

Integrating Technology in Teachers' Profession

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Abstract

The continuous fast developing field of Information and Communications Technology (ICT) is affecting every aspect of our life including education. The purpose of this research is to show the importance of ICT knowledge in Teachers' education journey (preservice and inservice). The first part of this paper discusses the teacher's professional knowledge. The second part discusses ICT in Education. Section three explains and discusses the TPACK (Technological Pedagogical Content Knowledge) model. Part four and five discuss preservice teachers' education and inservice teachers' training respectively. Last part sheds the lights on the benefits of teachers' networks. Finally, in the digital world we are living, teachers need to be digitally knowledgeable to be able to lead the students to be critically engaged active members.

1. Introduction

The continuous fast developing field of Information and Communications Technology (ICT) is affecting every aspect of our life including education. Teachers and schools are no more the only source of information. This has deeply affected teachers' role, their education, and the required professional knowledge and development. This paper examines the necessity of ICT knowledge in nowadays teachers' professional knowledge and its correlation with pedagogy and contents. This is discussed in four parts: teachers' professional knowledge, ICT in education, preservice teachers and inservice teachers.

2. Teachers Professional Knowledge

According to Bromme, 'professional knowledge seems to be sufficiently described by 'subject matter,' 'pedagogy,' and 'specific didactics'" [1]. Teachers' professional knowledge has undergone multiple transformations in the recent decades.

SITES2006, an international comparative study of pedagogy and ICT use in schools, defines the 21st century skills as "the capacity to engage in lifelong learning (understood as self-directed and

collaborative inquiry) and as connectedness (communication and collaboration with experts and peers around the world)" [2]. In line with this, 21st century teachers are expected to empower students to become lifelong learners; that is, teachers need to promote students' critical thinking skills, autonomous learning and collaboration to face the challenges of a rapidly changing world. To this end, teachers themselves need to be equipped with adequate professional knowledge so as to fulfill the social economical expectations and maintain the social trust in their professional work.

3. ICT in Education

ICT is penetrating in every aspect of our life, and education is not an exception. Educators need to use ICT in their learning and teaching process because it can facilitate and enhance the learning progress, and because it is a must to know how to use ICT in our life.

3.1. ICT impact on teachers' role

Education is undergoing a serious radical obligatory revolution. The Internet, the spread of information from diverse sources and the use of different multimedia provided everyone with the opportunity to learn anything, anywhere, anytime, and in many different ways! This change has vitally affected teachers' main role. Teachers are expected to prepare students to live and contribute to their own community and to the global world. In order to carry out their new role successfully, teachers need to understand, acquire and be expert in their students' digital native language [3] and environment.

From a different perspective, ICT extends the learning process outside school walls and renders it ubiquitous. 'The old certainties of a world defined by four classroom walls and impermeable boundaries have disappeared forever; replaced by global interdependencies and complex systems that require flexibility, responsiveness, and imagination' [4]. Teachers can now reach their students anytime and anywhere, and they can easily cooperate with them

and with students' parents. Moreover, different ICT tools and services accommodate several educational strategies: inclusion, differentiated learning, and personalized learning. Using different levels of educational software is a simple example of personalized learning. So, being ICT competent empowers teachers to reach every student and is consequently expected to have a positive impact on students' attainment, and therefore being ICT competent is not a choice anymore.

3.2. ICT in education training and framework

At the beginning, most training efforts focused on providing teachers with simple computer skills: how to operate hardware (computers, peripherals, and later on interactive whiteboards) and how to use simple software. However, it was not so long until educators found out that possessing ICT skills alone is not affecting the teaching process.

Education leaders noticed that it was not enough to train teachers on how to use ICT, but the most important is to make sure that teachers use ICT effectively in their work and get the most out of it to enrich their professional development and their students' achievements. Hence, the attention shifted to the effective use of ICT in education. "Technology integration" became the trend. Other initiatives and framework began to appear. Integrating technology in education has been widely discussed and researched. The combination of technology, pedagogy and knowledge has recently emerged by building on the pedagogical content knowledge (PCK) framework introduced by Shulman [5].

4. TPACK

'By introducing a model of technology that considers how the components of content, pedagogy, and technology co-constrain and intertwine, we have offered both a theoretical model (TPCK) as well as a potential analytical one for studying changes in teachers_ knowledge about successful teaching with technology' [6].

4.1. TPACK background

Koehler et al. [7] began their investigation of the connection between content, pedagogy, and technology in 2002 at Michigan State University, where they conducted a research-based study of the development of these ingredients (content, pedagogy, and technology, and their complex interrelation) through a learning by design approach where faculty members and graduate students cooperated together in a semester long term to design an online Master level's course. As a result of this study, Koehler et al.

offered their first model of how content, pedagogy and technology are related (figure 1).

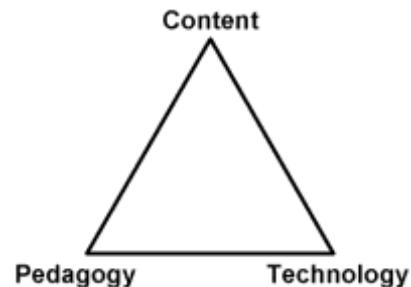


Figure 1. Three components to integrate for good online teaching [7]

Koehler et al. [7] noticed the ineffective old way of faculty technology development, where faculty members were given ICT skills training separately from pedagogy and content. They approached their new suggested development with the idea: '*there is no single technological solution that applies for every teacher, every course, or every view of teaching*' [7].

Faculty members enrolled in a master course in designing educational technology and working groups were formed by teaming a faculty member with each couple of master students. Their project was to form an online course that faculty members would be teaching in the next academic year. Therefore, instead of giving the course material to the IT department to transfer it to an online course, faculty members actually participated in designing the online course with graduate students. The authors, of whom two of them were the instructors of the mentioned course believed in the design-based method for its efficacy in studying complex and interconnected concepts, and were eager to see the result of this research.

4.2. What is TPACK?

TPCK stands for technology pedagogy content knowledge. As described previously, it is 'the result of 5 years of work on a program of research focused on teacher professional development and faculty development in higher education' [8]. It is now referred to it as TPACK [9]. TPACK was based on Lee Shulman's [5] research, where he teamed the pedagogy and the content knowledge (PCK).

For a deeper understanding and results, Koehler and Mishra [10] suggest another way of researching the usefulness of TPACK which is the use of surveys throughout the development process. The research showed the progress of the TPACK items in the designers' knowledge (figure 2). They began with standalone components, technology, pedagogy and content knowledge, and they ended up with better

understanding and management of the correlated components: Technology and content (TC), technology and pedagogy (TP), and the correlation of the three together, technology, pedagogy, and content (TPC).

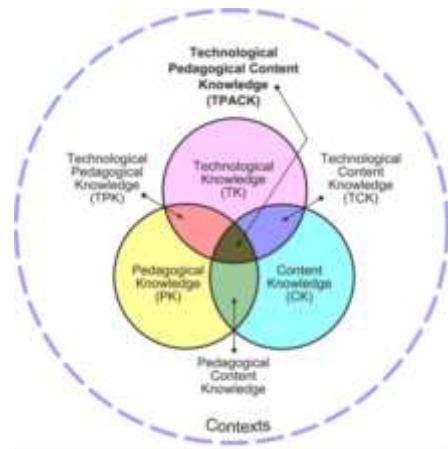


Figure 2. The TPACK framework and its knowledge components [11]

Having tech savvy teachers with good information about the relation between technology, pedagogy and content, enable them to find out the best usage of technology in their own teaching zone. This is very important regarding technology, since technology is developed outside schools or educational institutions, and it needs educators to use it, evaluate it, and to find out the real service that it may provide for the teaching and learning process. In addition to technology that is designed for general purposes and educators need to tailor it for their own use, like the Microsoft Office suit, which was designed for office works, “teachers need to reject functional fixedness, and develop skills to look beyond the immediate technology and “reconfigure it” for their own pedagogical purposes” [12].

TPACK framework (Figure 2) highlights the necessity to help teachers realize the relations among content, pedagogy and technology, as well as the need to support them in the practical implementation. Koehler and Mishra [11] recommended that “expert” teachers need to be knowledgeable in the three component of the TPACK framework: technology, pedagogy, and content, and the composite relation among each other. This newly emerging combined knowledge is not easily acquired and it needs time, testing, reflection, and continuous follow-up of upcoming educational technology and theory.

4.3. Researching TPACK

Only few years passed after the introduction of TPACK framework [10] and plenty of research studies about it abounded. This could be because of

the lack of previous theoretical framework of integrating technology in education as claimed by its introducers [10] and confirmed by other researchers like Niess [13] and Angeli and Valandies [14], or because it is the normal progress situation after long years of trying to integrate ICT in education, or simply to explore its usefulness because of the high importance and demand of technology integration in education nowadays.

The ICT knowledge and its interrelation with the other TPACK items were widely welcomed and received large interest from educators, researchers, and educational institutions because it gave them a practical framework for technology integration [15]. TPACK usefulness is under research in different countries, aspects, and environments: TPACK research studies are running in different countries in the world: USA, Europe, Far East, Middle East ([16], [17], [18], [19]); TPACK usage in specified subjects like: math, science, technology ([15], [20]); and in different class levels [21]; as well as in different teaching means: online and blended learning ([22], [23]); TPACK is also examined in teachers’ readiness and acceptance [24]; TPACK is checked as a guide for preservice and inservice teachers’ professional development [13]; and an assessment instrument [14].

These are only examples and what is meant by this citation of the TPACK spread research studies is the importance agreed upon of the ICT skills and ICT integration in teacher professional knowledge or teacher education, which will be discussed in the next section.

5. Preservice Teachers

To ensure a change in the use of ICT in schools, change should begin in preservice teachers’ education.

5.1. Preservice teachers’ education and beliefs

Despite all the debates about the usefulness of integrating ICT in education, researchers agreed on the importance of including ICT training in preservice teachers’ education [25]. Technology in education is expected to enhance the learning process and support the 21st century skills like critical thinking and problem solving skills, as well as facilitate and empower cooperation and collaboration processes.

According to Pajares [26], beliefs are often strongly rooted and they are not easy to change. Several research studies asserted the direct relation between teachers’ knowledge and beliefs and their teaching and learning practice in schools [27]. Teachers’ educators need to keep on evaluating their preservice education programs to embrace the

effective use of ICT in education, and to prepare teachers for the information age. "Strong preservice education on the use of ICT is also important because it can help to counter the possibilities of transmission-oriented school practices in the assimilation of beginning teachers." [28].

As per Guskey [29], to reach a change in practice, beliefs need to be changed before. However Thompson et al. [30] have another point worth considering: beliefs and practices influence each other, i.e. a change in beliefs may result in a change in practice, and vice versa. Throughout my work in training teachers on how to integrate technology in education for more than twelve years so far, I have seen this mutual relation very clearly. Some teachers used to have negative beliefs regarding the use of ICT in their teaching and learning process. In cases where school administration was not firm in the use of ICT, such beliefs changed first by observing other active positive teachers in the integration of technology. Hence, beliefs changed before practice.

However, in cases where school administration was so definitive in the use of technology in their schools and with students, teachers had to change their practice although they didn't believe in it, just to keep their position in the school, and with time, these teachers were able to find out how technology can help them in their specific subjects and cases, and consequently, their beliefs changed after a change in practice and not before.

5.2. Preservice teachers' educators practice and beliefs

Grove et al. [31] argued that preservice teachers need to be trained with tech savvy teachers, who are actually integrating ICT in their teaching and learning process and have faith in it. They also need to get enough access to educational technologies (software and hardware). This is to ensure a right base building for technology integration. Some higher education faculty members consider learning new educational technology a waste of time and they prefer to invest their time in taking care of their course content and teaching pedagogies. [7]

However, faculty members need to be role models in their effective use of ICT in the teaching and learning process. Mumtaz [32] noticed that the way ICT is used in higher education and the type of ICT training faculty attended highly affected how students will be using ICT in their upcoming teaching career. Russell el al. [33] also urged education departments in higher education to effectively train preservice teachers on how to integrate ICT in their teaching and learning process.

However, this change is crucial, digital native students [3] need 'digitally learned teachers'. 'Preservice teachers must routinely encounter the effective infusion of technology in the normal course

of their learning at the university and in their practicum placements in schools' [4]. Preservice teachers need to be exposed to technology in their education, have the opportunity to practice their teaching training with teachers adopting ICT integration, and get enough time to explore the benefits of educational technologies.

6. Inservice Teachers

The information age is forcing the need of technically knowledgeable population and workforce to keep the development and innovation rolling on. This emphasizes the importance of well experienced teachers in embracing ICT in students' life: enhancing their ICT skills and empowering its use as a learning and communication tool. Recommending adequate ICT knowledge education or TPACK education for preservice teachers will not at any point eliminate the vital need for related continuous professional development for inservice teachers. Different reasons are behind this statement and will be discussed in this section.

6.1. Teachers' education

Most teachers nowadays did not get the needed educational ICT skills and knowledge in their previous education. Integrating ICT in education is not yet available in all preservice teachers programs [34], and if ever available, only few ICT in education related courses are given to preservice teachers [8]. Although we started to have the digital teachers or the net generation teachers (the digital students who became teachers) integrating ICT in education is still primitive. These teachers may have a better attitude towards the use of ICT in general, since they are digitally fluent, but this did not show a successful integration. Add to this, the former teachers who never encountered ICT in their education, and got simple ICT skills training sessions only. That's why well designed and planned technology integration continuous professional knowledge is needed. In order to keep this on the right track, headteachers, school leaders and administrators need to be included in the professional development process to ensure a constant school improvement and not to leave things dependent on teachers' acceptance or resistance level.

6.2. Teachers' attitudes

Different barriers to technology integration were discussed and examined by researchers. Main barriers are lack or inadequate training, not enough resources (hardware or software), absence of internal support, ambiguity regarding the technology role in education, overloaded agenda and insufficient time to learn or practice the use of technology, and

restricted curriculum leaving no space for technology integration [25].

Ertmer [35] discussed two types of barriers when discussing teachers' use of technology. First-order barriers are external barriers that are not caused by teachers themselves, like lack of resources, training or support. Second-order barriers are those internal to teachers, like their attitudes and beliefs towards using technology. Both types of barriers are essential and should be dealt with to reach an optimal ICT usage. However, solving the second-order barriers is much harder. Add to this that if teachers were convinced of the importance and usefulness of ICT in their teaching and learning process, they may participate in solving the first-order barriers by taking responsibility for providing adequate software, hardware, training and support. Albeit, having a well technology furnished school will have minimal effect on teachers' beliefs and attitudes unless these issues were addressed directly in the school continuous professional development.

'The overall picture seems to be that introduction of ICT in schools, although long awaited and strongly supported, encounters significant problems related to the attitudes of the people who are responsible for its use in the classroom' [36]. Despite all the training sessions provided to teachers in the use of ICT, researchers and educators found that in most of the studied cases, teachers did not yet reach a fulfilling use of ICT in education [37]. Teachers' negative attitude towards ICT use in education is not originating only from the difficulty of the technology, but also from teachers' disbelief of the constructive impact of technology integration in the teaching and learning process. Some teachers may be counted as 'technophobic' [38], and therefore resisting any educational reform using technology because of their incorrect beliefs. Well-designed continuous learning process and professional development, close support, and enough resources are key elements in changing teachers' attitudes and beliefs towards an active use of ICT in education.

6.3. Current status of ICT integration

Introducing the ICT in education was supposed to be an important key factor in education reform. However, that was not the case. Educators' improper use of ICT was claimed to be the reason behind this failure. Most teachers are using ICT to support their old teaching strategies and not using it to enhance learner centered teaching approach. That was seen also with new teachers, who possess good ICT skills [33]. That's why supporting educators for an effective use of ICT became a main concern.

6.4. Continuous Professional Development

Hargreaves and Fullan [39] argued that the new professionalism stresses hardly on teachers' continuous self-learning and development. Teachers need to keep up with every progress or invention of anything related to education that can enhance their teaching and learning process from educational technology or learning theories. The new professionalism also highlights the interaction of teachers with their colleagues outside the classrooms and with the whole community outside the classroom. This could begin in teachers' education institution, but it will flourish, mature and continue to grow during their work, i.e. inservice. Hargreaves and Fullan [39] noticed that schools nowadays are not very well designed or do not accommodate for such a continuous professional development. Teachers are most of the time overloaded with their own work, restricted to long curriculum to finish, and are not provided continuously with well framed professional development and enough support.

Most available ICT training for teachers did not fulfil teachers' need in integrating technology in education. These training sessions were basically informative and tend to build ICT skills. It did not take into consideration the teaching pedagogy and contents, and it did not accommodate for the long time needed to reach a stable educational practice [34]. Short term training sessions are not enough to enable teachers to effectively integrate technology in their teaching and learning procedures. Interactive, practical, and long term professional development, and which is directly related to the curriculum is much more effective. Such professional development has 'easy to digest' chunk of information and consequently easier to implement, and it is less stressful in the change process.

7. Teachers' networks

With the ease access to internet and with the spread of online communities, teachers' network begins to appear and to add a new dimension to teachers' professional development. Teachers now can cooperate and benefit from other teachers even if they don't see each other or they are miles away. Teachers learn from their peers by sharing information, discussing ideas, and assessing work and results. Outside school networks give a larger experience and learning opportunities. "School networks help us learn across cultures to identify, analyze and solve pertinent problems impacting teaching and learning, and just like Socrates, we become citizens of the world learning and conversing with all." [40].

Hargreaves and Fullan [39] showed that the teachers' relationships with their colleagues affect their relation with their students inside the

classroom. They observed the change happening with teachers initiating or cooperating in work professional communities. In the end of their research, Hargreaves and Fullan suggested that ‘teachers today must learn to become leaders of their colleagues as well as teachers of their classes’ [39], where colleagues are not meant to be their colleagues in the same school only, but every teacher they may be able to reach. They emphasized this issue stating: “At a time of rapid change and increasing professional expectations, getting access to this professional learning and expertise is more important than ever.” [39]

8. Conclusion

Although ICT came in to education with lots of hopes and expectation to education enhancement or even reform, challenge accompanying this could never be ignored and should be taken care of and dealt with. Training teachers to use ICT effectively in education cannot be done through simple ICT skills training sessions. “It requires appreciation of the complex set of interrelationships between artifacts, users, tools and practices. In particular, it requires teachers to become sensitive to the demands of harnessing and integrating technology, pedagogy and content.” [6]. TPACK was largely welcomed, and researchers [28] saw what is available so far a descriptive model of the TPACK and they encourage educators to use this framework to have more practical comprehensive understanding for the framework and for the relationship of each item of this framework to the other.

Teachers will need what is called ‘functional competence’ at least to be able to join the new teaching profession. ‘By ‘functional competence’ is meant ability to perform at least at a minimum occupational standard. Complete mastery of practice may of course take much longer’ [41]. Teachers need to be tech savvy and not technicians. They need to know how to operate technology and have simple troubleshooting notions. It is not possible to ask for help from the IT support division just to connect a loose electricity cable for example. They need to be knowledgeable in some productive programs to process their own teaching, learning and education management materials, like word processing, spreadsheets, presentations, and simple image and design programs. They need to be at ease in using the Internet for communication in every direction: with their students, with their colleagues, or other teachers around the world through specialized networks, with school administrators, students’ parents, and the whole community. They need to be up-to-date with multimedia programs and educational platforms to support their teaching materials and strategies and to enhance students learning and achievements. They need to have a good idea about the available ready-

made software or educational materials that could be suitable for their own curriculum. They need to have basic ICT terminology in case they needed to follow up a new issue or search for help.

The philosophy that technology can be used only as a supplement to the existing pedagogical practices has significant implications on the teachers’ professional knowledge. In particular, it accentuates the teachers’ impression of the redundancy of any adequate preparation to more effective ICT use. In line with this, Ertmer and Ottenbreit-Leftwich [42] call for shifting the teachers’ mindsets away from such philosophy and assuming the necessity of technology for promoting students’ performance. ‘Unfortunately, the rapidly changing field of information and communication technologies (ICT) can make becoming, and remaining, a “technology competent” teacher a daunting task’ [43].

‘Learning how to teach and learn in new ways with technology requires imagination, intellect, creativity, and no small courage.’ [4]. That’s why high quality initial education is needed in preservice with a continuous updates of teachers education programs; in addition to a related continuous professional development inservice with the perpetual presence of support. School leaders, head teachers and administrators should be always included in this education and professional development.

9. References

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