutes allocated by the participant. Not having an activity on which to work, there was no further follow-up.
Emerging Immediacy of need	Immediate integration and use of ICT to enhance practice	Optional	Opportunity to reignite/ enrich project in stand-by due to lack of ICT skills.	Opportunity to respond to mandatory request of addressing an identified need of students.	Optional
Grow's 1991-1994 SSDL	Reached Stage 4: Self-directed learner.	Reached Stage 2: Interested Learner.	Reached Stage 3: Involved learner.	Reached Stage 4: Self-directed learner.	Reached Stage 2: Interested Learner.
eLearning Culture Level Reached	Level 4: Comprehensive e-learning culture.	Level 3: Awareness of facilitating conditions and constraints when integrating ICT.	Level 4: Comprehensive e-learning culture.	Level 4: Comprehensive e-learning culture.	Level 3: Awareness of facilitating conditions and constraints when integrating ICT.

Development of Participant Teacher Trainers' e-Learning Culture

Data from the pre- and post-intervention surveys, as well as notes from the researcher's journal and interviews, allowed to create a graphic to illustrate that participant teacher trainers (PTT) passed through different levels of development of their e-learning culture (see Fig. 17, below), which encompasses participants' *representations* of ICT, their *skills* (self-efficacy beliefs) and *attitudes* regarding ICT use in their teaching *practice*. Depending on where participant teacher trainers were in the process, these levels evolved from possessing very basic knowledge regarding ICT use to having acquired a more comprehensive e-learning culture:

Level 1- Very basic knowledge: They merely use [*practice*] basic tools such as Word, PPT and email to plan, prepare and deliver their courses; have some idea of the existence and potential of other ICT tools, without necessarily being willing to [*attitude*] explore them; and lacking knowledge [*skills*] and reflection about [*attitude*] ICT pedagogical added value (PAV) [*representations*]. When one of the participant teacher trainers was asked during the interview whether she had become more aware of the pedagogical added value of technology by participating in this research, she replied:

> *"[…] I was going to tell you that I did not become more aware of the pedagogical added value of ICT. I was unaware of it." (PTT4)* [25]

Level 2- Awareness of existence of tools and of pedagogical added value (PAV) of ICT: At this stage participant teacher trainers are aware [*skills*] of the diversity of ICT tools and of their pedagogical potential [*representations*]; they also acknowledge the benefit of [*attitude*] seeking some ICT pedagogical added value [*representations*] in teaching activities [*practice*]. For example, referring to the list of ICT tools presented in the pre- and post-intervention surveys, a participant teacher trainer declared:

[25] *« […] et bien, j'allais te dire, je ne suis pas devenue plus consciente. Je l'ignorais. » (PTT4)*

> *"This has allowed me to see the range [of tools…]. " "ICT is the big title, but in this set, there are all kinds of tools to meet my needs." (PTT1)*[26]

Level 3- Awareness of facilitating conditions and/or constraints when integrating ICT: Participant teacher trainers are aware [*skills*] of the facilitating conditions as well of constraints regarding ICT tool(s) integration in a specific teaching and learning context [*representations*]; they reflect on the benefit of [*attitude*] including some ICT pedagogical added value in teaching activities; they are capable of [*skills*] making the link between content, pedagogy and technology. However, there is no actual implementation of activities [*practice*] integrating ICT looking for PAV yet.

Level 4- A comprehensive e-learning culture: At these level, participant teacher trainers reflect on the benefit of [*attitude*] including some ICT PAV; they are aware [*skills*] of specificities of the tool, its suitability and pedagogical potential [*representations*] for integration in a chosen activity [*practice*]; they reflect on the benefit of seeking specific ICT pedagogical added value to enhance teaching and achieve targeted objectives [*practice*]; they reflect on and consider [*attitude*] facilitating conditions and constraints having an impact on the effective and successful pedagogical integration of ICT in the teaching/learning process; they are willing to [*attitude*] learn about and master the tool [*skills*]; they are able to connect content, pedagogy and technology [*skills*]; plan for and design activities [practice] that foster capacity to transfer; they have the intention of [*attitude*] actually implementing activities integrating ICT looking for ICT PAV.

Figure 17 below presents the evolving process regarding participant teacher trainers' e-learning culture and their features. It includes '**Level Zero:** No idea about, no interest in ICT', even though it does not describe an actual situation in our current research. We decided to include this level along with the other participant teacher trainers' e-learning culture levels emerging from our data, since it completes the whole process by beginning at the lowest basic level.

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[26] *« […] ça m'a permis de voir la largeur de l'éventail […] On dit les TIC, mais les TIC c'est le grand titre, mais dans cet ensemble-là il y a tout plein d'outils pour répondre à mes besoins. » (PTT1).*

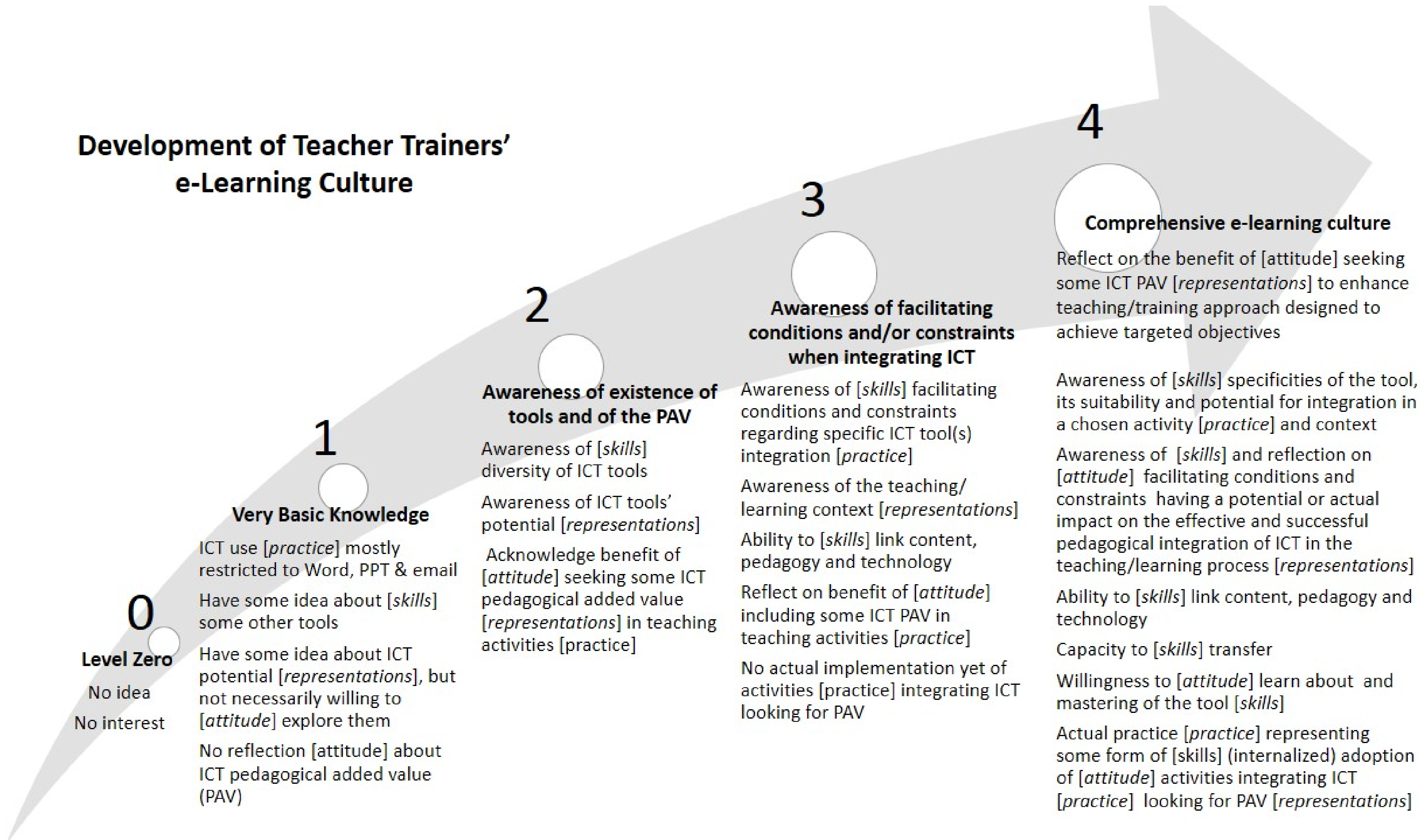

Figure 17: Development of participant teacher trainers' e-learning culture – Levels 1 to 4- and their features. Level zero is shown here as a possibility, even though not found in the current research

We also present here in a capsule-form, since further explained and illustrated throughout this chapter, how after the training intervention, participant teacher trainers have become (more) aware of their perceptions and how they have evolved regarding ICT integration; how they think now about ICT, namely, their emerged e-learning culture. This was made evident most of all from their comments and answers to questions during the interview.

As such, a summary table of participant teacher trainers' (PTT) answers to the individual interview questions provides us with a means to: 1) have some insight of their emergent profile and illustrate their evolving e-learning culture; 2) present in a compiled mode their perception regarding ICT integration in the teaching practice, as well as the impact of the training intervention, including follow-up and (optional) personal support. (See Tables 18 below)

Table 18: Participant Teacher Trainers' Emergent Profile through Synthesis of their Answers during Individual Interviews

Question	PTT1	PTT2	PTT3	PTT4	PTT5
Q1: In your opinion, would it be important, or not, to integrate ICT into your teaching practice?	Focus mainly on ICT as TOOLS that allow to go further: -Tools that provide access to a wealth of resources (including human resources), knowledge. - Tools that allow networking, having access to experts; making students active; - As collaborative tools for students to co-build knowledge e.g. blogs, where teachers can foster high-level knowledge; high-level skills ("*because it allows students going beyond the recitation"*), and problem solving, by facilitating exchange among them.	Focus on RENEWING her teaching practice (She perceives it as being quite old, and too "20th century") to: - Integrate *some* ICT elements into her practice, i.e., it won't be a model essentially based on ICT. -Address her students' needs - Be able to help ALL her students grow in the use of ICT. (Since she perceives some students as being even more competent in ICT integration than their teachers).	Focus on CREATIVITY ICT allows to dive into the voice, image and sound via the computer.	1. It is MANDATORY. 2. Focus on ICT tools and all the resources: It helps to IMPROVE STUDENTS' LEARNING. - Since not enough time to respond to students individually, ICT may allow reaching each one of them in a personalized way. - Allow teachers to SAVE WORK AND TIME. For example, by having students working in pairs or in groups of 3, giving feedback to and evaluating each other.	Focus on her teaching practice: ICT could ENRICH her course. - It can facilitate and enrich teacher-student communication - It can also facilitate evaluations, and course design.

Table 18: PTT's Emergent Profile through Synthesis of their Answers during Individual Interviews (Continued)

	PTT1	PTT2	PTT3	PTT4	PTT5
Q2: After participating in this research, which changes you have observed in your perception about the use of ICT in your teaching practice?	- It was not her way of seeing ICT, but her perception of competence/skills that changed: She had fears that were not justified. - She feels now more confident, more capable and competent. - Before, she thought she had to get to know the content first, because it would take her time getting to know the tools. But exploring the tool feeling/being supported and guided, it did not take her a minute to understand its capabilities, how it worked. - She plans to make changes when giving her course a second time (an online questionnaire); do more: collaborate with her students online rather than having inclass discussions.	- She was surprised by realizing her lack of in-depth knowledge about ICT, since she had the impression she knew about it. - She now sees she could do rather "extraordinary" things using ICT. - She is now aware of capabilities StudiUM offers (forum, wikis) - PPT becomes more than just a visual aid (by inserting sound, *capture video.* - Blog was something from the social domain not school related.	- *"This has made me get control of my own activity. It didn't come near me, the possibility, because I was not yet completely available to work with ICT*." - Before, she had not set her mind in relation to ICT. No opening. - She always took ICT as a possibility. She didn't explore. She had no time to explore. - If now she opens and accepts it, she thinks it'll help her with structured projects, to enjoy and achieve the results she's looking for (Creativity).	- Before participating in this research she perceived ICT as being difficult. She has trouble with the technical aspect. - But exploring the tool feeling/being supported and guided, it did not take her a minute to understand its capabilities, how it worked. - Now it's easy for her after seeing how to do it. She used to put some resistance because she learned as situations arose. For her it's gone now, this difficulty. As she said, "*it's easy, and now I can do it*." Because of the personal support received. - She perceived this personal support as being very important. Her fears are gone. Because she was being guided/ supported when following instructions, she perceived them as simple and easy to follow. She became motivated to create her own tool: –"supported, of course. (She feels that she will always have to ask for help when working with ICT).	- *"It gave me a choice. From the beginning my intention, when you presented it, then suddenly, I saw it to enlarge and become of a wider range. Look, I can also use it to do this and that. Not just a thing or two, it expands, without any doubt, my intentions."*

Question	PTT1	PTT2	PTT3	PTT4	PTT5
Q3: Impact of training intervention on intention to use ICT to: a) Look for PAV of ICT in course activities	- She mentioned that she was already interested in integrating ICT into her practice. - But, she feels now more competent; more motivated to try new things out and look for the PAV of ICT.	- Having a pedagogical interlocutor/discussion with researcher/trainer motivated her to teach again this course, but in another format, using methodologies to keep students engaged. - Even though more motivated, still needing support & guidance.	- It increased her intention to develop her activity integrating ICT. - Open new avenues to take ownership of her activity by integrating ICT tools that facilitated her reaching of goals while enriching it.	- She acknowledged not knowing about the ICT PAV prior to this training: *"I didn't become more aware of it, I ignored it"*. - She feels motivated to try new things; look for ICT's PAV to increase students' engagement.	- She mentioned having in mind from the very beginning the *collaboration* aspect.
b) Some new ICT uses you would like to make?	c) Strategies you'd like to implement to e.g. introduce an activity; embark students?	- Online survey (pop-quiz) - Google Form - Convert at least one of her courses into a "flipped course"	-Actually, she hadn't think of any. - Strategies that help her going beyond knowledge transmission, foster students' understanding, engaging them in their own projects to improve learning. It takes time, though.	- Mini-productions: To start exploring/working on actual personal projects and experiences. - To address students' own needs, but using the strategies she chose.	- Include "flipped classroom" format to her classes, aiming at fostering students' active participation in achieving learning goals.
c) Strategies you'd like to implement to e.g. introduce an activity; embark students?	- Online survey (pop-quiz) - Google Form - Convert at least one of her courses into a "flipped course"	-Actually, she hadn't think of any. - Strategies that help her going beyond knowledge transmission, foster students' understanding, engaging them in their own projects to improve learning. It takes time, though.	- Mini-productions: To start exploring/working on actual personal projects and experiences. - To address students' own needs, but using the strategies she chose.	- Include "flipped classroom" format to her classes, aiming at fostering students' active participation in achieving learning goals.	- Using Drive to follow students' evolution, and work share.

Table 18: PTT's Emergent Profile through Synthesis of their Answers during Individual Interviews (Continued)

Table 18: PTT's Emergent Profile through Synthesis of their Answers during Individual Interviews (Continued)

Question	PTT1	PTT2	PTT3	PTT4	PTT5
Q4: Impact of the follow-up and personal support on your e-learning culture?	- Personal support made her feel equipped. She knew the researcher ⁄ trainer was there available if she had any concerns, questions - Easier for her to embark in and exploring new tools, software. - It allowed her to learn a new software she totally ignored. - Awareness regarding scope of the possibilities at her disposal to address needs (list of tools presented in the pre-and post-intervention survey).	- Super motivated her. She feels 'super'. She would teach this course tomorrow, but in the new format. It would be more interesting for the students. - Increased perception of: * Benefits & advantages of integrating ICT in class; * Awareness of amount of preparation time required for planning these courses; * Need of (formal) training, time allocation, and support.	-Openness regarding the prior reticence and hesitation to use ICT tools. - Change of attitude: Feeling more relaxed and appreciative of ICT tools' PAV in teaching musical environments, instead of being upset and stressed. - It is the notion of *affect* that is key for her here. It enabled her to express herself freely and safely.	- They were fundamental. She was used to be asked to do ICT-related tasks and be left alone to carry them out. Thus, she did nothing, or just pretended to do it. - She had researcher⁄trainer to guide, support her, had pedagogical discussions to weigh decisions, when planning and designing a diagnostic tool. This increased her motivation and self-efficacy beliefs.	- There was no activity to be actually discussed.

Table 18 above (pp.171-174), provides a portrait of participant teacher trainers' emergent and evolving e-learning culture. We may argue that their e-learning culture was actually developed during the individual meetings held with the researcher ⁄ trainer, for follow-up and personal support, as illustrated through their comments during the individual interviews.

Excerpts of these interviews with participants are also presented throughout this section to illustrate the different items resulting from the analyses we conducted and attached to the category e-learning culture and its 4 sub-dimensions: Representations, skills/resources, attitude/affect, and use/practice. The information collected from the post-intervention survey, as well as notes taken during follow-up meetings contributed to confirm any changes taken place in their e-learning culture.

Using the IntersTICES model proved effective not only in facilitating teacher trainers' understanding regarding where the pedagogical added value of technology is,

> *"These are tools that provide access to a wealth of resources, a wealth of knowledge, resources, ultimately, knowledge that can be accessed, but also human resources [...] It allows us to networking, have access to experts, which we would not otherwise be entitled to or otherwise access [...] another reason, I also see the importance of making our students active and ICT allows this, collaborative tools allow that. [...] tools for knowledge co-building [...] to make students active, [...] blogs, where you can work out the high-level knowledge, the high-level skills because we go beyond the recitation, and solve problems, [...] by exchanging among them. These tools allow to go further. " (PTT1)*[27]

but also in reflecting the participants' e-learning culture. Teacher trainers' understanding regarding where the pedagogical added value of ICT is, implied a substantive

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[27] « *c'est des outils qui donnent accès à une foule de ressources, une foule de savoirs, des ressources, en fin, des connaissances qu'on peut aller chercher, mais aussi des ressources humaines* […] *Ça nous permet de nous resauter, d'aller avoir accès à des experts, auxquels on n'aurait pas le droit autrement ou accès autrement* […] *une autre raison, voir aussi l'importance de rendre actifs les étudiants et les TIC permettent ça, les outils collaboratifs permettent ça.*[…] *les outils de co-construction de connaissances comme les blogues, les wikis, les pages wiki* […] *les créations des sites qu'on peut faire autant de nos recherches ou d'un cours* […] *je vois aussi pour rendre actifs les étudiants tous les forums de discussions*[…] *les blogues, où là on peut travailler les savoirs de haut niveau les compétences de haut niveau parce qu'on va au-delà de la récitation. » (PTT1)*

change vis-à-vis their perceptions about working with technology, as well as a change in their actual current practice or their intentions to practice. It also required teacher trainers to go way beyond the presentation of these new ideas and to take ownership of and discuss these ideas (e.g. with their colleagues), look for other references, etc. By means of the IntersTICES model we provided them with tools for identifying and reflecting on, for instance, what facilitating conditions and/or constraints were to be taken into account when planning activities (integrating ICT), and taking full advantage of the potential pedagogical added value of the tool.

The presentation of the following results is done establishing the relationship between the e-learning culture and its sub-dimensions, and not necessarily following their order of appearance in the table, which is determined by number of occurrences, and is presented in Table 19 below.

Table 19: Impact of the Intervention, personal support and follow-up on participants' e-learning Culture

Code - Indicator	Occurrence (138 times)	Occurrences by Participant Teacher Trainer (PTT)					Cases (N=5)
		PTT 1	PTT 2	PTT 3	PTT 4	PTT 5	
Positive Representation	12	5	2	1	2	2	5
Awareness of existence of tools	10	4	2	1	2	1	
Awareness of potential of ICT tools to respond to needs	14	2	6	1	3	2	
Awareness of resources at their disposal	5	1	1	1	1	1	
Increased self-efficacy	14	5	2	1	6	0	4
Changed Negative Representation- skills	11	2	4	2	3	0	
Negative Representation- Time	10	4	2	2	3	0	
Student-related representation	6	2	2	0	1	1	
Need of Resources - Time, training	6	1	2	1	2	0	
Aiming at making students active	4	1	1	0	1	1	
Access to resources	4	1	1	1	1	0	
Change in e-learning culture	11	1	1	4	5	0	
Awareness of own ICT use	6	2	3	0	1	0	3
Importance of making student become active	3	1	1	0	1	0	
Institution-related representation	3	1	1	0	1	0	
Positive Attitude	9	5	2	2	0	0	
Negative Attitude	3	1	1	1	0	0	
Need of Resources - Personal support, technician	4	1	0	1	2	0	
Higher Order Knowledge Skills	3	1	1	1	0	0	
Specific actions to be taken when giving course next time	3	1	1	0	1	0	
ICT- as tools that facilitate learning	3	0	1	0	2	0	2
Access to experts	2	1	0	0	1	0	
Access to information	2	1	0	0	1	0	
Access to knowledge	3	1	0	0	2	0	
Type of information shared via the tool	3	1	0	0	1	0	
Previous bad experience	3	0	0	1	2	0	
Awareness of own ICT Skills	2	0	1	0	0	1	
Expressing need of support	2	0	1	0	0	1	
Attitude regarding social influence	2	0	0	1	1	0	
Knowledge-Building Tools	2	0	0	0	2	0	1
Access to human resources	1	1	0	0	0	0	
ICT use	1	1	0	0	0	0	

Table 19 presents the Impact of the Intervention, personal support and follow-up on participants' e-Learning culture. For example, for the first line regarding positive representation, results show that this dimension was mentioned 12 times as follows: participant teacher trainer (PTT) 1 talked about it 5 times, PTT2: 2 times , PTT3: 1 time, PTT4: 2 times, PTT5: 2 times. The last column (Cases N) indicates the number of participants out of five that have talked about this dimension. The total number of occurrences is 138.

Representations. One of the main elements of the e-learning culture is the Representations. To find out about participant teacher trainers' representations we used mainly the intervention surveys, the interviews, and notes from the researcher's journal.

Results show that all 5 participant teacher trainers manifested 12 times during the interview having a positive representation of ICT (See Table 19 above). All of them expressed during the individual interview being now aware of the potential of some ICT tools to respond to their needs, and illustrated this perception through the use they could make of ICT, which is summarized below under Uses.

Having a look at the number of occurrences per code, e.g. *positive representation*, we could easily be led to think that PTT1 has a much better representation of ICT, since she mentioned 5 uses we can make of ICT. However, these uses were previously mentioned to/by all participants during the first meeting when the IntersTICES model was introduced, and its indicators of pedagogical added value (PAV) were discussed, explained and exemplified. We may then suppose that after the training intervention taking place, all participants were equally aware regarding these uses, as clearly illustrated also by PTT2's number of occurrences when referring to *potential of ICT tools to respond to needs* and, as such, suggesting an implicit use. (See Table 19, above).

What is evident, though, is that PTT1 elaborated more, she made a synthesis of the possibilities already discussed, some of them already known by her - as she confirmed when asked for validation regarding this question. She presented the many possibilities of using ICT tools as reasons she has to integrate (some of) them in her teaching practice. She verbalized her awareness. As well as the others, she was presented and saw a panoply of tools that could be used to address an identified need of their course/students, and as the others, she chose one tool to integrate in her activity. Two different ways of reacting to our question. Therefore, we can assume that the number of times a topic was mentioned does not mean that the participant was more aware than the one that referred to it just once. Whether during the interview one of them decided to integrate in her answer something already discussed, there is no means to know why the others didn't. Nevertheless, it may be taken as some shared knowledge that was internalized.

Positive representation expressed via *Use*. Here we present some of the uses participant teacher trainers mentioned they could now make of ICT tools. e.g: 1) for creation of websites for research and for their courses (PTT1); 2) as collaboration tools where networking is facilitated to exchange information via a specific chosen tool (PTT1); 3) to facilitate access: a) to knowledge; b) to material resources; c) to human resources; d) to experts (PTT1); 4) as knowledge-building tools that facilitate learning (PTT4), (PTT5) allow going beyond and foster higher order thinking skills (PTT1); 5) as tools that can be used aiming at making students active (PTT1), (PTT2), (PTT4), (PTT5); 6) as tools that facilitate doing things they wanted and decided to do (PTT2); 7) as tools allowing to look for added value for the student, (PTT1) (PTT2), (PTT3),(PTT4), (PTT5) all the above, presented also as valid reasons to integrate ICT.

All participant teacher trainers viewed technology presented as a '*What is in it for me'* proposition. They evaluated the technology based on how it was going to assist them in accomplishing their educational goals, which matched the perspective facilitated by IntersTICES.

Regarding participant teacher trainers' positive representations made evident through their willingness to try new things out integrating ICT, we may argue along with Fullan (2001) that teachers who are actively involved in their own professional development are more prepared to implement the changes they consider necessary in their teaching. Furthermore, teachers who have a strong engagement towards their own professional development, are more motivated to undertake activities, which lead to a better understanding of the goals of an innovation (Somekh, 2008).

ICT Skills. Changed negative representation. Data also suggest that negative representations related to their perceived lack of ICT skills was participant teacher trainers' main concern, being mentioned 11 times. They realized that it is no longer the case, though, and that they are very capable of learning about and master one tool at a time, when they are shown how (via modelling) and feel supported while doing it.

> *"Personally, I had a hard time when faced with new technologies. [...] I had difficulty manipulating machines. Technically." (PTT4)*[28]

> *"I was not yet completely available to work with ICT. [...] at the beginning I was terrified" (PTT3)*[29]

Participant teacher trainers admitted having wondered whether it would be difficult to learn the tool they picked, when presented with ICT choices. This attitude conforms to results of research on acceptance and use of technology (e.g, TAM, Davis, et al. 1989; UTAUT, Venkatesh et al., 2003) where the expected amount of effort required to interact effectively with the technology affects user's attitude toward using the technology. Those technologies that are perceived to be easier to use will more likely be accepted and in turn used more (TAM, Davis, et al. 1989; UTAUT, Venkatesh et al., 2003).

Perceived lack of ICT skills.

Even though, as aforementioned, being participant teacher trainers' main concern prior to participating in this research, the influence of their perceived non-ICT competence on their innovative use of ICT actually didn't count much. This may be explained by the fact that in our research participant teacher trainers aiming at using ICT innovatively (i.e. Doing things differently), developed their competence based on their own needs and the educational goals they wanted to achieve with the help of ICT - One tool at a time, though - and accompanied/supported during its exploration and use. Moreover, they demonstrated a positive attitude and were pro-active in taking actions to address identified issues, and setting goals for themselves, which played an important role in their intentions to integrate ICT in their practice.

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[28] *« Personnellement, faire face à la technologie était difficile pour moi* [...] *Il y avait de la difficulté pour moi dans la manipulation des machines. Techniquement. » (PTT4)*

[29] *« J'étais pas encore disponible complétement à travailler avec les TIC, voilà.* [...] au début j'étais terrorisée *» (PTT3)*

For instance, designing and building a diagnostic test using Google form, to identify knowledge gaps in students' course content-prerequisites. The teacher trainer went a step further to exploring alternative approaches via video clips, to help students upgrade identified knowledge gaps. Embarking on this exploration may also explain the positive influence that ICT competence has on the pedagogical approach to be implemented –more student-centered. It seems that this perception of ICT competence is a necessary condition for the use of ICT, but in order to implement innovative use of ICT, other factors are also important and need to be considered. For example, building on the IntersTICES model, becoming knowledgeable about and reflect on how to foster facilitating conditions and overcome constraints e.g. actual characteristics of their students, as illustrated above.

As aforementioned, results suggest that participant teacher trainers were concerned about their lack of ICT skills. It is, therefore, important to make them become aware via explanatory theories (e.g. our merger of the UTAUT with the e-learning culture dimension of the IntersTICES model) that there is common understanding regarding acceptance and use of (new) technology as somewhat complex and demanding.

In our research, being working on their own activity, learning at their own pace about one tool at a time that responds to their specific needs while counting on optional support, motivated participant teacher trainers to explore different ICT uses. (See Table 16 for an illustration).This also encouraged them along the path towards creating the type of ICT integration they wanted. Participant teacher trainers actually perceived and explicitly reported an increase in their self-efficacy, as illustrated in Table 17.

Moreover, in contrast with expectations, initial teacher trainers' competence in ICT-use, (perceived by the teacher trainers themselves) had no direct influence on their innovative ICT-planned and intended use. They were able to describe what they wanted to achieve by integrating an ICT tool into one chosen activity. They were also willing to explore the tool identified as allowing them to achieve their targeted goal. All this, despite the fact that they did not know in advance, either, which ICT tool would allow them to address their identified need(s).

Regarding the constant and fast change of technology, many teachers feel that they are perpetually novices in its use. As one of the participant teacher trainers expressed, she felt an endless pressing need to keep up-to-date and train herself on the use of technology. This statement conforms to Wood et al. (2005) and Ertmer, et al. (2012) who emphasize the affective nature of teachers' responses to technology.

However, while ICT tools are continuously changing, content and pedagogies are in most cases relatively constant. Teacher trainers can be reassured by reminding them to keep in mind that the role the tool plays is determined by its affordances and the use the teacher assigns to them. This boosts teacher trainers' feeling of being in control so they can easily keep focused more on content and pedagogy, without being much distracted by the characteristics of the tool.

Skills and student-related representations. Results from data suggest that ICT is perceived as being part of their students' lives, and their students as being more ICT-skilled than them -the teachers.

> *"[…] It's because [the] students [have ICT skills] above [the normal]. Some students are even more competent than teachers are in ICT integration. As a teacher, if I'm not capable of helping them continue through that process, I don't know why I am here." (PTT2)*[30]

As such, institutions cannot ignore the need of ICT integration in the teaching practice. Moreover, administrators may have immense influence on teachers' intention to use technology for instructional purposes. It is just a matter of deciding to actually doing their part regarding this ICT integration in the curriculum.

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[30] *« […] parce que des étudiants sont en avant [des TIC] […] Certains des étudiants sont même plus compétents que les enseignants le sont en intégration des TIC, moi, si en tant qu'enseignant je ne suis pas capable de les aider à poursuivre dans ce cheminement-là, je ne vois pas pourquoi je suis là.* » (PTT2)

"I would need support and assistance because I don't see me doing this by myself, because I am still, euhhhhee, lost. […] Some students are better than teachers in the integration of ICT." (PTT2)[31]

"[…] there is also the speed at which technology changes. This means that every time or every day, I have to train me, what, on the new technology." (PTT2)[32]

There is, nevertheless, as aforementioned, a concern that emerged. Participant teacher trainers stated the need of constant retraining to keep abreast of the technological changes, since technology changes so fast. This is highlighted by Teo (2011), who found that due to rapid technological advancements, teachers will soon experience limitations if they do not participate in continuing professional development to keep abreast with more advanced skills and knowledge on the use of technology. Consequently, such teachers will soon perceive technology to be difficult to use, not contributing to their productivity, and a problem to use, resulting in the development of avoidance behaviours with respect to technology use for teaching and learning (p. 2438).

Skills -ICT competence- Self-efficacy beliefs

According to teacher trainers participating in this study, their intention of integrating ICT in their teaching practice is highly influenced by the positive changes they perceived in their ICT competence, as a result of personal support in the form of modelling, while exploring the tool, and pedagogical discussion with the researcher during the Follow-up and Personal Support Phase of the training intervention.

Our findings conform to Bandura's (1997) theorizing and other researchers' (e.g. Ertmer, 2005; Ertmer et al. 2012) empirical reports showing that perceived mastery experience is a powerful source of self-efficacy.

[31] *« J'aurai besoin d'un soutien et d'un accompagnement, parce que je ne me vois pas à faire ça toute seule, parce que je pense que je suis encore, euhhhhee, perdue là* […] *Certains des étudiants sont même plus compétents que les enseignants le sont en intégration des TIC. » (PTT2)*

[32] *«* […] *Il y a aussi la vitesse à laquelle la technologie elle change. Cela veut dire qu'à chaque fois ou chaque jour, je suis obligée de me former, quoi, sur la nouvelle technologie » (PTT2)*

Participant teacher trainers felt that the opportunity to discuss and share their concerns -regarding ICT integration with the researcher/trainer during meetings for follow-up and personal support- contributed to their confidence in attempting to explore the tool. This feedback from pre-service teacher trainers confirmed the findings from literature (e.g. Dede, 2014; Drent and Meelissen, (2008); Somekh, 2008) that teachers need to feel comfortable with the technology skills before they can consider designing and integrating the tool into a lesson. Furthermore, participant teacher trainers stated that they very much appreciated the time allocated for hands-on exploration of the tool in team with the researcher/trainer rather than as individuals (by themselves).

Resources. Regarding other representations, results indicate that participant teacher trainers in terms of both material and human resources, recognize: 1) having more resources at their disposal when planning to integrate ICT into their teaching practice. They are actually more aware of the existence of tools with potential to respond to their needs than before the intervention. e.g. Having guides and tutorials available for free in YouTube; illustrations and examples via specialised fora and blogs on the Internet; educational software (to be) installed in their personal computers, and in the labs (for their students); 2) particularly the need for support e.g. from a more expert colleague/a mentor, to help them using ICT in pedagogically meaningful ways.

Need of resources: Accordingly, and even though to a lesser degree, results show that need of resources e.g. time and training, as well as personal support –a technician-, appeared also as a concern, mentioned 6 and 4 times respectively.

Time: It was the second-most cited apprehension – 10 times. It refers to participant teacher trainers' representation of the amount of time required to plan and prepare courses integrating ICT.

> *"I did not explore, I didn't have the time to explore." (PTT4)*[33]
> "[...] *that takes time to do it, too." (PTT3)*[34]*;*

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[33] *« Je n'explorais pas, j'avais pas le temps de l'explorer. » (PTT4)*
[34] « [...] *ça prend le temps de le faire, aussi. » (PTT3)*

"[…] already when you take a course without ICT, it takes a huge amount of time to prepare the class beforehand and you weren't even going for that. But with ICT it's even worse." (PTT2)[35]

Regarding participant teacher trainers' needs, results show that all participant teacher trainers found the following facilitating conditions as required for them to start using technology in their courses:

Facilitating conditions: 1) **Training** for both themselves and their students, in terms of learning about how to use the tool, its advantages, potential and specificities; 2) **Time** allocated to learn how to use, explore and actually try ICT tools; 3) **Access to material resources** (labs, computer and software) **and human resources** (a technician, support from a mentor or more proficient colleague during all steps of mastering of the tool process).

"I can really see it, the potential of ICT, but from there, I know that at some point, I have to put something in place. They have to put in place training, coaching and take into account that it takes time." (PTT2)[36]

Constraints. Absence of the above mentioned facilitating conditions may constitute for participants teacher trainers and their students, constraints that would prevent them from using ICT.

"When people used to tell me: "ICT are good. Come! Here's the Moodle platform, look at all you can put on it." Yes, but they didn't tell me how to use it pedagogically, with a model, and a good theoretical basis, that's what they are useful for." (PTT4)[37]

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[35] « [...] *déjà quand tu prends un cours normalement sans les TIC, tu prends du temps énorme pour préparer le cours avant et tu n'es même partie pour ça. Mais avec les TIC c'est encore pire. » (PTT2)*

[36] *« J'arrive à vraiment voir, les vraies potentialités des TIC, mais à compter de ça, je sais qu'à un moment donné il faut que je mette quelque chose en place. Faut qu'ils mettent des formations, un accompagnement, deprendre en considération que ça prend du temps. » (PTT2)*

[37] « […] *Lorsqu'on me disait : les TIC sont très bonnes, venez, voici la base Moodle, regardez tout ce que vous pouvez y mettre. Oui, mais on ne m'a pas dit comment l'utiliser pédagogiquement, avec un modèle, avec une bonne base théorique, cela sert à ça. » (PTT4)*

Accordingly, in terms of resources, action requires material and technical resources (Masciotra and Morel, 2010).

> *"[…] it was like a realization. Both times. I know this wasn't your intention when proposing the questionnaire, but …" (PTT1)*[38]

In fact, it was on purpose that we presented participant teacher trainers - through the pre-and post-interventions surveys- a list of ICT tools asking them about their use. This strategy aimed at not only informing them about their existence, but most of all, making them aware of the wide array of ICT tools that may be used to respond to their specific needs.

Other Resources / Types of Support

It should be noted that providing software, hardware and support is critical, but other strategies are needed if technology is to be used in a meaningful and effective manner (Kay, 2006, p. 390). In our research, for example, all participant teachers found that for them to start using technology in their courses they would require to have some training (for them and their students) regarding how to use the tool, time for meeting for discussing, exploring and actually start using it, as well as material resources (software) and human resources, a mentor. These facilitating conditions would allow them to engage in pedagogical discussions to explore, get to know and align the affordances of the tool with appropriate pedagogy strategies for achieving their targeted objectives.

In fact, teacher trainers made evident, by explicitly stating to the researcher/trainer their need for pedagogical and professional support as they began exploring new ways to integrate ICT within their teaching practice. This finding conforms to what Masciotra and Morel, (2010) call *a social resource*, since according to them action rests on social mediation[39] (Masciotra and Morel, 2010).

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[38] *"… C'était comme une prise de conscience. Les deux fois. Je sais que ce n'était pas ton but…» (PTT1)*

[39] *L'action repose sur une médiation sociale : mon entraîneur, qui me conseille, constitue pour moi une ressource sociale. (Masciotra et Morel, 2010)*

Personal Support

Exploration and modelling of how to use the tool during follow-up and personal support sessions were then provided to scaffold teacher trainers on how to integrate ICT in their chosen activities. These results corroborate research evidence (e.g. Chandler and Sweller, 1997; Wedman and Diggs, 2001; Angeli, 2005) indicating that pre-service teachers usually have difficulties when learning how to use technology tools. Focusing on the role that technology can play in the design of technology-enhanced learning environments, and not on being the point of instruction, is vital, according to Angeli (2005). Therefore, helping teacher trainers to have a clear and pedagogical rationale (e.g. the pedagogical added value- PAV for them and their students) for integrating technology in their practice kept them motivated to actually start using and eager to incorporate some ICT in their teaching.

The clear advantage of using modelling when exploring together the tool and learning how to use it, is that it transfers directly to the real world classroom. The results of our research suggest that this can be easily and effectively fostered by first selecting an activity of their own courses on which teacher trainers would like to integrate some ICT. As such, the researcher/trainer needs to focus on collaboratively exploring (with the teacher trainer) ways of addressing their specific needs in terms of pedagogical strategies, tools and resources to be implemented through an activity.

No Modelling and No Personal Support Resulted in not Achievement of Activity's Objective

To illustrate this, we have for example a participant teacher trainer's activity. The PTT and the researcher⁄trainer had a first meeting and discussed about this participant teacher trainer's desire to improve *Collaboration* among her students while making them active; as well as her need to be able to follow students' participation and work on the assigned team-task.

Together, during a first meeting the PTT and the researcher⁄trainer decided on the tool that could respond to her need. -The same procedure that was implemented with the other participants: a first meeting to discuss and decide on a tool -. Regarding PTT5 however, due to her lack of availability- No time- to meet, there was no proper follow up and personal support. When contacted by phone, the PTT made clear that she could allocate 10 minutes for that phone meeting. During that phone meeting, the researcher⁄trainer was unable to clearly provide guidance on how to proceed to start working with and sharing a document via the chosen tool. Not just because of the short time allocated, but mostly because being very visual the researcher⁄trainer was lacking a visual reference to be able to go through with the explanation: They were using different operating systems: MAC and PC.

We may accurately suggest, that this lack of availability, in terms of time to meet, and the exasperating experience on the phone, hindered PTT's participation afterwards. Besides, there was no further step or activity to be discussed about. Nevertheless, her participation during the interview and final meeting provided us with insightful feedback. Moreover, this incident confirmed the importance of allotting time to meet for at least three times, for a customized and appropriate follow-up and personal support.

Attitude. Changed negative attitude regarding *Time*. Participant teacher trainers' negative attitude was mainly related to the perception they had regarding the amount of time required to learn how to use and master the tool. They realized it was not the case any longer. This change in attitude may be explained based on Weiner (1984), who posits that a person's perceptions are in close relation with emotions and motivation, and they are also influenced by their cognitive processes and evolve according to the events she lives.

> *"If I hadn't taken the time to do it, it's because I had the impression that for me to get to know the tools, it would have required time. I kept putting [ICT] off" (PTT1)*[40]

It was mentioned, however, that there is **Lack of the institution's recognition** regarding time investment needed to integrate ICT in courses, openly expressed as:

> *"[...] it takes an enormous time, is not negligible the time that is not counted in the payroll for the lecturer." (PTT2)* [41]

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[40] *« Si j'avais pas pris le temps de le faire c'est parce que j'avais l'impression que m'approprier les outils ça me prendrais du temps. Je remettais ça à plus tard.* » (PTT1)
[41] *« [...] ça prend un temps énorme, c'est pas négligeable le temps qui n'est pas compté dans la paie du chargé du cours. » (PTT2)*

Attitude. Positive attitude. Data also show that participant teacher trainers have a positive attitude towards ICT integration in their teaching practice. As illustrated by the following comment from a participant teacher trainer:

> *"I think this is a course that has great potential, and in which we can actually develop many things [by integrating ICT]."* (PTT2)[42]

Regarding participant teacher trainers' investment, we may argue that they had the intrinsic motivation, which may translated into positive attitude, to embark in exploring, learning and taking ownership of the tool chosen, since they would be able to address an identified need of their own course/students. This is aligned with the principles that guided our intervention in terms of adults working with authentic tasks or real-world problems as part of the teaching and learning process.

Two participant teacher trainers (PTT3 and PTT4, both aged over 50 years old), for example, regardless their previous reluctance to use ICT , went even a step farther, and together with the researcher/trainer, designed instruments to be used as part of their activity. Both of them explicitly declared 4 and 5 times respectively, how they have changed their perceptions regarding ICT integration, their attitude towards this integration (e.g. "*I did not become more aware [of the pedagogical added value of ICT], I did not know about it*!"[43] "[…] *now, I can begin to integrate the added values*." PTT4)[44]; their self-efficacy beliefs ("*To me it is gone…this difficulty. As I said, now, it is easy, and I can do it. I know I can do it!*" PTT4)[45] ; their perception of amount of time required to explore, learn and take ownership of an ICT tool, *("Since I took it as a possibility, I didn't explore [ICT]. [Now] I am open to it, and even*

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[42] *« J*e pense que c'est un cours qui a un gros potentiel, dans lequel on pourra mettre en place vraiment beaucoup de choses-là. » (PTT2)
[43] Je ne suis pas devenue plus consciente: Je l'ignorais [la valeur pédagogique ajoutée]! (PTT4)
[44] […] maintenant, je peux commencer à intégrer les valeurs ajoutées (PTT4)
[45] Pour moi, elle n'est plus là ... cette difficulté. Comme je le disais, maintenant, c'est facile et je peux le faire. Je sais que je peux le faire!(PTT4)

if I accept that, yes! It will help me." PTT3)[46] "*The hesitation I had in using it [ICT], has moved toward a certain level of openness."* PTT3)[47]. In other words, they expressed how they experienced changes in their e-learning culture. Moreover, it was clear that they were at ease explaining the rationale of their pedagogical added value (PAV) choices and integration of technology.

On a more general note, even though participant teacher trainers' ages varied between 29 and around 55 years old, they were equally unskilled regarding pedagogical use of ICT. However, they were not equally aware of their actual lack of skills. The older ones, from the very beginning, manifested openly their fears and previous bad experience regarding ICT. This contrasted with declarations made by the younger ones during the interview, where only at this time, they mentioned and even recognized with surprise, being now aware of their lack of ICT skills and the need they had of support to embark on this exploration of ICT tools.

We may argue that participant teacher trainers experienced a notorious change in their attitude regarding ICT adoption, in terms of self-efficacy beliefs and perception of the amount of time required to learn how to use and master the ICT tool. They realized that after exploring the tool with the researcher/trainer the self-perceived difficulty was not any longer felt, and the time to learn the tool was amazingly shorter than expected. As Masciotra and Morel, (2010) posit, *L'action relève d'une attitude,* -action stems from attitude-. Attitude is the key factor for the integration of the innovative use of ICT into the teaching/learning process. Even when resources are limited and access to computer suites is problematic, the individual teachers' attitude is the vital factor in determining ICT use (Gill and Dalgarno, 2008). It fosters the motivation to keep in charge of their own personal development in the use of ICT (Somekh, 2008, Gill and Dalgarno, 2008). This was made evident via the manifested increase in intention of participant teacher trainers to integrate ICT in their teaching practice, to try new things out and introducing new strategies seeking for the pedagogical added value of ICT.

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[46] […] comme je le donnais en possibilité, je n'explorais pas, j'avais pas le temps de l'explorer. En plus, j'ai ouvert là-dessus et moi-même j'accepte que oui. Ça va m'aider (PTT3)
[47] L'hésitation que j'avais à l'utiliser [les TIC], s'est déplacé vers l'ouverture, l'acceptation (PTT3)

These findings are confirmed by Villeneuve (2011) whose study on the techno-competency of pre-service teachers in Quebec shows that “it is not only technical problems that affect future teachers to integrate ICT, but that personal factors such as motivation and perceived competence towards ICT also have a role to play.” (Our translation, p.29)

4.4. Impact of the Training Intervention on Participant Teacher Trainers' Intention to Use ICT and on the Type of Activities

If asked to describe in one word the major impact of our intervention, it would be AWARENESS.

Table 20: Impact of the Training Intervention on Participant Teacher Trainers' Intention to Use ICT and on the Activities They Plan to Implement during Their Course.

Code – Indicator	Occurrence (148 times)	Occurrences by Participant Teacher Trainer (PTT)					Cases (N=5)
		PTT 1	PTT 2	PTT 3	PTT 4	PTT 5	
Awareness of diversity, scope and potential of ICT tools	24	13	4	3	3	1	5
Awareness of potential of activities integrating ICT	13	2	2	2	4	3	
Increased intention to integrate ICT	11	2	3	1	3	2	
Motivation to integrate ICT	9	2	2	1	3	1	
Intended outcome- Added Value	7	0	1	1	4	1	4
Awareness of existence of tools	7	4	1	1	0	1	
Change of representation about ICT pedagogical potential	4	0	1	1	1	1	
Reflection process drawing on the model and guideline	4	1	1	1	1	0	
Change in e-learning culture	11	1	1	4	5	0	
Increased motivation that results in trying things out	7	3	1	0	3	0	3
Manifested interest regarding intro of new strategies	4	1	2	1	0	0	
Awareness of limited ICT competency and skills	4	0	2	2	1	0	
Change in representation of ICT competency	2	1	1	1	0	0	
Getting to know and use new tool	3	1	1	0	1	0	
Wanting to introduce new uses of ICT- Video Clips	4	2	0	0	2	0	2
Awareness of own e-learning culture	3	0	2	1	0	0	
No change regarding representation of ICT	2	1	1	0	0	0	
Using tutorials to upgrading students prior knowledge	1	0	0	0	1	0	1
Would have preferred a multi-disciplinary intervention	1	0	1	0	0	0	

Table 20 shows the Impact of the training intervention on participant teacher trainers' intention to use ICT and on the activities they plan to implement during their course. For example, for the first line regarding Awareness of diversity, scope and potential of ICT tools, results show that this dimension was mentioned 24 times as follows: participant teacher trainer PTT1 talked about it 13 times, PTT2: 4 times , PTT3: 3 times, PTT4: 3 times, PTT5: 1 time. The last column (Cases N), indicates the number of participants out of five that have talked about this dimension. The total number of occurrences is 148.

Awareness. Our intervention, as suggested by the results we obtained, clearly made participant teacher trainers become more aware not only of the existence of ICT tools in terms of diversity, potential and scope (mentioned 24 times),

> *"These are tools that provide access to a wealth of resources, a wealth of knowledge, resources, ultimately, knowledge that can be accessed, but also human resources [...] It allows us to networking, have access to experts, which we would not otherwise be entitled to or otherwise access [...] another reason, I also see the importance of making our students active and ICT allows this, collaborative tools allow that. [...] tools for knowledge co-building such as blogs, wikis, wiki pages [...] the creation of websites that can do as much of our research or course [...] I also see to make students active, all the discussion fora [...] blogs, where you can work out the high-level knowledge, the high-level skills because we go beyond the recitation." (PTT1)*[48]

but also of the potential of activities integrating ICT tools (mentioned 13 times)

> *"Students can discuss among them always based on the theory that will be learned during the course, but may exceed it by having... being able to solve problems, being able to access case studies, for example, interacting with each other too. It allows to go further." (PTT1)* [49]

> *"This is when I could see that ... we could do things anyway rather "extraordinary" not just to produce maps, and present the maps in class." (PTT2)* [50]

They expressed as well, being now aware – even with certain surprise - of their actual level of competency and skills regarding ICT tools.

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[48] « *c'est des outils qui donnent accès à une foule de ressources, une foule de savoirs, des ressources, en fin, des connaissances qu'on peut aller chercher, mais aussi des ressources humaines* […] *Ça nous permet de nous resauter, d'aller avoir accès à des experts, auxquels on n'aurait pas le droit autrement ou accès autrement* […] *une autre raison, voir aussi l'importance de rendre actifs les étudiants et les TIC permettent ça, les outils collaboratifs permettent ça.*[…] *les outils de co-construction de connaissances comme les blogues, les wikis, les pages wiki* […] *les créations des sites qu'on peut faire autant de nos recherches ou d'un cours* […] *je vois aussi pour rendre actifs les étudiants tous les forums de discussions*[…] *les blogues, où là on peut travailler les savoirs de haut niveau les compétences de haut niveau parce qu'on va au-delà de la récitation. » (PTT1)*

[49] *« Les étudiants peuvent en discuter entre eux toujours basés sur la théorie qui sera appris durant le cours, mais ils pourront dépasser ça en ayant… en pouvant résoudre des problèmes, en pouvant avoir accès à études de cas, par exemple, en interagissant entre eux aussi. Ça permet d'aller plus loin » (PTT1);*

[50] *« C'est là que j'ai pu voir que... on pourrait faire des choses quand-même assez "extraordinaires" pas juste pour produire des cartes, puis présenter des cartes dans la classe. »(PTT2*

"That's what really surprised me. I thought that I knew about it, but in fact I didn't actually know. I wasn't really in depth of the tool." (PTT2) [51]

Increased intention and motivation. Their newly developed awareness implies, as shown by the results, an increase in intention to integrate ICT in their pedagogical activities, as well as in their motivation to try new things out, and introducing new strategies seeking for the pedagogical added value of ICT.

"My practice, I find it quite old. I think it is too "20th century". It clearly doesn't work, I see that it doesn't work, and that I must add new things to it." (PTT2) [52]

"My intention is certainly higher than I realized until now, so it motivates me to continue in this vein then. Yes." (PTT1); [53]

"This is already changing my perception. This will change my motivation level when facing it, because I now know what I can use it for. Instead of: "here is the forum. Use the forum". Well yeah, but the forum? But why? Now it's clear what this program allows me to do. But if I'm going to use this tool, what for? Well, to go to look for an added value for the student? And for me? Aha!" (PTT4) [54]

"It gave me a choice. From the beginning my intention, when you presented it, then suddenly, I saw it to enlarge and become of a wider range. Look, I can also use it to do this and that. Not just a thing or two, it expands, without any doubt, my intentions." (PTT5)[55]

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[51] *« Moi c'est vraiment ça qui m'a étonné. J'avais l'impression d'en connaitre, mais en fait je ne connaissais pas vraiment. J'étais pas vraiment en profondeur de l'outil. »(PTT2)*

[52] *« Ma pratique, je la trouve vieille. Je crois qu'elle est trop "20e siècle", visiblement ça marche pas, je le vois que ça marche pas, et qu'il faut que je rajoute des choses à l'intérieur. » (PTT2)*

[53] *« Mon intention est surement plus élevée que j'ai réalisé jusqu'à maintenant, donc ça motive à poursuivre dans cette veine-là. Oui. » (PTT 1)*

[54] *"Cela change déjà ma perception. Ça va maintenant changer la motivation avec laquelle je vais faire face, parce que maintenant je sais à quoi ça sert. Et non, voici le forum. Utilisez le forum. Eh bien oui, mais le forum ? Pour quoi? Maintenant, c'est clair ce que ce programme me permet de faire. Mais si je vais utiliser un outil, pour quoi faire ? et pour aller chercher quelle valeur ajoutée pour l'étudiant? et pour moi? aha ! " (PTT4)*

[55] *" Cela m'a donné un choix. Dès le départ mon intention, quand tu l'as présenté, alors du coup j'ai vu agrandir et faire un éventail plus large. Tiens, je peux aussi m'en servir pour faire ça et ça. Pas juste une chose ou deux, ça vient élargir sans doute mes intentions. "(PTT5)*

They are also aware of how they feel about getting to know the tools that will allow them to achieve and do what they are planning to achieve and do, and using the ones they need to attain their goals.

> *"Now I feel more competent and even more motivated to seek the added value by using ICT."(PTT2)*[56]

> *"I have more confidence, because it is not that easy. If I think Google Form, and the other software that you presented to me [screencast -o-matic], with the tutorial, so, I am capable. I feel more capable. More competent." (PTT1)*[57]

Changes in e-learning culture. Awareness, certainly led to a change of perception regarding participant teacher trainers' own e-learning culture (mentioned 11 times). During the interview they stated having a more accurate idea about their limited ICT competency and skills.

> *"I regret one thing. I did not understand quickly enough that I had to train myself in there. That it would be advantageous for me to get trained in that. And I resisted. And I resisted completely, and now, it is harmful for me, because I, I… But now, today, that's it!" (PTT3)*[58]

However, they also expressed their willingness to start exploring and learning about and how to use the tool that will allow them to achieve their targeted pedagogical added values.

> *"I don't really like the way this course is given, I didn't feel at all comfortable in that course. [...] So when you offered me this solution, in*

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[56] *"Maintenant je me sens plus compétente et d'autant plus motivée à aller chercher une valeur ajoutée en utilisant les TIC."(PTT2)*

[57] *« J'ai plus de confiance, parce que pas si facile que ça. Si je pense à Google formulaire, et à l'autre logiciel que tu m'as présenté [ScreenCast-o-matic], avec le tutoriel, donc, je suis capable. Je me sens plus capable. Plus compétente. » (PTT1)*

[58] *« Moi, je regrette une chose. Je pas compris assez vite que je devais aller me former là-dedans. Que j'avais avantage à me former là-dedans. Et j'ai résisté. Et j'ai résisté complétement, alors, ça m'a nuit, parce que je, je... Mais là, aujourd'hui, c'est ça! » (PTT3)*

fact, it's really not the same. I feel great, I'd give the course tomorrow, what. I wanted to give the course tomorrow." (PTT2)[59]

"When I will give this course a second time, I will change the written questionnaire for online questionnaires; I will be able to do more, I can collaborate with the students online rather than having in class discussions." (PPT1)[60]

This illustrates to a certain degree, their change of representation regarding ICT pedagogical potential, mentioned by all 5 participant teacher trainers.

"I had, nevertheless, a good idea that these tools existed, but the way you presented them in the questionnaire… the idea wasn't to make me a list, but to ask me questions about each of these tools. Both times when you showed them to me, it was like a realization. Both times. I know this wasn't your intention when proposing the questionnaire, but that's the effect it had on me. When I was answering the questions, I was telling myself, oh, this thing, we say ICT, but ICT is the big title, but in this set, there are lots of tools to meet my needs." (PTT1)[61]

"This aroused my curiosity [...] I found that there was utility in integrating ICT in the school context, I would say it may have increased as a result of the activity. (PTT2)[62]

"It gave me a choice. From the beginning my intention, when you presented it, then suddenly, I saw it to enlarge and become of a wider range. Look, I

[59] *« Je n'aime pas vraiment la manière comme ce cours est donné, je ne sentais pas du tout à l'aise, dans ce cours-là.* […] *Du coup quand tu m'as proposé cette solution, en fait, vraiment, c'est vraiment pas le même. Je me sens super, je donnerais le cours demain, quoi. Je voulais donner le cours demain. »(PTT2)*

[60] *« Quand je donnerais le cours une deuxième fois, là je changerai le questionnaire écrit par des questionnaires en ligne, je pourrai faire davantage, collaborer avec les étudiants en ligne plutôt que faire des discussions en classe. » (PTT2)*

[61] *« J'avais quand même une bonne idée des outils qu'existaient, mais le fais que tu me le présentes dans le questionnaire, l'idée n'était pas de me faire une liste mais de poser des questions par rapport à chacun de ces outils-là, Les deux fois que tu m'as montré ça, c'était comme une prise de conscience. Les deux fois. Je sais que ce n'était pas ton but, en me proposant ce questionnaire là, mais cela a eu cet effet là sur moi. À mesure que je répondais aux questions, je me disais oh cette affaire-là. On dit les TIC, mais les TIC c'est le grand titre, mais dans cet ensemble-là il y a tout plein d'outils pour répondre à mes besoins. »(PTT1)*

[62] *« Cela a éveillé ma curiosité […] je trouvais qu'il y avait une utilité d'intégrer les TIC dans le contexte scolaire, je dirais que ça a peut-être augmenté suite à l'activité. » (PPT2)*

can also use it to do this and that. Not just a thing or two, it expands, without any doubt, my intentions."[63] *(PTT5)*

Reflection. Notes from our pedagogical conversations during follow-up and/or personal support sessions with participant teacher trainers, show that they are (more) aware of the reflection process in which they (have to) get involved when planning for integrating ICT in their chosen activity. Reflection can be facilitated by providing continual time to teachers to interact with knowledgeable others and to share developing ideas via professional development activities (in virtual or real time), through ongoing conversations and co-construction with colleagues. As Persky (1990, in Ertmer, 2005) noted, "when teachers engage with each other in ongoing reflection about their use of instructional technology, they are more likely to critically evaluate their practice and redesign instruction to better meet students' needs and curricular goals" (p.37). Drawing on Benchmark 2: ICT as Mind tools (section 2.2.2, pp.36-38), we were helping teachers following van den Berg, Wallace and Pedretti, (2008), represent what they knew as they transformed information into knowledge and were engaged in deliberate reflection (Schön, 1983), and critical thinking. Also based on our *Guidelines* (Table 11, p.147), they were supported while judiciously considering the many aspects to be taken into account for a successful implementation and achievement of targeted goals. These encounters were actually rich occasions for professional development. Requisites and conditions were easily identified, and appropriate solutions were suggested, discussed and sometimes designed and made collaboratively.

For example, the need to upgrade the actual pre-requisite level of knowledge among students of a given course, resulted in:

1) The development of a diagnostic test that will report on the students' actual knowledge gaps regarding the main topics of the subject matter. (This diagnostic test is presented in the Annex Section as a product- Annex #3).

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[63] «*Cela m'a donné un choix. Dès le départ mon intention Quand tu l'as présente, alors du coup j'ai vu agrandir et faire un éventail plus large. Tiens, je peux aussi m'en servir pour faire ça et ça. Pas juste une chose ou deux, ça vient élargir sans doute mes intentions.. J'avais en tête la collaboration. Voilà. »*

2) A discussion of content to be included and exploration regarding how to design a *tutorial* - video-clip or at least a PPT commented and enriched with questions using voice and video, (screencast-o-matic/Camtasia)- to be used by students outside the classroom (mentored by teachers, though) in order to acquire the pre-requisite knowledge identified as missing. Tutorials would be prepared by colleagues to fill in these knowledge gaps by topic;

3) Targeted pedagogical added value: *Autonomy*: students assuming greater responsibility of self and their learning as they grow up as professionals; Motivation because of success;

4) Teacher can focus on teaching the subject content, without having to deal with filling up pre-requisite knowledge gaps.

Data from these gatherings also suggest that facilitating conditions and constraints are now well present and considered by participant teacher trainers when planning their activities integrating ICT, as well as questions regarding what the advantages of using this tool are for them and their students. This is not a process that can be achieved quickly, but by its very nature and when done properly, will have a long-lasting impact.

Regarding access to optional personal support and a pedagogical interlocutor

Personal support was found to be vital, fundamental and THE condition to embark on this endeavour of ICT integration. Participant teacher trainers explicitly manifested during the interview that they appreciated having access to optional personal support when they required it. They also liked having a pedagogical interlocutor to discuss with when planning activities integrating ICT, and choosing the appropriate tools and approaches to implement them.

The following results illustrate the importance of including continuous, appropriate and just-in-time personal support to ensure that participant teacher trainers' (PTT) motivation and intention to integrate ICT, as well as their willingness to try new things out, are enhanced or at least maintained.

> *"I think that as the impact of this personal support: the result is that I felt that I was fully equipped, that you were there if I had questions. It was*

easier for me to get started because I knew that if I had any problem, you were going to be able to guide me ... this allowed me to take ownership of a new tool that I really ignored."(PTT1)[64]

Importance, scope and duration of personal support. Data obtained from the interviews highlight the importance participant teacher trainers attach to personal support and the degree of flexibility on its duration and scope, by explicitly mentioning it 21 times. For example, as already mentioned (see also Table 18, p.174 for more illustration), personal support was fundamental. It facilitated pedagogical discussions; made them feel equipped, confident, more relaxed and appreciative of ICT tools' PAV in education; motivated them to explore new tools and embark in ICT integration; increased their self-efficacy beliefs.

"I felt that I first had to get to know the content because to get to know the tools it would take me time, but when you forced me to dive to the bottom… She told me she would help me, [that she would] guide me in this. I finally have Google Form, [it did] not take me a minute to understand how it was, how it worked." (PTT1)[65]

Increased self-efficacy. Clearly these strategies (i.e. follow-up and personal support), nurtured a sense of increased self-efficacy (stated 14 times) in participant teacher trainers.

"I had fears that were not justified. It allowed me not to change my way of seeing ICT, but my perception of competence, of my skills that has changed." (PTT1) [66]

"For example, our quiz on Google Form, I thought maybe it would be ... very difficult. And no! You just have to know the algorithms, read the icons, and then, I tell myself now, it's easy after seeing how. I put some resistance

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[64] *" Je pense que comme impact de l'accompagnement: ça fait en sorte que je me sentais outillée, savais que tu étais là, si j'avais de questions. Peut-être plus facile pour moi de me lancer, parce que je savais que si j'avais des problèmes, tu allais pouvoir m'orienter…. ça m'a permis de m'approprier d'un nouvel outil que vraiment j'ignorais. "(PTT1)*

[65] *« J'avais l'impression qu'il fallait d'abord que je m'approprie le contenu parce que m'approprier les outils me prendrais du temps, mais, alors que tu m'as forcé à plonger dans le fond… Elle m'a dit qu'elle allait m'aider, allait me diriger dans cela. J'ai finalement Google formulaire, m'a pas pris une minute pour comprendre comment ça allait, comment ça fonctionnait. » (PTT1)*

[66] *« J'avais des craintes qui n'étaient pas justifiées. Ça m'a permis pas de changer ma façon de voir les TIC, mais ma perception de compétence, de mes habiletés qui a changé. » (PTT1)*

because I learned as situations arose [...] for me it's gone, this difficulty. As I said, it's easy, and I can do it." (PTT4)[67]

Participants' beliefs and attitudes are prone to change over time as they gain first-hand experience with various ICT tools and very likely becoming more proficient as technology users. As one of the participants openly expressed, her improved self-efficacy perception has surely changed her attitude in terms of motivation and willingness to start exploring what other ICT tools can allow her to do, in terms of added value for her and her students. This is aligned with Teo (2011) who found that teachers' perceptions on the usefulness and ease of technology use are dynamic and do not remain static.

Dare to explore. These strategies also promoted their curiosity and new ideas, thus encouraged them to try new things out (mentioned 13 times).

> *"[…] this has made me to gain control of my own activity. It didn't come near me, the possibility, because I was not yet completely available to work with ICT. That's why."* (PTT3)[68]

> *"Yes, indeed, I have the personal support. That's what seems to me very important here. You were trying to guide me and you helped me, and now I have no fear. It's like when you go swimming. If you don't have a teacher, you don't dare. You, you were giving me directions, telling me: it's very easy. It can be done like that. Ah, so, it encourages me to do my own*

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[67] *« Mettez par exemple, notre quiz sur Google formulaire, j'ai pensé que peut-être, ce serait… très difficile. Et non! Seulement, il faut connaître les algorithmes, lire les icônes, puis je me dis maintenant, c'est facile après avoir vu comment. J'ai mis de la résistance parce que j'ai appris à mesure que les situations apparaissaient […] Pour moi elle n'est plus là cette difficulté. Comme je le disais, c'est facile et je peux le faire*. » (PTT4)

[68] *« […] ça m'a fait me rentre en dessus de, de m'approprier ma propre activité. il arrivait pas près de moi, la possibilité, parce que j'étais pas encore disponible complétement à travailler avec les TIC. Voilà. »* (PTT3)

instrument. Of course, asking for help. I will always have to ask for help."*(PTT4)*[69]

Increased motivation and intention. Access to optional personal support and follow-up also raised participant teacher trainers' motivation as well as their intentions to integrate ICT in their teaching practice.

> *"The personal support has super motivated me. Yes. It has super motivated me to retake this course, but in that format. If it is not in that format, I will not take it. It is not worth the effort." (PTT2)*[70]

> *"[…] for me, the personal support has been the key aspect. Since my experience has been that of: "Here you are. Do as you please." And I do nothing! Or I pretend to do."(PTT4)* [71]

Affect and trust. These feelings were also mentioned as essential conditions to participate in this process of pedagogical integration of ICT.

> *"[…] for me it is the concept of affection. I am a person that in a team or in duo, if I do not feel that trust is there, I couldn't be with the person." (PTT3)*[72]

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[69] *« Oui, précisément, que j'aie de l'accompagnement. C'est ça qui me parait très important ici. Que tu étais en train de me guider et tu m'as aidé et maintenant je n'ai plus peur. C'est comme quand on va nager. Si on n'a pas d'enseignant, on n'ose pas. Toi, tu étais en train de me donner des indications, de me dire: c'est très simple. Il peut être fait comme ça. Ah, alors, cela m'encourage à faire ma propre ressource. Bien sûr, en demandant de l'aide. Cela toujours, je vais devoir demander de l'aide.* » (PTT4)

[70] *« L'accompagnement, cela m'a super motivé. Oui, ça m'a super motivé. Pour reprendre ce cours mais en ce format-là. Si n'est pas à ce format-là, je ne le reprendrai. Pas la peine. Genre, pour le coup, là. » (PTT2*

[71] « *[…] Pour moi, l'accompagnement a été l'aspect fondamental. Parce que mon expérience était celle de : Voilà ceci, faites comme vous voulez. Et je ne fais rien! Ou je fais semblant. » (PTT4)*

[72] *« […] C'est la notion de l'affecte. Moi, je suis une personne, en équipe ou en duo, si je ne sens pas que la confiance est présente je ne pourrais pas être avec la personne.* » (PTT3)

Table 21 below, presents a selection of results particularly corresponding to the impact of follow-up and personal support on participant teacher trainers' intention to use ICT.

Table 21: Impact of Follow-Up and Personal Support on Participant Teacher Trainers' Intention to Use ICT

Code – Indicator	Occurrence (75 times)	Occurrences by Participant Teacher Trainer (PTT)					Cases (N=5)
		PTT 1	PTT 2	PTT 3	PTT 4	PTT 5	
Dare to try things out counting on support	13	3	3	2	4	1	5
Motivation to integrate ICT	9	2	3	1	2	1	
Promoted curiosity and new ideas	8	1	2	2	2	1	
Importance, scope and duration of support	21	5	6	3	7	0	4
Increased self-efficacy	14	5	2	1	6	0	
Intention to integrate ICT in teaching practice	8	3	2	0	2	1	
Affect and trust as conditions to embark	2	0	0	1	1	0	2

Table 21 shows specifically the Impact of follow-up and personal support on participant teacher trainers' intention to use ICT. For example, for the first line regarding Dare to try things out counting on support, results show that this dimension was mentioned 13 times as follows: participant teacher trainer PTT1 talked about it 3 times, PTT2: 3 times , PTT3: 2 times, PTT4: 4 times, PTT5: 1 time. The last column indicates the number of participants (Cases N) in this study. Cases N= 5 participants. The total number of occurrences is 75.

Participant teacher trainers manifested being ready to try new things out counting on support. Personal support and follow-up were found vital and fundamental in the approach we implemented. Results suggests that personal support and follow up are not only essential for participant teacher trainers to dare to try things out, but also to increase their self-efficacy, promote curiosity and new ideas, and enhance their motivation to integrate ICT.

Chapter 5. Discussion and Conclusion

This chapter presents a retrospection of the work we carried out and its limitations. Research perspectives are presented in the conclusion section.

In this research we intended to operationalize IntersTICES through the development, and implementation of a training intervention. We followed the steps suggested by Action Research, integrated the actors and supported them in the development of ICT activities to meet specific needs of their course⁄ students. It was expected that this training intervention would help them develop their e-learning culture.

The resulting IntersTICES-Type Activity's guidelines are not intended to be prescriptive. Nevertheless, they may be used not only to support the development and implementation of future training interventions, but also, with particular attention given to teachers' feedback, they can be used to validate, refine and add to them to improve future training interventions.

The rigorous application of our research methodology has allowed us to meet the research objectives and accordingly, to answer our research question by proposing guidelines and defining strategies aiming at supporting the development of the e-learning culture of teacher trainers teaching subjects different from ICT in initial teacher training programs.

1. Specific objective 1: To operationalize the IntersTICES model through a training intervention.
2. Specific objective 2: To examine the impact of the training intervention, the follow-up and personal support on participant teacher trainers' e-learning culture and on their intention to integrate ICT in their teaching practice.

5.1. Specific objective 1: Operationalization of the IntersTICES Model through a Training Intervention

5.1.1. Determining the requirements for the design of a training intervention

Following the steps prescribed by Action Research (AR) as well as a systemic, pedagogical engineering approach, the UTAUT, Adult Learning Theory- Andragogy, and our merger of IntersTICES' e-Learning culture dimension with UTAUT, allowed to design and implement the planned training intervention, which encompassed three stages. (i.e. Introductory training intervention, follow-up and personal support, and final collective meeting). We were able to identify the basic requirements for the design of a training intervention to operationalize the IntersTICES model, which included having a clear understanding of the model, its sub-dimensions (i.e. Indicators of pedagogical added value, Spaces of pedagogical integration and participants' e-learning culture), and the process to articulate them. As such, regarding the nature of the indicators of pedagogical added value, and the sub-dimensions of the e-learning culture, since, as aforementioned, no definition is proposed in former documents at the origin of the IntersTICES Model (Peraya and Viens, 2005), we conducted a literature review to provide these definitions, while highlighting their actual value and contribution. (See Sections 2.4.4.1., pp. 70-74 and 2.4.4.3, pp. 76-80). Afterward, the above-mentioned framework, guided the identification of the principles that take into consideration the type of participants targeted in this research. Facilitating conditions and constraints related to the context, and participants' characteristics were also considered to plan for and allocate appropriate resources. As required by AR, documenting and keeping track of all processes and procedures undertaken for further access was carried out; as well as ongoing validation (with the expert(s) and ⁄ literature reviews) of any decision regarding the design of the training intervention and its implementation. These iterations prompted the refining and monitoring of all planned action, while the engineering pedagogical approach ensured systematic rigour of the whole process.

5.1.1.1. Strengths *of the above-described procedure to determine design requirements*

The operationalization of the IntersTICES model facilitated having a clearer understanding about how a training intervention using this model looks like, and resulted in *the IntersTICES-type activity* (See Section 4.2.4, p.154 for detailed information). It also allowed us to identify: 1) clearly and explicitly the IntersTICES model's principles; 2) the steps of a rather effective procedure (*By creating Table 13 below*,… p.154) to present the model and make explicit how we operationalized a systemic innovative model through a training intervention. This type of implementation allowed for a good grasp of the impact that facilitating conditions and constraints may have on teacher trainers' intentions to use ICT in their teaching practice. It was therefore critical that teacher trainers' e-learning culture be better understood; 3) the stages and strategies of an effective training intervention to facilitate the development of participant teacher trainers' e-learning culture (Table 13, p. 157); and 4) the resources (facilitating conditions/constraints), when planning for ICT pedagogical integration (Table 14, p.159).

The methodology ⁄ procedure to the *implement action* step is in itself a result. We had to design how to implement the whole training intervention from scratch. It encompassed ongoing fact-finding to monitor and evaluate how things were going, and acted as formative evaluation. This fed forward into a revised plan of procedures for implementation, themselves accompanied by monitoring and evaluation (Kemmis and McTaggart, 1981). In this research, some items identified in advance as requiring to be observed and questioning participants about were recorded in the researcher's journal. These items addressed, for example, participants' perception regarding whether the training intervention worked or not, appropriateness of its duration, etc. The expected feedback referred then to their appreciation in terms of the training intervention itself, not to their e-learning culture. These insights became useful data in form of notes for further planning and refining of this type of intervention. Furthermore, to implement this training intervention, we took into account the guiding principles of adult learning and the IntersTICES model's mentioned above as well as notes taken while discussion and exchange of ideas with experts regarding appropriate strategies to do so.

Since we were working in a AR context, there were certain elements that have to be considered and respected, namely: 1) documenting, and keep track in the researcher's journal, any process and procedures for further access, e.g. to better understand the implementation and results; 2) being both participant/actor AND researcher required ongoing validation – with expert(s) and literature review- of any decision regarding, for example, the key items shaping the design of the training intervention, the training intervention itself, and its implementation. These iterations for appropriateness of decisions taken, facilitated refining and monitoring of any (planned) action, while the pedagogical engineering approach we implemented continued to ensure the systematic rigor of the whole process.

For the training intervention to be effectively implemented, as already mentioned, it was also important to consider the facilitating conditions and constraints related to the context i.e. their course and its objectives; participants' characteristics and type of activity chosen, to plan for and allocate the appropriate resources (e.g. modelling and YouTube videos, pedagogical discussions).

All this information was necessary to determine how to appropriately design a training intervention through which we could operationalize the IntersTICES model.

5.1.1.2. Limitations *of the above-described procedure to determine design requirements*

It emerged from the interviews that the duration of the first introductory meeting (2 and a half to 3 hours), was somewhat daunting for some participants, and may have prevented pre-service teacher educators from participating in our research (e.g. hindered motivation to participate, workload, cognitive load, etc.). This aspect has to be considered when planning for future training interventions.

For this research we focused on the design requirements of an effective training intervention and its implementation to operationalize the IntersTICES model. Therefore, conducting further research to implement the IntersTICES-Type Activity in an actual classroom setting is desirable. It could provide additional information regarding other requirements, facilitating conditions, and constraints of their context (i.e. their course and its objectives), and refine the results of this research.

5.2. Specific objective 2: To examine the impact of the training intervention, the follow-up and personal support on participant teacher trainers' e-learning culture and on their intention to integrate ICT in their teaching practice.

5.2.1. Determining strategies best suited for teacher trainers to develop their e-learning culture

5.2.1.1. Strengths *of the procedure to determine these strategies*

As an essential step to determine the best procedures in the design of the training intervention, we carried out a review of the literature on the use of ICT in the teaching practice by teachers (trainers). The analysis of these writings revealed information relevant to the problem and was necessary for the design of the training intervention operationalizing the IntersTICES model. Indeed, thanks to this analysis, it was possible to extract a set of data, such as: factors affecting⁄determining ICT adoption and use (see section 2.3, p. 41); principles that compose the knowledge base of adult learning (Table 8, p.115) ; exemplary practices – benchmarks (section 2.2., p. 34); effective strategies (e.g. modelling, mentoring, fostering individual and collective reflection - metacognition) that could later be transformed into pedagogical strategies for ICT integration, and incorporated into the IntersTICES-Type Activity (see 4.2.4. for a synthesis of the IntersTICES-Type Activity).

When analyzing the literature, it was found that most of the literature focused on the benefits of and factors that influence the use of technology by teachers (trainers) (e.g. Ertmer, 2012; Fullan, 2001; Dede, 2014; Karsenti and Grégoire, 2015; Rasmy and Karsenti, 2016; Villeneuve, 2011). We could notice that research continues to find that, even in teacher preparation programs that promote use of ICT for active student learning, ICT is used mostly for information presentation (Graham, Tripp, & Wentworth, 2009), rather than on the actual design process or criteria for the design of learning scenarios integrating ICT that would foster the development of pre-service teachers' e-learning culture. Some researchers (e.g. Angeli & Valanides, 2009; Ertmer, 2012; McDougall, 2008; Somekh, 2008) have, nevertheless, presented recommendations or criteria to be met in the design of these training interventions. We aligned these recommendations and strategies identified through the literature review with our guiding framework criteria and principles (AR, Adult Learning Theory- Andragogy, IntersTICES, and UTAUT). The purpose of this alignment ⁄ analysis was to identify the qualities as well as the improvements that could be made, for training interventions to be more effective. In doing so, it was necessary to take into consideration the strengths (e.g. see for example research study by van der Berg et al. (2008), Benchmark 2, ICT as mind tools 2.2.2) and weaknesses of reviewed ICT integration-related studies, thus making it possible to refine and propose strategies to develop a training intervention that was as effective as possible.

In the process of analysis via IntersTICES and our merger of IntersTICES' e-Learning culture dimension with the UTAUT, this is the first time that: The combined use of its principles, variables and constructs to identify and implement appropriate guidelines, training intervention steps, and strategies to support the development of teachers' e-learning culture, is done. It would be pertinent to continue working on these suggested training intervention guiding framework criteria and principles (Adult Learning Theory- Andragogy, IntersTICES, and UTAUT), in order to make them available to be used when designing activities aiming at seeking the pedagogical added value of ICT to address identified course⁄students' needs.

The literature review on factors affecting ⁄determining ICT adoption and use, also highlighted different strategies (e.g. personal support via mentoring, modelling, pedagogical discussions) for encouraging ICT implementation among pre-service teacher trainers. This provision was necessary to support pre-service teacher trainers, during meetings for follow-up and personal support, in overcoming barriers to integrate ICT into their chosen activities to address a need of their own course⁄students.

Operationalizing IntersTICES led to the drafting, refinement and first validation of the IntersTICES-Type Activity, the *Principles*, the *Guidelines,* and the List of Facilitating Conditions⁄ Constraints (Resources) when planning for ICT integration. In these resulting tools are integrated the different steps that the training intervention should undertake to satisfy the teaching and learning needs of potential pre-service teacher trainers. Moreover, these tools should also ensure that we appropriately address the specific question and goal of this research: How can the IntersTICES model be used to support pre-service teacher trainers in the design of activities to effectively integrate ICT into their teaching practice and enable them to get the very most out of the pedagogical added value (PAV) of ICT?, while helping them develop their e-learning culture.

Furthermore, this operationalization of the model demonstrated the specificity and role played by each of IntersTICES' dimensions in a training intervention for an effective ICT integration. We could also grasp, how each dimension is influenced by the other two, in a synergy that facilitates addressing course/student's needs and priorities. It put in evidence the model's systemic nature that takes explicitly into account the analyses of the needs and context, i.e. the course and its objectives, as well as the actors and their e-learning culture. It highlighted how their e-learning culture could be modified through their practice by integrating pedagogical indicators of added value and spaces of pedagogical integration. It is by its very nature that IntersTICES suggests making explicit, reflecting and trying to circumscribe and, then linking these elements together. As such, based on the analysis participant teacher trainers conducted about their students' needs and characteristics, they were (more) able to tap on appropriate facilitating conditions/resources to address these needs.

Regarding personal support and follow-up, results suggests that they were not only essential for participant teacher trainers to dare to try things out, but also to increase their self-efficacy, promote curiosity and new ideas, and enhance their motivation to integrate ICT. We strongly recommend incorporating these strategies i.e. personal support and follow up, in future teacher training interventions. By using these strategies, the ICT tool introduced, learned and integrated to respond to a specific need may have an (noticeable) impact on the teacher trainers' e-learning culture, while facilitating its development - taking into account, though, on which level they may be.

Every time teacher trainers need to learn about a new tool –one at a time- to address a specific need, they are developing their ICT competency. Moreover, being supported while having to learn about and being able to use the ICT tool in an activity of their own, fosters in them growing feelings of self-efficacy, which in turn can nurture a positive attitude towards ICT use, and increase their intentions to (actually) integrate ICT in their teaching practice. This whole process resulting in a developed and more comprehensive e-learning culture.

Results regarding for example, participant teacher trainers awareness about the potential of activities integrating ICT tools to do “rather extraordinary things”, not just producing maps to be presented to students (PTT2) and foster students’ learning, indicate that experience with the use of ICT and the changes related to ICT representation, may support the development of a student-oriented pedagogical approach. According to these results, changes teacher trainers undertake aiming at integrating some innovative use of ICT in their practice are simultaneous with and influence changes they willingly embrace aiming at implementing a more student-oriented pedagogical approach. This is consistent with the outcomes of the Apple classroom of tomorrow (ACOT2) study (2008), Ebert-May, Derting, Momsen, Arnold, Henkel, Middlemis Maher, and Passmore (2015), and Gibbs (2004) in which the teacher is concerned primarily with supporting student learning, so that they acquire the knowledge or develop concepts and skills require to appropriately perform in the knowledge society.

5.2.1.2. Limitations *of the procedure to determine these strategies*

The IntersTICES, UTAUT, Adult Learner Theory- Andragogy and our merger of the IntersTICES’ e-Learning culture dimension with the UTAUT’s criteria, used in the design of the training intervention were considered to better address the characteristics that the training intervention required, as well as the characteristics of teacher trainers who do not systematically integrate ICT in their teaching practice. However, when actually implemented in an actual classroom setting, it is possible that the IntersTICES-Type activity will be subject to improvements.

The training intervention allowed to formulate some new propositions and clarifications regarding one way of using the IntersTICES model as a tool to intervene, aiming at integrating ICT pedagogically. It also helped to determine facilitating conditions and constraints, as well as their impact on the whole process of the intervention, which promoted teacher trainers intention to integrate ICT in their teaching practice. Nevertheless, because of the dynamics involved among teachers, learners and technology, as well as the changes of perception that may occur in the transition between intention of use and actual implementation, it is suggested that longitudinal research studies be conducted. These should last at least one academic year encompassing three academic sessions. Examination of actual integration and use of ICT tools in the teaching practice can provide greater insight regarding desired outcomes of this type of research.

Results suggest that follow-up and personal support are essential for teacher trainers, and may facilitate knowledge transfer. Participants in this research stressed the importance of the follow-up and of receiving personal support. However, it is not just any personal support that works, but one that: 1) encourages them to reflect on the pedagogical added value of ICT; 2) fosters pedagogical discussion and reflection; 3) facilitates getting to learn and master the tool (via modelling, watching video-tutorials in YouTube; trying things out together with the researcher⁄trainer); 4) facilitates this process of empowering them to meet their needs and those of their course⁄students, while promoting the development of their e-learning culture.

Nevertheless, and always regarding our population, these strategies are to be handle with care, since depending on teacher trainers' needs and profile, some of these strategies may not be appropriate.

5.2.2. Identifying levels of development of participant teacher trainers' (PTT) e-learning culture.

5.2.2.1. Strengths *of having these identified levels*

Data from the pre-and post-intervention surveys, notes from the researcher's journal, the interviews, as well as their analyses made it possible to identify the evolving process in terms of participant teacher trainers' e-learning culture. Also, these data allowed us to bring about the graphic representation (See Figure 17, p.186) of four levels of the teacher trainers' e-learning culture participating in this research (i.e. Level 1: Very basic knowledge; Level 2: Awareness of existence of tools, and of the PAV; Level 3: Awareness of facilitating conditions and ⁄or constraints when integrating ICT; Level 4: Comprehensive e-learning culture). The identification of these levels makes it also possible to validate the design requirements and implementation specifications that this first iteration of a training intervention aiming at helping teacher trainers develop their e-learning culture must have. These data and their analyses thus made emerge PTTs' profiles that may be used as a reference when planning for this type of interventions.

5.2.2.2. **Limitations** *of these identified levels*

Teacher trainers participating in this research responded fully to the characteristics required to be part of the study: 1) Being pre-service teacher trainers/lecturers working in initial teacher training programs; 2) Teaching subjects different from ICT at the undergraduate level; and 3) Not having experience integrating ICT systematically into their teaching practice. They were 5 female, aged between 29 and 55 years old, having different perceptions regarding ICT use and integration in their teaching practice. It would have been desirable, though, to include male teacher trainers and from diverse backgrounds, teaching different subjects to have more information about pedagogical uses of ICT. However, it was difficult to find teacher trainers from other faculties to participate, and those contacted did not respond to the many attempts to reach them. These five teacher trainers were then approached. Their participation to this research was mostly driven by "solidarity and willingness to help". We considered, then, that we started our study with a bias. Further research should take care of validating these suggested levels against a broader and diverse population.

Moreover, even though this research allowed us to see an immediate positive effect of the training intervention, the follow-up and personal support on participant teacher trainers' e-learning culture, and their intention to integrate ICT in their teaching practice, we cannot predict/suggest whether this effect will last. It would be interesting to see, after having implementing an IntersTICES-Type Activity, what the impact on teacher trainers' e-learning culture -in terms of their teaching practice- actually is. However, it would require to train a certain number of teacher trainers that in turn will train some pre-service teachers. Then, see whether there has been any consistent pedagogical integration of some ICT tools in their teaching practice as a result of a (more) developed e-learning culture or whether they continue to use the same three identified tools, i.e. Word, PPT, and email in the same old ways they were used, without considering any broader vision of the potentialities made evident through the indicators of innovation (added value) facilitated by IntersTICES. In this research, though, we just undertook a segment of a whole training program.

5.3. Conclusion

This section aims at putting into perspective the results obtained based on our objectives: to operationalize the IntersTICES Model and to examine the impact of the training intervention, the follow-up and personal support on participant teacher trainers' e-learning culture and on their intention to integrate ICT in their teaching practice.

The originality of this research resulted in the method used to determine the training intervention specifications necessary for the operationalization of the model to carry out this intervention. In fact, the methodology forced us to explicitly articulate the Interstices model in order to better implement it afterwards. The iterations followed to validate decisions for all actions planned and taken, ensured credibility of results -fundamentally important for Action Research (AR) (See, chapter 3, p. 94). Furthermore, this methodical and iterative nature of AR along with the engineering pedagogical approach implemented, contributed to a clearer identification and understanding of the different steps that this type of intervention could engage.

The different training intervention tools generated through this work (e.g. IntersTICES-Type Activity (Table 13, p.157), the guiding *Principles*, the *Guidelines* (Table 11, p.147), the List of Facilitating Conditions⁄Constraints (Resources) (Table 14, p. 159) when planning for ICT pedagogical integration), could be used as a reference to design proposals of training interventions to address teacher trainers' needs regarding pedagogical integration of ICT while helping them develop their e-learning culture.

As suggested by the analyses of the interviews and data from our other sources, pre-service teacher trainers' intentions to integrate ICT in their teaching practice are influenced by their newly-developed e-learning culture. In other words, by their improved representations of the pedagogical added value of technology for their students, their course, and for them; their awareness regarding availability of resources such as support from a coach ⁄ more competent colleague ⁄ technician at their disposal; their changed attitude in terms of time required to learn how to use the tool and master it, as well as by their improved self-efficacy beliefs. Therefore, these changes could be thought as actually being due to the impact of the IntersTICES-Type Activity on participants’ e-learning culture.

Keeping in mind that “teachers tend to teach in the way they were taught” (Hargreaves, 2003), teacher training programs should promote the development of pre-service teacher trainers’ e-learning culture that will allow them to model and demonstrate effective ways ⁄ strategies to integrate ICT pedagogically. This would better prepare pre-service teachers for effective use and integration of ICT in their future K-12 classrooms.

We have observed -and corroborated this assumption with participant pre-service teacher trainers- that providing them with opportunities to reflect on the pedagogical uses and implications of ICT integration have a positive impact on their intentions to use and integrate these same tools in their teaching practice.

Success in this regard may require to move away from stand-alone technology courses (Karsenti and Grégoire, 2015) or “one-shot workshops” (Fullan, 1993) and disconnected training, towards the implementation of training activities that focus on teachers’ own projects and needs, make explicit the pedagogical added valued sought, and take into account teachers’ e-learning culture. The IntersTICES-Type Activity resulting from the operationalization of the IntersTICES model we carried out, might adequately support and guide teacher trainers during the process. This process encompasses steps for exploration, learning and utilization of ICT tools, as well as coaching for the production of pedagogical activities integrating ICT into their teaching practice.

For example, comprehension and application of our notion of the pedagogical added value of technology progressing toward positive intentions and prospective action, requires pre-service teacher trainers to: 1) identify a need of their course ⁄ students they would like to address; 2) choose the pedagogical added value they aim to achieve and; 3) meet with the researcher⁄trainer to reflect on and have a pedagogical discussion about every aspect conducive to its implementation. This may be assured by putting into practice the identified steps suggested in the IntersTICES-Type Activity (Table 13, p. 157); following a more conscious process of reflection and analysis facilitated by the *Guidelines* (Table 11, p.147) we designed to start working with participant teacher trainers on the activity they chose; and being supported by the pedagogical engineering approach we implemented, covering and interrelating the relevant conditions and actors.

Accordingly, results suggest that it is important to help pre-service teacher trainers become aware of and understand the pedagogical added value of technology. This will allow them to make meaningful connections between technology and teaching. Technology skills alone cannot guarantee the effective use of technology in the classroom (Ertmer et al., 2003). As Dutt-Doner, Allen, and Corcoran, (2005) noted “meaningful technology integration is more of a pedagogical endeavor than a technological one”.

Data from the interviews, as well as notes taken during meetings for follow-up and personal support, allow us to conclude that pre-service teacher trainers’ intentions to integrate ICT in their teaching practice can be fostered by: 1) showing them how they can use ICT to address identified need(s) of their course⁄students; 2) demonstration ⁄ modelling and co-creation of tool(s) ⁄ instruments; 3) discussion and reflection to try out and refine the resulting instruments, activities, and alternative forms of evaluation; 4) further discussion about benefits, advantages and implications for teacher trainers and their students e.g. tips for designing peer evaluation by using rubrics, may all act as positive feedback, thus helping to improve pre-service teachers’ self-efficacy beliefs and develop their e-learning culture.

Some authors claim that change in conceptions about teaching is a necessary prerequisite to changing instruction (Ho et al., 2001), while others claim the opposite; that is, change in teaching practices occurs before change in beliefs (Guskey, 1986, 2000). We corroborated that participant teacher trainers’ representations and beliefs determine[73] their practice (Bandura, 1994; Viens and

[73] To what degree it is determined or influenced, we will not enter into a debate on that now, but we can ask ourselves the question.

Renaud, 2001). However, we observed that the follow-up and personal support provided, fostered improved practice that had an impact on their beliefs and ICT representations, which in turn effected positive changes in their self-efficacy beliefs. A chain of influence: practice feeds, confirms and, perhaps, even modifies the representations.

For example, participant teacher trainers were under the impression that to learn how to use the tool they wanted to integrate into their activity, it would require more time than it actually took them. They realized that by exploring the tool in team with the researcher/trainer and being shown how to do it, it took them just a few minutes to learn about and being able to reuse it by themselves. It put in evidence that participant teacher trainers were ready to learn a tool, one at a time, 1) when it was aimed at addressing their course/students' needs; 2) when follow-up and optional personal support were made available; 3) when together with the researcher/trainer, they discussed on the suggested tool, explored it, saw how it worked, its application(s) (via modelling or watching a video) assessed its suitability to address the identified need, and tried it out -accompanied. As such, this research provides a broader understanding of the dynamics leading to the acceptance and intention to use ICT tools by teacher trainers. It would be useful, though, to follow these participants for a few years to examine how beliefs and practice do change, if at all. Will change in practice lead to changes in beliefs, or is a change in beliefs necessary to facilitate a change in practice?

It would seem pertinent to foster the implementation of an online community of practice where everyone could make a contribution and ask for help when needed - as a follow-up. Nevertheless, regarding personal support it will be adequate to have face to face encounters, even via Skype. These meetings could take place to foster subject-related pedagogical conversations while providing opportunities to address particular needs of participants.

Furthermore, it is important to highlight that this research goes beyond stating the need for teacher trainers to have solid initial ICT training followed by access to continuous professional development and support to integrate ICT in their teaching practice. This research documents and describes in detail the training intervention we carried out to operationalize the IntersTICES model, while making it available to be used to conduct this type of training. Our results from the interviews suggest that there is quite an important impact of follow-up and personal support on pre-service teacher trainers' increased feelings of competence and self-efficacy regarding ICT use as well as on their intentions to integrate ICT in their teaching practice.

However, although skills training and follow-up support are necessary to initiate teacher trainers and future teachers in the use and integration of ICT in their teaching practice, at various occasions participants openly manifested that it is also essential that administrators also recognize that teachers' preparedness to achieve higher levels of integration are affected by other important factors (e.g. teacher's time required for attending ICT training sessions; for planning lessons integrating ICT, etc.). Administrators may then, find it worthwhile to provide incentives for teachers to embark in ICT integration at classroom level.

Research Perspectives

This research would require to be followed-up by the actual implementation of the IntersTICES-Type Activity in a classroom setting. This may allow to 1) validate the training intervention implemented, and the suggested strategies to help pre-service teacher trainers develop their e-learning culture and better prepare them as pedagogical ICT users; 2) understand what happens with the teacher trainers and their students in terms of impact of the IntersTICES-Type Activity's implementation, 3) determine if their developed e-learning culture translate into actual integration of ICT in the classroom during pre-service teaching experiences; and 4) verify, validate and add to the List of Facilitating Conditions ⁄ Constraints (Resources) required when planning for ICT integration.

To apply to elements that are not part of this research but could benefit from it, to address the issues raised by the Quebec's Steering Committee of Teacher Training (CAFPE) in 2002- but still relevant today-, the Inspectorate of Education of the Netherlands, (2015) and the OECD (2016), regarding ICT as factors of teachers' feelings of pedagogical incompetence, becomes day by day a must. Regarding an element that emerged, the lack of ICT skills, and that was brought up repeatedly by the participants as being hindering their use of ICT, we might think that training interventions using the IntersTICES model, could help solving, at least partially, this problem regarding teachers' feelings of low self-efficacy or lack of ICT competency.

Given the lack of (rather general) understanding regarding the need of effective interventions that focus on teachers' own projects and needs, make explicit the pedagogical added valued sought, and take into account teachers' e-learning culture to facilitate the type of training, this thesis may contribute to the solution of this problem by making available the different training intervention tools generated through this work (i.e. The *IntersTICES-Type Activity*, the guiding *Principles,* the *Guidelines,* the List of Facilitating Conditions⁄ Constraints (Resources)) when planning for ICT pedagogical integration. These tools could be used as a reference to design proposals of training interventions to address teacher trainers' needs regarding pedagogical integration of ICT, while helping them develop their e-learning culture, and embark on a critical, reflective and informed practice based on the 7 indicators of PAV.

Finally, having operationalized IntersTICES will allow to have the tools and a procedure to be able to accompany the teacher trainers in a reflective practice about the pedagogical added value of ICT; negotiate with them definitions and applications that make sense for them; and accompany them in the tasks to solve their own problems. This would empower and equip them to engage in the process with the required skills to effectively respond to societal demands regarding fostering 21st century skills through their teaching practice.

Publication List

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Villa, G., Viens, J., Maina, M. 2015. "Impact of a training activity using a systemic pedagogical innovative tool. Pre-service teacher trainers' e-learning culture at the center of the process." 21st Century Academic Forum Conference. Harvard University, Boston, MA. September 20-22.

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Annexes

Annex 1: Pre-and Post-Intervention Surveys – Preliminary and Final Revised Versions.

Questionnaire pre-intervention (Nov. 5)

Afin de mieux documenter et rendre plus explicite l'utilisation des TIC dans la pratique d'enseignement, nous cherchons à identifier quels seraient les différents éléments qui pourraient avoir un impact sur la conception d'activités pédagogiques intégrant les TIC.

Ce questionnaire vous prendra environ 15 minutes et les données collectées seront codifiées et traitées de manière anonyme. Les résultats de cette étude seront rendus publics à la soutenance de thèse.

Nous vous remercions d'avance pour votre aide et le temps que vous nous accordez.

*Required

1. **0. Code: (Vos initiales avec le mois et jour de naissance, separés par un trait de soulignement (__): Genny Villa 29 octobre: G10_V29, par exemple.)** *

   ....

1. Renseignements personnels et formation

2. **1. 1. Sexe** *

   Mark only one oval.

   ◯ Féminin

   ◯ Masculin

3. **Âge** *

   Mark only one oval.

   ◯ Moins de 30 ans

   ◯ De 31 à 40 ans

   ◯ De 41 à 50 ans

   ◯ Plus de 50 ans

4. **Statut d'enseignant** *

   Mark only one oval.

   ◯ Permanent

   ◯ Contractuel

5. **Rang ou grade dans la profession** *

Tick all that apply.

- [ ] Professeur(e) titulaire
- [ ] Professeur(e) agrégé(e)
- [ ] Professeur(e) adjoint(e)
- [ ] Professeur(e) (autre)
- [ ] Chargé(e) de cours
- [ ] Doctorant(e) (auxiliaire d'enseignement/auxiliaire de recherche)

6. **Les matières principales enseignées (Écrivez le nom complet)** *

7. **Durant votre formation initiale, avez-vous suivi des cours portant spécifiquement sur l'utilisation pédagogique des TIC?** *

Mark only one oval.

- ◯ Oui *Skip to question 8.*
- ◯ Non *Skip to question 9.*

8. **Si, OUI, précisez** *

9. **Si NON, avez-vous eu d'autres activités de formation ou sources d'information pour vous aider à maîtriser les avantages et contraintes des TIC en éducation?** *

NOV. 5

10. **1. 7. Plus spécifiquement, si vous avez bénéficié depuis les 5 dernières années d'activités de formation continue ou de journées de formation de perfectionnement dans les domaines suivants, indiquez les contenus abordés:** *

Tick all that apply.

- [ ] Recherche d'information sur Internet
- [ ] Gestion/création site Web
- [ ] Utilisation pédagogique de l'ordinateur
- [ ] Utilisation des fonctions de communication des TIC (forum, blogue, chat, etc.)
- [ ] Création d'un cours avec Moodle/StudiUM
- [ ] Portant sur l'utilisation de différents logiciels
- [ ] Other: ______________________

Skip to question 11.

11. **1. 7. 1. Si vous avez été formé(e) à l'utilisation de logiciels, spécifiez lesquels**

____

____

____

____

____

Skip to question 12.

2. Votre Culture e-learning

2.1. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez déjà faits dans votre enseignement?

XIOV.5 P.3

12. **USAGE 1: POUR PRÉPARER MES COURS, J'UTILISE:** *

Mark only one oval per row.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)					
b. Logiciel de présentation (Powerpoint, etc)					
c. Logiciel de création de quiz (Google formulaire, etc)					
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)					
e. Vidéoconférence (Skype, etc)					
f. Blogue (Blogger, etc)					
g. Wiki (Wikipédia, etc)					
h. Réseaux sociaux (Facebook, LInkedin, etc)					
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)					
j. Logiciel de montage audio (Audacity)					
k. Courriel électronique (Outlook, Gmail, etc)					
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)					
m. Forum de discussion (Google Groupes, etc)					
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)					
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)					
p. Logiciel de collaboration en ligne (Google Docs, etc)					
q. Tableau blanc interactif (TBI/TNI)					
r. Télévoteurs					
s. Logiciel de cartes conceptuelles (cmap, etc)					
t. Listes de distribution/diffusion d'information					
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)					
v. Autre					

Nov.5 P.4

13. **Si Autre, lequel?:**

2.2. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez déjà faits dans

vos interventions pédagogiques?

14. **USAGE 2. DANS MES ACTIVITÉS POUR DONNER MES COURS (Interventions pédagogiques et non pour préparer les cours), J'UTILISE: ***

Mark only one oval per row.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)					
b. Logiciel de présentation (Powerpoint, etc)					
c. Logiciel de création de quiz (Google formulaire, etc)					
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)					
e. Vidéoconférence (Skype, etc)					
f. Blogue (Blogger, etc)					
g. Wiki (Wikipédia, etc)					
h. Réseaux sociaux (Facebook, LInkedin, etc)					
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)					
j. Logiciel de montage audio (Audacity)					
k. Courriel électronique (Outlook, Gmail, etc)					
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)					
m. Forum de discussion (Google Groupes, etc)					
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)					
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)					
p. Logiciel de collaboration en ligne (Google Docs, etc)					
q. Tableau blanc interactif (TBI/TNI)					
r. Télévoteurs					
s. Logiciel de cartes conceptuelles (cmap, etc)					
t. Listes de distribution/diffusion d'information					
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)					
v. Autre					

15. **Si Autre, lequel?:**

Nov. 5 P.S

[illegible] que vous avez demandé à vos étudiants dans vos cours?

UTILISER (OU) PRODUIRE AVEC CES OUTILS? *

Mark only one oval per row.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)					
b. Logiciel de présentation (Powerpoint, etc)					
c. Logiciel de création de quiz (Google formulaire, etc)					
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)					
e. Vidéoconférence (Skype, etc)					
f. Blogue (Blogger, etc)					
g. Wiki (Wikipédia, etc)					
h. Réseaux sociaux (Facebook, LInkedin, etc)					
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)					
j. Logiciel de montage audio (Audacity)					
k. Courriel électronique (Outlook, Gmail, etc)					
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)					
m. Forum de discussion (Google Groupes, etc)					
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)					
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)					
p. Logiciel de collaboration en ligne (Google Docs, etc)					
q. Tableau blanc interactif (TBI/TNI)					
r. Télévoteurs					
s. Logiciel de cartes conceptuelles (cmap, etc)					
t. Listes de distribution/diffusion d'information					
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)					

Nov. 5 P.6

2.3. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez demandé à vos étudiants dans vos cours?

16. **USAGE 3. DANS MES ACTIVITÉS D'ENSEIGNEMENT, MES ÉTUDIANT(E)S DOIVENT UTILISER (OU) PRODUIRE AVEC CES OUTILS: ***

Mark only one oval per row.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)					
b. Logiciel de présentation (Powerpoint, etc)					
c. Logiciel de création de quiz (Google formulaire, etc)					
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)					
e. Vidéoconférence (Skype, etc)					
f. Blogue (Blogger, etc)					
g. Wiki (Wikipédia, etc)					
h. Réseaux sociaux (Facebook, LInkedin, etc)					
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)					
j. Logiciel de montage audio (Audacity)					
k. Courriel électronique (Outlook, Gmail, etc)					
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)					
m. Forum de discussion (Google Groupes, etc)					
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)					
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)					
p. Logiciel de collaboration en ligne (Google Docs, etc)					
q. Tableau blanc interactif (TBI/TNI)					
r. Télévoteurs					
s. Logiciel de cartes conceptuelles (cmap, etc)					
t. Listes de distribution/diffusion d'information					
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)					
v. Autre					

nov.5 P.6

17. **Si Autre, lequel?:**

2.4. Lors des 3 usages énoncés précédement, pour les nombreux outils, indiquez quels usages ou quels impacts avez-vous observé:

18. **2. 4. 1. Sur le développement ou la mise à jour de vos propres connaissances?** *

19. **2. 4. 2. Sur le développement des connaissances ou compétences de vos étudiant(e)s?** *

20. **2. 4. 3. Sur votre motivation?** *

21. **2. 4. 4. Sur la motivation de vos étudiant(e)s?** *

Nov. 5 P7

22. **2. 4. 5. Autre(s) impact(s) des usages des TIC ? Si OUI, précisez lesquels.**

2.5. De manière générale, quelle est ou quelle pourrait être la valeur pédagogique ajoutée des TIC:

23. **2. 5. 1. Pour l'apprenant(e)? ***

24. **2. 5. 2. Pour l'enseignant(e)? ***

25. **2. 5. 3. Si vous avez identifié une valeur pédagogique ajoutée des TIC, quelles seraient, selon vous, les conditions nécessaires pour que l'APPRENANT(E) bénéficie des potentialités des TIC? ***

Nov. 5 P. 8

26. **2. 5. 4. Si vous avez identifié une valeur pédagogique ajoutée des TIC, quelles seraient, selon vous, les conditions nécessaires pour que l'ENSEIGNANT(E) bénéficie des potentialités des TIC? ***

27. **2.6. Selon votre opinion, disposez-vous des ressources nécessaires pour utiliser les TIC dans votre pratique enseignante (préparation et prestation de vos enseignements), en termes de:**

Tick all that apply.

- [ ] Sites Web ou autres ressources diverses (matériel audio/vidéo)
- [ ] Exemples tranférables à votre pratique
- [ ] Guides d'utilisation/tutoriels
- [ ] Réseaux (de praticiens/amis) avec qui échanger des astuces
- [ ] Soutien/accompagnement pédagogique
- [ ] Logiciels installés (par un technicien/ou par vous) dans votre ordinateur
- [ ] Logiciels installés au laboratoire et à disposition de vos étudiants
- [ ] Aide technique (un technicien) disponible pour dépannage
- [ ] Other:

28. **2. 7. Quelles seraient les contraintes d'utilisation des TIC dans votre cours? ***

Précisez

29. **2. 8. À quel niveau d'habileté se situent vos compétences à intégrer les TIC dans votre pratique enseignante? ***

Mark only one oval per row.

Novices	Intermediaires	Bonnes	Très bonnes	Expertes
◯	◯	◯	◯	◯

30. **2. 9. Comment vous sentez-vous face à l'intégration des TIC dans vos activités d'enseignement?** *

Tick all that apply.

- [ ] Cela me motive
- [ ] Cela me rend inquièt(e)
- [ ] J'ai des craintes
- [ ] Je me sens à l'aise
- [ ] J'ai eu des mauvaises expériences avec les TIC
- [ ] Other: ______________________

Mercí!

Questionnaire post-intervention (17 décembre)

Ce questionnaire vise à mieux comprendre l'impact de l'activité de formation que vous avez suivi, et vous prendra environ 15 minutes.

Les données collectées seront codifiées et traitées de manière anonyme. Les résultats de cette étude seront rendus publics à la soutenance de thèse.

Nous vous remercions d'avance pour votre aide et le temps que vous nous accordez.

* Obligatoire

1.
0. Code: (Vos initiales avec le mois et jour de naissance, separés par un trait de soulignement (__): Genny Villa 29 octobre: G10_V29, par exemple.) *

....

2.
1. L'activité de formation a-t-elle changé votre perception des TIC? Élaborez votre réponse. *

Marquez un seul ovale.

- ◯ Oui *Passez à la question 3.*
- ◯ Non *Passez à la question 5.*
- ◯ Je ne sais pas encore *Passez à la question 5.*

Si Oui, précisez

3.

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Si Non, précisez

4.

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Si vous ne savez pas encore. Expliquez votre réponse

5.

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2. Votre Culture e-learning

2.1. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez déjà faits dans votre enseignement?

6.
USAGE 1: POUR PRÉPARER MON COURS, J'UTILISE: * Q2 - Usage 1

Marquez un seul ovale par ligne.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)	◯	◯	◯	◯	◯
b. Logiciel de présentation (Powerpoint, etc)	◯	◯	◯	◯	◯
c. Logiciel de création de quiz (Google formulaire, etc)	◯	◯	◯	◯	◯
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)	◯	◯	◯	◯	◯
e. Vidéoconférence (Skype, etc)	◯	◯	◯	◯	◯
f. Blogue (Blogger, etc)	◯	◯	◯	◯	◯
g. Wiki (Wikipédia, etc)	◯	◯	◯	◯	◯
h. Réseaux sociaux (Facebook, LInkedin, etc)	◯	◯	◯	◯	◯
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)	◯	◯	◯	◯	◯
j. Logiciel de montage audio (Audacity)	◯	◯	◯	◯	◯
k. Courriel électronique (Outlook, Gmail, etc)	◯	◯	◯	◯	◯
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)	◯	◯	◯	◯	◯
m. Forum de discussion (Google Groupes, etc)	◯	◯	◯	◯	◯
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)	◯	◯	◯	◯	◯
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)	◯	◯	◯	◯	◯
p. Logiciel de collaboration en ligne (Google Docs, etc)	◯	◯	◯	◯	◯
q. Tableau blanc interactif (TBI/TNI)	◯	◯	◯	◯	◯
r. Télévoteurs	◯	◯	◯	◯	◯
s. Logiciel de cartes conceptuelles (cmap, etc)	◯	◯	◯	◯	◯
t. Listes de distribution/diffusion d'information	◯	◯	◯	◯	◯
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)	◯	◯	◯	◯	◯
v. Autre	◯	◯	◯	◯	◯

7.
Si Autre, lequel?:

....

2.2. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez déjà faits dans vos interventions pédagogiques?

8.

USAGE 2. DANS MES ACTIVITÉS POUR DONNER MES COURS (Interventions pédagogiques et non pour préparer les cours), J'UTILISE: *

Marquez un seul ovale par ligne.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)					
b. Logiciel de présentation (Powerpoint, etc)					
c. Logiciel de création de quiz (Google formulaire, etc)					
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)					
e. Vidéoconférence (Skype, etc)					
f. Blogue (Blogger, etc)					
g. Wiki (Wikipédia, etc)					
h. Réseaux sociaux (Facebook, LInkedin, etc)					
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)					
j. Logiciel de montage audio (Audacity)					
k. Courriel électronique (Outlook, Gmail, etc)					
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)					
m. Forum de discussion (Google Groupes, etc)					
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)					
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)					
p. Logiciel de collaboration en ligne (Google Docs, etc)					
q. Tableau blanc interactif (TBI/TNI)					
r. Télévoteurs					
s. Logiciel de cartes conceptuelles (cmap, etc)					
t. Listes de distribution/diffusion d'information					
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)					
v. Autre					

9.
Si Autre, lequel?:

....

2.3. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez demandé à vos étudiants dans vos cours?

9.
Si Autre, lequel?:

....

2.3. Quels sont les usages des technologies de l'information et de la communication (TIC) que vous avez demandé à vos étudiants dans vos cours?

10.

USAGE 3. DANS MES ACTIVITÉS D'ENSEIGNEMENT, MES ÉTUDIANT(E)S DOIVENT UTILISER (OU) PRODUIRE AVEC CES OUTILS: *

Marquez un seul ovale par ligne.

	Jamais	Rarement	Quelques fois	Souvent	Toujours
a. Logiciel de traitement de texte (Word, etc)					
b. Logiciel de présentation (Powerpoint, etc)					
c. Logiciel de création de quiz (Google formulaire, etc)					
d. Logiciel de création de pages Web (Weebly, Google Sites, etc)					
e. Vidéoconférence (Skype, etc)					
f. Blogue (Blogger, etc)					
g. Wiki (Wikipédia, etc)					
h. Réseaux sociaux (Facebook, LInkedin, etc)					
i. Logiciel de montage vidéo (Movie Maker, iMovie, etc)					
j. Logiciel de montage audio (Audacity)					
k. Courriel électronique (Outlook, Gmail, etc)					
l. Logiciel de recherche et de gestion bibliographique (Endnote, Zotero, etc)					
m. Forum de discussion (Google Groupes, etc)					
n. Logiciels de dépôt de fichiers (Google Drive, Dropbox)					
o. Logiciel exerciseur (Google formulaire, Netquiz, etc)					
p. Logiciel de collaboration en ligne (Google Docs, etc)					
q. Tableau blanc interactif (TBI/TNI)					
r. Télévoteurs					
s. Logiciel de cartes conceptuelles (cmap, etc)					
t. Listes de distribution/diffusion d'information					
u. Plateforme d'apprentissage en ligne - LMS (Moodle/StudiUM/ Faculté virtuelle)					
v. Autre					

11.

Si Autre, lequel?:

2.4. Lors des 3 usages énoncés précédement, pour les nombreux outils, indiquez quels usages ou quels impacts avez-vous observé:

12.

2. 4. 1. Sur le développement ou la mise à jour de vos propres connaissances? *

13.

2. 4. 2. Sur le développement des connaissances ou compétences de vos étudiant (e)s? *

14.

2. 4. 3. Sur votre motivation? *

15.

2. 4. 4. Sur la motivation de vos étudiant(e)s? *

16.

2. 4. 5. Autre(s) impact(s) des usages des TIC ? Si OUI, précisez lesquels.

2.5. De manière générale, quelle est ou quelle pourrait être la valeur pédagogique ajoutée des TIC:

17.

2. 5. 1. Pour l'apprenant(e)? *

18.

2. 5. 2. Pour l'enseignant(e)? *

19.

2. 5. 3. Si vous avez identifié une valeur pédagogique ajoutée des TIC, quelles seraient, selon vous, les conditions nécessaires pour que l'APPRENANT(E) bénéficie des potentialités des TIC? *

20.

2. 5. 4. Si vous avez identifié une valeur pédagogique ajoutée des TIC, quelles seraient, selon vous, les conditions nécessaires pour que l'ENSEIGNANT(E) bénéficie des potentialités des TIC? *

21.

2.6. Selon votre opinion, après avoir suivi l'activité de formation, disposez-vous des ressources nécessaires pour utiliser les TIC dans votre pratique enseignante (préparation et prestation de vos enseignements), en termes de:

Cochez toutes les réponses qui s'appliquent.

- [ ] Sites Web ou autres ressources diverses (matériel audio/vidéo)
- [ ] Exemples tranférables à votre pratique
- [ ] Guides d'utilisation/tutoriels
- [ ] Réseaux (de praticiens/amis) avec qui échanger des astuces
- [ ] Soutien/accompagnement pédagogique
- [ ] Logiciels installés (par un technicien/ou par vous) dans votre ordinateur
- [ ] Logiciels installés au laboratoire et à disposition de vos étudiants
- [ ] Aide technique (un technicien) disponible pour dépannage
- [ ] Autre : ____________________

22.

2. 7. Selon votre opinion et après avoir suivi l'activité de formation, quelles seraient les contraintes d'utilisation des TIC dans votre cours? *

Précisez

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23.

2. 8. Après avoir suivi l'activité de formation à quel niveau d'habileté se situent vos compétences à intégrer les TIC dans votre pratique enseignante? *

Marquez un seul ovale par ligne.

	Novices	Intermediaires	Bonnes	Très bonnes	Expertes
	◯	◯	◯	◯	◯

24.

2. 9. Après avoir suivi l'activité de formation, comment vous sentez-vous face à l'intégration des TIC dans vos activités d'enseignement? *

Cochez toutes les réponses qui s'appliquent.

- [ ] Cela me motive
- [ ] Cela me rend inquiét(e)
- [ ] J'ai des craintes
- [ ] Je me sens à l'aise
- [ ] J'ai eu des mauvaises expériences avec les TIC
- [ ] Autre : ....

25.

3. Après avoir suivi l'activité de formation, quelle est votre position face à l'énoncé : "J'ai davantage envie d'intégrer les TIC dans ma pratique enseignante" *

Marquez un seul ovale.

◯ Très en accord avec l'énoncé *Passez à la question 26.*

◯ En accord avec l'énoncé *Passez à la question 27.*

◯ En désaccord avec l'énoncé *Passez à la question 28.*

◯ Très en désaccord avec l'énoncé *Passez à la question 29.*

Si vous avez répondu " Très en accord avec l'énoncé" quelles seraient les conditions requises pour favoriser cette intégration des TIC?

26.

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Si vous avez répondu " En accord avec l'énoncé" quelles seraient les conditions requises pour favoriser cette intégration des TIC?

27.

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Si vous avez répondu " En désaccord avec l'énoncé" quelles seraient les conditions requises pour favoriser cette intégration des TIC?

28.

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Si vous avez répondu " Très en désaccord avec l'énoncé" quelles seraient les conditions requises pour favoriser cette intégration des TIC?

29.

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30.

4. Selon vous, que faudrait-il améliorer à l'activité de formation qui vous a été offerte? *

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Merci!

Annex 2: Guidelines Suggested for Working on Participant Teacher Trainers' Activities Integrating ICT (Votre activité)

Votre activité

Choix d'une activité dans laquelle vous aimeriez intégrer des éléments de valeur pédagogique ajoutée, à partir des concepts discutés pendant notre activité de formation

0. **Code:** (Vos initiales avec le mois et jour de naissance, séparés par un trait de soulignement (__): Par exemple : Genny Villa 29 octobre= G10_V29.)

1. Parmi les activités des différents thèmes de votre cours, **choisissez une activité que vous aimeriez réaliser à l'aide de la technologie**. Énoncez-la.

2. S'il s'agit d'une activité existante dans laquelle vous aimeriez intégrer la technologie, **quel aspect** voulez-vous changer/améliorer?

3. Quelles **nouvelles façons de faire** les choses qui contribueraient à atteindre l'objectif aimeriez-vous explorer à l'aide de la technologie?

4. Quelle est **la valeur pédagogique ajoutée que vous aimeriez aller chercher**? Quelles seraient autres valeurs reliées?

5. Quel est **l'objectif de cette activité**?

6. Quelles sont les **ressources nécessaires** pour réaliser l'activité et atteindre son objectif?
    1) Ressources à mettre sur place pour vous :

    2) Pour vos étudiant(e)s :

7. Quelles sont les **conditions facilitatrices**? À niveau personnel et/ou institutionnel

8. Quelles sont **les contraintes?** À niveau personnel et/ou institutionnel

9. Et l'évaluation, quelles (nouvelles) **formes d'évaluation** aimeriez-vous explorer ?

    1) Aviez-vous déjà songé à ce type d'évaluation? Pourquoi ne l'avoir pas fait avant?

    2) Comment la technologie vous permettrait-elle de le faire?

10. Quelles sont les **avantages**?
    1) Pour vous

    2) Pour vos étudiant(e)s

11. Quelles sont **les conditions facilitatrices?**

12. Quelles sont **les contraintes?**

Annex 3: Diagnostic Test – A final product being currently used at a Basics Biochemistry Course, to identify students' entrance level for further remedial course.

QUESTIONS RESPONSES 1

Section 1 of 2

Prueba diagnostico curso de bioquimica basica

Estimados alumnos,

Esta prueba diagnóstica tiene por objetivo identificar el nivel de conocimientos sobre los "Grupos Funcionales", un tema de la química orgánica que forma parte de los pre-requisitos para la asignatura de Bioquímica que cursarás en el presente ciclo.

Al cuerpo docente de la Academia de Bioquímica nos permitirá proporcionarles apoyo para que logren su nivelación mediante módulos y tutoriales que respondan a sus necesidades específicas y cursar con éxito esta materia.

El resultado de esta evaluación no repercute en la calificación del curso, es confidencial, y se proporcionará a quienes lo soliciten en una sesión de retroalimentación personalizada.

Agradecemos su colaboración y participación en esta prueba.

0. Matricula de estudiante

Escribe en la casilla tu número de matrícula

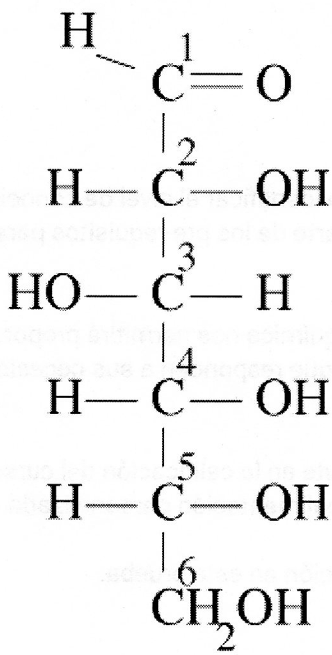
Short-answer text

1. CUALES SON LOS ELEMENTOS QUIMICOS BASICOS QUE COMPONEN LA MATERIA DE LOS SERES VIVOS

Puedes marcar diferentes respuestas correctas y si en las opciones dadas falta alguno, escribirlo en la opcion

- [ ] OXIGENO
- [ ] CALCIO
- [ ] NITROGENO
- [ ] POTASIO
- [ ] Other...

2. Composicion quimica de una



a. Selecciona la opción correspondiente a la composicion quimica de esta molecula

- [ ] C6 H12 O7
- [ ] C6 H12 O7
- [ ] C6 H12 O6

*

b. Grupos funcionales

El grupo funcional del carbono NUMERO 3 de la biomolecula corresponde a

- [ ] alcohol primario
- [ ] alcohol secundario
- [ ] alcohol terciario
- [ ] aldeido
- [ ] acetona

c. Selecciona la opción correspondiente al grupo funcional del carbono NUMERO 1 de la biomolécula :

- [ ] Cetona
- [ ] Aldehido
- [ ] Alcohol
- [ ] Acido

After section 1 **Continue to next section**

Section 2 of 2

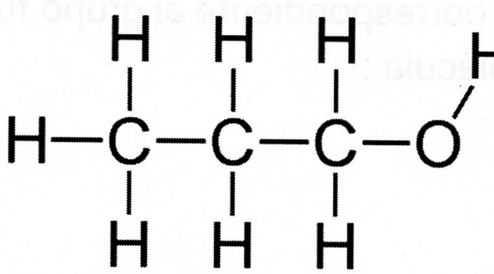
Section title (optional)

Description (optional)

¿A qué clase de compuesto químico pertenece la molécula

- [ ] Aldehído
- [ ] Alcohol
- [ ] Acido
- [ ] Amina
- [ ] Cetona

Molécula A

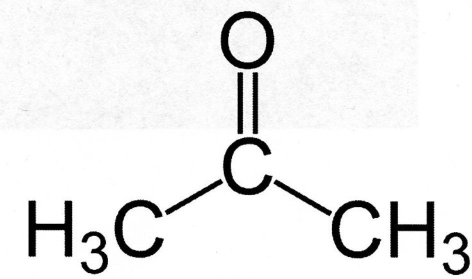


¿A qué clase de compuesto químico pertenece la molécula

- [ ] Cetona
- [ ] Acido
- [ ] Amina
- [ ] Ester
- [ ] Anhidrido

Molécula B

¿Cuál es el nombre químico de cada uno de los siguientes compuestos?

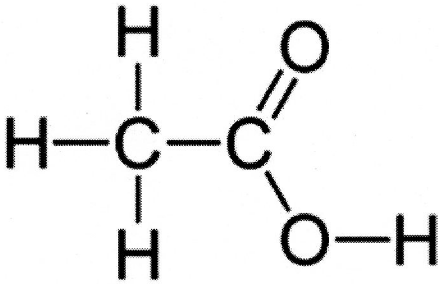


¿Cuál es el nombre químico del compuesto C?

Escribe dentro del recuadro

Short-answer text

Molécula C



¿A qué clase de compuesto químico pertenece la molécula

Escribe dentro del recuadro

Short-answer text

Molécula D