

## ***Examining Technological Pedagogical Content Knowledge Competencies in In-Service Teachers***

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### **Abstract**

Taking digital technology as the framework of the research, this study investigates in-service teachers' Technological Pedagogical Content Knowledge competency (TPCK), by contextualizing teachers' beliefs and competencies of using the TPCK model in teaching English as a foreign language. The study is an extension of a previous research made by Tovar et al., (2019). Methodology included a survey-based questionnaire, an unstructured interview, and classroom observations. Assessment instruments were administered to sixteen in-service English teachers. Results revealed that a high percentage of the teachers, who work in the Language Center at the Technical University of Cotopaxi, are not familiar with the use of the TPCK framework. Research outcomes, therefore, suggest that developing teachers' TPCK competency, strengthens their knowledge domains, skills, and beliefs of the usage of technology in classroom settings. Implications of this study and considerations for further research are discussed.

**Keywords:** *TPCK competency, classroom practices, computer literate*

## ***Competencias en el Conocimiento de Contenido Pedagógico y Tecnológico en docentes de inglés***

### **Resumen**

Al tomar la tecnología como el objeto de estudio de la investigación, el artículo investiga la competencia de Conocimiento de Contenido Pedagógico y Tecnológico (TPCK) de los docentes de lengua extranjera, Inglés, contextualizando las creencias y competencias de los docentes en el uso del modelo TPCK en la enseñanza del idioma inglés. El estudio es una extensión de la investigación de Tovar *et al.*, (2019). La metodología incluyó un cuestionario basado en una encuesta, una entrevista no estructurada y observaciones en el aula. Los instrumentos de evaluación fueron administrados a dieciséis profesores de inglés en servicio. Los resultados revelaron que un alto porcentaje de docentes, que trabajan en el Centro de Idiomas de la Universidad Técnica de Cotopaxi, no están familiarizados con el uso del modelo TPCK. Los resultados de la investigación, por tanto, sugieren que el desarrollo de la competencia "TPCK" en los maestros fortalece sus dominios de conocimiento,

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habilidades y creencias sobre el uso de la tecnología en el aula. Se describen implicaciones del presente estudio y consideraciones para futuras investigaciones.

**Palabras clave:** *Competencia TPCK, prácticas de aula, alfabetización informática*

## ***Competência no conhecimento do conteúdo pedagógico e tecnológico em professores de inglês***

### **Sumário**

Tomando a tecnologia como objeto de pesquisa, o artigo investiga a competência do Conhecimento de Conteúdo Pedagógico e Tecnológico (TPCK) de professores de língua estrangeira, inglês, contextualizando as crenças e competências dos professores no uso do modelo TPCK no ensino da língua inglesa. O estudo é uma extensão da pesquisa de Tovar et al., (2019). A metodologia incluiu um questionário baseado em uma pesquisa, uma entrevista não estruturada e observações em sala de aula. Os instrumentos de avaliação foram administrados a dezesseis professores de inglês em serviço. Os resultados revelaram que uma alta porcentagem de professores, que trabalham no Centro de Idiomas da Universidade Técnica de Cotopaxi, não está familiarizada com o uso do modelo TPCK. Os resultados da pesquisa, portanto, sugerem que o desenvolvimento da competência “TPCK” nos professores fortalece seus domínios de conhecimento, habilidades e crenças sobre o uso da tecnologia na sala de aula. Implicações do presente estudo e considerações para futuras pesquisas são descritas.

**Palavras-chave:** *competência TPCK, práticas em sala de aula, alfabetização em computação*

### **Introduction**

Digital era, has considerably changed and modified teaching practices and methodologies in most areas and disciplines across humanities and science fields. Mishra and Koehler (2015) highlight that, in order to skillfully teach with technology, teachers need solid know-now about reconnecting technology to both subject-matter knowledge and pedagogical understanding to reshape them according to learners’ needs (p. 3). Accordingly, Luu and Freeman (2011), and Windschitl (2009) claim that in the 21st century, the inclusion of educational technologies into the classroom practices should be taken as an integral aspect of teacher education to improve teaching and learning experiences in both, trainers and trainees. In the digital era, technology, to some extent, is becoming part of our social and classroom practices. Hilton (2016), states that nowadays, technology is in our “student’s pockets, mounted on a wall, and perhaps in a device cart at the back of their classrooms” (p. 68). Students, therefore, are living in the digital age where

technology, at one hand, can be a powerful learning tool, and, on the other, a harmful source, in terms of addiction and unfruitful use.

The productive integration of digital tools generates learners’ positive attitudes toward learning. For example, tools like forums, videoconferences, and e-learning platforms provide learners not only with positive and rewarding learning experiences but also with support the acquisition of knowledge and skills. Nonetheless, it should be understood that pure technology alone could not help to develop pedagogical and content knowledge and that their effectiveness depends on their right application. In this way, Hechter and Vermette (2013) state that in teaching and learning process, teachers more often deal with some administrative, technological, organizational, and philosophical barriers, which altogether affect or influence the successful integration of technology into their classroom practices. A possible reason for such difficulties

may be that teachers need to update their digital competencies and expertise to successfully implement the potential possibilities that today ICTs offer.

Since technology extensively emerges and evolves fast, teachers require a solid knowledge and deep understanding of using digital tools in teacher education (e.g. Mishra and Koehler, 2006). That is, in order to support the integration of Information and Communication Technologies (ICTs) in education, Wachira and Keengwe (2011) suggest that technology should be embedded in line with the pedagogical and methodological approaches, and content knowledge of the subject. Apart from technological know-how, Hilton (2016) argues that:

[...] a well-considered and meaningful lens through which to plan and reflect on technology integration is required. A lens that not only allows teachers to determine if technology use better meets student needs and learning objectives but also a lens out of which future directions and improvements can be gleaned. (p. 68)

Research across disciplinary fields has demonstrated the necessity of understanding how technology can be synchronized with pedagogy and content knowledge (e.g., Atun & Usta, 2019; Graham et al., 2009; Niess, 2005; Miller, 2008). Although the accessibility to digital tools and internet

connections continues increasing in some educational institutions, particularly in Ecuador, the use of ICTs for academic goals is poorly developed. It could be because some teachers do not probably have the necessary competence or enough experience to incorporate technology into their classroom practices (Niess, 2005; Miller, 2008). Technology, in teacher education, is often seen as an isolated component, independent from pedagogy and content knowledge. Therefore, there is a limited understanding of the conceptual basis of educational technology (Koehler & Mishra, 2008) which, in large part, shows an imbalanced relationship between technology, pedagogy, and content knowledge. Accordingly, adapting teachers' skills to the new digital classroom practices could be described as one of the most challenging issues in education.

Taking digital technology as the framework of the research, the present study investigates teachers' beliefs and competencies of integrating technology, pedagogy, and content knowledge (TPCK) in language teaching. To reach this goal, the following research questions will be addressed: what is the competency level of in-service English teachers in terms of TPCK components? And to what extent the proportion of knowledge of each component contributes to effective teaching and learning experiences?

### **Development: Literature review**

There is a growing body of literature that recognizes the importance of using technology in teacher education. For example, Hofer and Grandgenett (2012) found that teachers' knowledge of technology significantly contributes to the implementation of training and learning programs. Atun and Usta (2019) emphasized that TPCK framed lesson has a positive impact on learning outcomes as long as activities rich in a technological environment are included into the process. Similarly, Tanak (2018) discovered that the technology-based courses provide teachers better opportunities to incorporate materials into their subject matter; nonetheless, lack of direct teaching experiences limited the effective use of technology. The primary reason for such skill difficulty in teacher education is that teachers see technology, pedagogy, and content as independent components of each other (Koehler *et al.*, 2007). Accordingly, Shulman (1986) claim that teachers need "an understanding of how particular topics, problems, or issues are organized, represented and adapted to the diverse

interests and abilities of learners and presented for instruction" (p. 8). Therefore, the integration of technology in language teaching according to Van Olphen (2008) should consider "how learners' linguistic and cultural backgrounds can contribute when using technology, what facilitates or hinders the acquisition of language and the development of language competence" (p. 6-7).

Ahmadi (2018) stated that effective use of new technologies positively improves learners' language skills. Technology then provides learners with a wide variety of sources to learn and practice the language inside or outside of the learning environments. Nonetheless, such effectiveness depends on the method that instructors use to facilitate the language learning process (Ahmadi, 2017); that is, if they do the instruction well, learners will be inspired to explore and learn more. Apart from providing learners with instructional materials, Genç İter (2015), highlighted that teachers should also encourage learners to find by themselves appropriate language activities that integrate computer technology to

feedback and feedforward their learning process. The authors concluded that technology enhances learning and supports academic achievement.

Research on the use of the TPCK as the base for language development has been examined in a wide range of fields and disciplines. Regarding the best way to use TPCK into classroom practices, Tai (2013) suggests that modeling activities with available technology, selecting appropriate pedagogy, developing specific content activities, applying practical learning instructions and designing authentic learning tasks allow teachers to integrate technology into language teaching and learning effectively. Exploring several frameworks for technology integration, Schrum et al., (2007) found that the application of digital tools makes the learner more interested in the subject. Thus, when providing them with comprehensive learning, Kereluik et al., (2011) state that “a new level of technical competency and literacy is needed for teachers to use technology in ways that enhance students learning” (p. 13).

In this way, Mishra and Koehler (2006) point out that the students’ prior knowledge contributes to understanding what makes content difficult or easy to learn and how technology can be used to build on existing knowledge, taking the technological pedagogical and content knowledge into account. It is because TPCK competency, today, plays a critical role in education not only to develop teachers’ technological competency, but also it helps increasing learners’ performance. As a conceptual construct, TPCK has led to a variety of definitions as well as methods for measuring and facilitating its development (Brantley-Dias & Ertmer, 2013). In this vein, Tondeur et al., (2013) indicate that different views and approaches on TPCK have been developed over time, including a) TPCK as

extending of Shulman’s (1986) pedagogical content knowledge, and b) TPCK as a conceptual framework that connects three areas of expertise and their intersections within a specific context (Koehler et al. 2014).

The intersections between technology, pedagogy and content form the Content knowledge (CK), Pedagogical knowledge (PK), and Technology knowledge (TK) (Koehler & Mishra, 2008; Mishra & Koehler, 2006). Whereas the connections at each other, according to Koehler et al. (2014) create the Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). It can be concluded, therefore, that TPCK (Technological Pedagogical Content Knowledge) emerges by the intersection and connection of technology, pedagogy, and content. The TPCK framework suggests that teachers need to have a deep understanding of each of the components listed above. For instance, the TCK, which represents the blending of technology and content, requires not only understanding the content itself but also developing technical skills for teaching specific content.

The literature review discussed-above suggests that for teachers using educational technology into their classrooms, they require a comprehensive understanding of the intersection between technology, pedagogy, and content. Because technology provides real context and real interaction with people around the world, it has become an essential tool to create a stimulating, motivational, and dynamic learning environment. Therefore, the present study investigates how the synergy between technology, pedagogy, and content knowledge are integrated into language teaching by examining teachers’ beliefs and competencies of using the TPCK framework.

## Method and procedure

Due to the nature of the small sample size and methodology used, this study is qualitative as well as descriptive. Therefore, it is an exploratory, diagnostic and descriptive research. That adopts the assessment instrument developed by Schmidt et al., (2009) to gather information about: a) teachers’ technology competence; b) knowledge at using the TPCK framework in their classroom practices; and (c) the frequency of using technology for academic purposes. Accordingly, the 16 English Foreign Language (EFL) instructors who constitute the English teaching staff of the Language Center. Were surveyed on a 5 point Likert

scale (1= Low, 2= Basic, 3= Intermediate, 4= Upper, and 5= Strong). To collect data on the items a and b above-mentioned whilst the 5 point Likert scale (1 = never, 2 = once a month, 3 = once a week, 4 = once a day, and 5 = more than once a day) surveyed item c. Additionally, the study carried out classroom observations and teachers’ interviews.

Data research collection consists of a sequential and baseline procedure. In the first stage, 16 EFL teachers were surveyed; then, based on the data analysis of the survey, four teachers teaching English at A1 and A2 levels were randomly selected to be observed and interviewed in order

to gain knowledge of their teaching and learning experiences at using technological tools. In the second stage, eight digital resources were introduced to the four teachers, for example, Jimdosite.com, VOKI (recording app), Comic Strip (designing app), Spotlight, Ego4u, Kahoot, Koala Text, Voscreen so that they can explore these sources before integrating them into their language classrooms. Finally, four teachers who received orientations in the management of those digital sources were observed to identify the improvement of their technological knowledge and to see if, during their classroom practices, technology is integrated.

The triangulation of instruments and sources used to gather information, as observations, interviews, and surveys support the validity and reliability of the data analysis. Thus, the study consisted of the segmentation of the data collected from the interview and class observations such as coding and categorization of meaningful and relevant information related to the research goals. The excel data analyzer statistic tool performed the analysis. Therefore, the data analysis was based on teachers' technology skills, thus teacher's self-perception, types and frequent use of technology, and some visions on integrating the TPCK components were the foci of the study to establish the domains of the TPCK competency.

## Results

Investigating in-service EFL language teachers' perceptions of their knowledge in technology, pedagogy, content, and the dynamic intersection of these three basic components is crucial, to determine what digital tools and how frequent those tools are used by teachers inside and outside their classroom practices. Data in bar chart 1 (below) illustrates in-service English teachers' frequency of using technology on a 5 point Likert scale (1= never, 2= once a month, 3= once a week, 4= once a day, and 5= more than once a day). Participants reported that the average frequency of using text messages was approaching more than once a day outside their academic purpose. That is, they used text

messages ( $M= 5$ ) more often than emails ( $M= 4.37$ ), followed by Facebook ( $M=4.06$ ). Concerning the use of technology for academic purposes (inside), the majority of the surveyed teachers use publishing platforms more than once a day ( $M=5$ ) compared to the institutional rented platform, Moodle ( $M=4.06$ ). Weblogs were reported to be the third frequent tool used inside classrooms ( $M= 2.81$ ), whereas computer-assisted language learning (CALL) was the fourth instructional tool to create collaborative space for language learning ( $M=1.56$ ). Video chats were the least technological source used as an e-learning tool for forums and classroom language discussions ( $M= 1.25$ ).

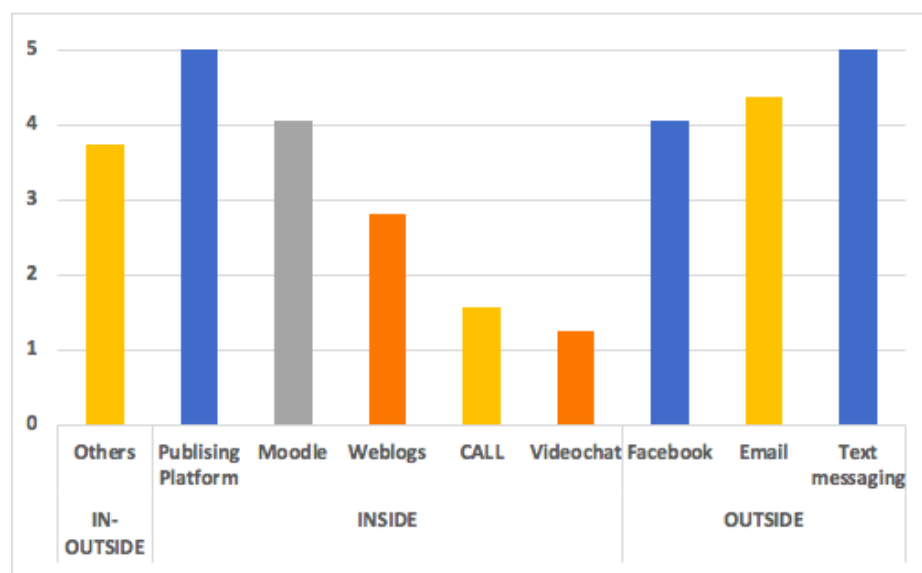


Figure 1. Frequency of technology used by EFL teachers

The table below (1) presents an overview of the results obtained from the preliminary analysis of teachers' knowledge and ability to use and integrate technology into their teaching settings. As we can see from the data, 75% of the respondents revealed an average understanding of using TPCK as the basis for successful teaching and learning. However, 13% of EFL teachers indicated to have either strong or low competency when integrating the TPCK framework in their teaching practices. We can infer from the data that very few EFL teachers have strong knowledge of the TPCK components, but they have difficulties at selecting pedagogical approaches applicable to particular disciplines and educational technologies that generate constructive ways to teach. The possible reason could be that their pedagogical knowledge (38%) is not according to their technological and content knowledge.

In contrast, over half of those surveyed reported the appropriate level of PK (56%) and PCK (50%); nonetheless, further analysis indicated that they show a low level of confidence when accounting the technological knowledge. In other words, it is not only enough the understanding of content to be taught but also how to explain that content via technology, integrating cognitive, social and developmental theories of learning (Koehler and other, 2007). What stands out in the data analysis is that teachers' knowledge about digital videos and computers is considered their technological know-how. TK knowledge includes more than that; rather, it integrates all instructional materials, ranging from the whiteboard to a wide variety of advanced technologies utilized in the online or offline learning environment.

**Table 1**  
***In-service EFL teachers' TPCK competency***

Category	TK		CK		PK		PCK		TPK		TCK		TPCK	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
SK	8	50%	8	50%	6	38%	7	44%	8	50%	7	44%	2	13%
MK	7	44%	8	50%	9	56%	8	50%	7	44%	8	50%	12	75%
LK	1	6%	-	-	1	6%	1	6%	1	6%	1	6%	2	13%

**Note:** \*SK= Strong Knowledge, MK=moderate knowledge, LK= Low Knowledge; \*TK= Technology Knowledge, CK=Content Knowledge, PK=Pedagogical Knowledge, PCK=Pedagogical Content knowledge; \*TPK= Technological Pedagogical Knowledge, TCK=Technological Content Knowledge, TPCK=Technology Pedagogy and Content knowledge

From the bar chart 2 (below) we can see that female outperformed in all the TPCK components; however, they reported a moderate level of knowledge in comparison with the advanced level of expertise indicated by male teachers. It was hypothesized that participants with advanced levels of technological expertise were highly competent to integrate the three knowledge domains; nonetheless, the classroom observations showed the opposite side of the continuum. Although few participants responded they have a low level of competency in all the six knowledge domains (see bar chart 2), it does not mean that the rest of the surveyed had the right knowledge and competence in the

related domains. It is because, teachers sometimes revealed positive beliefs to the TPCK model (Ansyari, 2015), but limited learning and teaching experience related to time and technology exploration (Ansyari, 2012). These results are in line with those of Lee and Tsai (2010), who found less confidence towards technology integration in English teachers. In this way, Koehler *et al.* (2007) suggest before using the TPCK framework to gain knowledge of what makes concepts difficult or easy to learn and how technology can positively guide the way of building on existing knowledge and teaching materials (p. 743).

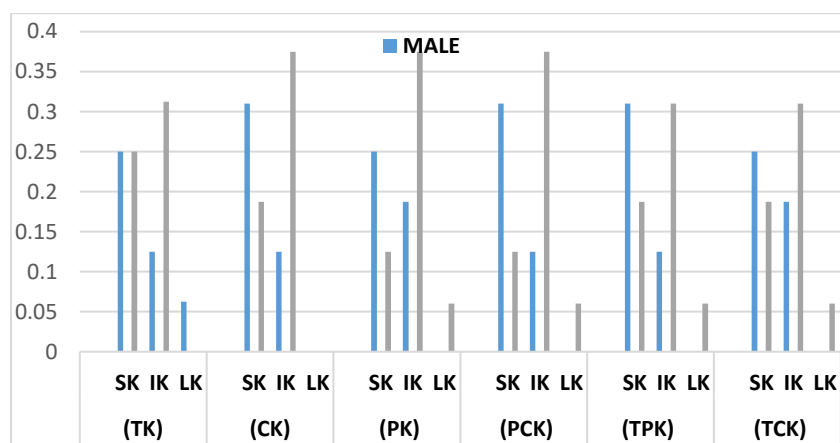


Figure 2. TPKC competencies by gender

When surveying about the importance of technology and their technological knowledge usage, the majority of the subjects indicated that technology, to some extent, helps improving language teaching. Nonetheless, further analysis revealed that the third part of those surveyed reported basic technological knowledge of using new websites and solving technical inconvenience (see bar chart 3, below). Although data on bar chart 3 showed that over half of

participants informed positives outcomes at using technology and computerized device, it was seen that teachers rarely use technology into their language classrooms; that is, they struggled problems at integrating technology into their lesson plans. This result is in line with Cando and others (2018) and Tanak (2018) who found lower levels of technological competence in in-service teachers.

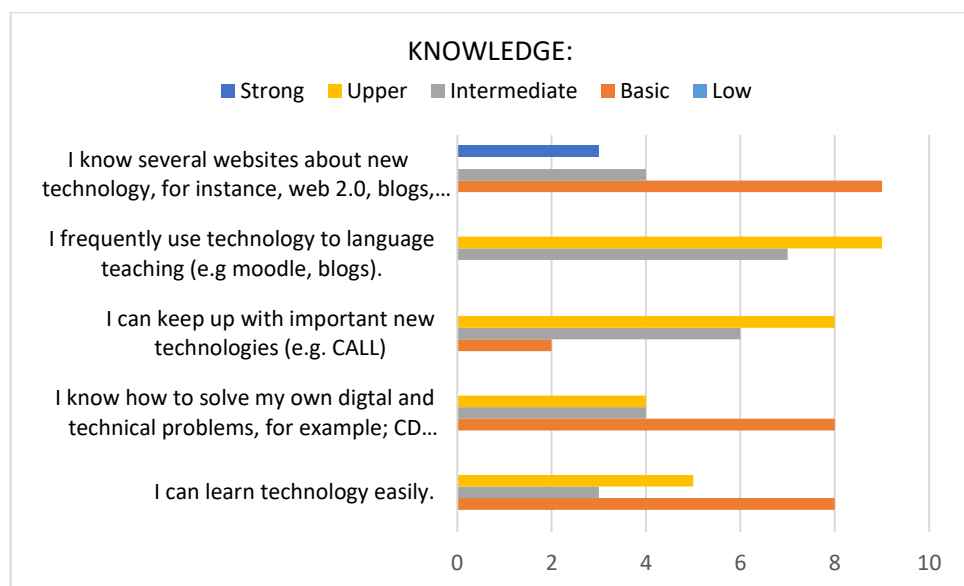


Figure 3. Technology competency and its knowledge domains

Contrary to expectations, this study found that after introducing the use and benefits of technological resources (e.g. Jimdosite.com, Ego4u, Kahoot, Koala Text), learners' attitude towards language learning was more active and dynamic compared to the previous classroom observations, in which learners' performance was limited. This gain makes sense in the context of the teacher preparation because, at

this point, students were actively enrolled in their learning. Additionally, teachers were able to think systematically about appropriate teaching strategies, language instructions, and technology integration into their classroom practices. Therefore, implementation of the TPKC framework in teachers' current language teaching provides them with useful instructional materials to

improve learners' linguistic and communicative competences. From this point of view, Koehler *et al.* (2007) state that consistent use of technology enhances learning environments in teaching languages. In effect, technology

provides many alternatives as making teaching interesting and more productive; indeed, learners have the opportunity to receive online feedback and self-assessment of their language achievement.

## Discussion and Conclusions

With the use of technology, students become active learners, not just consumers. In this way, when using digital technology to learn, for instance, comic strip, Kahoot, language learners develop problem-solving and critical thinking, and transfer knowledge from other learning experiences to accomplish the task. However, the positive outcome of technology does not come out automatically; it depends on how teachers use it in their classroom practices. The inclusion of educational technologies in language teaching should be taken as an integral aspect of teacher education in such a way that teachers and learners improve their teaching and learning experiences. Aside from worksheets, textbooks, and computers, smart boards and flashcards were reported as the most frequently used materials respectively in the observation and interview; nonetheless, nobody indicated the use of technology and methods according to the content. Consistent with the literature, observation classes, interview, and survey, this research found that there is limited knowledge of using digital tools into language teaching.

Results showed that more than 50% of the subjects interviewed had experienced the use of technological tools. However, during the observation classes, they reported having basic knowledge about how to effectively integrate technology with pedagogy and content in their classroom practices. Accordingly, there is clear evidence of lower competence in the use of the TPCK components, namely TCK, TPK, and TPC Knowledge as the base for active language learning. Classroom observations and data gathered from the surveyed questionnaire supports the claim that teachers probably have technological knowledge, but they are not well-prepared to combine teaching resources and appropriate pedagogical methods for language teaching and learning. Therefore, they do not know how to take advantage of digital tools available online. Indeed, the lack of technological knowledge limits the proper use of technology for academic purposes. Consequently, teachers may face difficulties in developing their technological competence to take part in the digital society. Moreover, following a textbook and the

instructional material provided by the publishing company seems to be the recurrent technological practice of teachers, which to some extent, is misinterpreted as enough technological knowledge to understand the integration of TPCK framework better.

The advancement of new technologies is extensively changing the way of teaching. Strategies and methods, today, integrate technology with the content and teaching goals. It can thus be suggested that English lessons integrate technology as the learning will be more dynamic and contextualized. Although there are many technological tools available online, there is limited knowledge of how to select the best ones to achieve the learning objectives set out in the lesson plans. Accordingly, teachers need specific training to integrate technology into their work effectively. However, its integration in teacher education programs is sometimes challenging and complicated as it should be more focused on pedagogical approaches. Consequently, it is crucial to include into the teacher education programs, the implementation of TPCK framework and instrumental materials that contribute not only to develop English skills but also to improve the technological competence and teaching methodologies.

The following conclusions and implications can be drawn from the present study. Even though most of the in-service EFL teachers showed a reasonable level of understanding of the three basic categories (Technology, Pedagogy, and Content), this research revealed difficulties at the moment of integrating these three knowledge domains into the educational process. As a result, English teachers' current technology-related knowledge is deficient. Education in the 21<sup>st</sup> century requires the intersection between technology, pedagogy, and content knowledge as learners develop linguistic and communicative competence through e-learning environments. Nevertheless, its implementation requires more effort than usual because there is not an ideal to integrate technology into the curriculum. Rather, integration efforts must be creatively designed for a particular subject and in specific learning contexts, either online or offline.

In today's increasingly digital world, teachers require a sophisticated understanding of technology, pedagogy, and content knowledge to systematically support students' knowledge development (Hofer & Grandgenett, 2012). From this point of view, there is no guarantee of learning whether primary technological resources like interactive whiteboards are not effectively used in language teaching. Therefore, if teachers are unable to know what technology-related knowledge is inherent to each content and how they should be integrated into the pedagogical and methodological approaches, learning outcomes will be slightly rewarding.

A successful integration of technology in different classroom settings is an intricate work, in the sense that it requires the implementation of computer-assisted language learning knowledge (CALL) and a deeper understanding of the complex interactions between multiple types of knowledge. Research findings are further in line with Chai et al. (2010), who states that teachers' lack of direct teaching experiences limited them in effectively

using or integrating technology into their teaching. Consequently, results highlighted the necessity of training programs based on the pedagogical integration of the TPCK framework in teacher education. Because teachers' knowledge and beliefs on technology integration into their language instructions and classroom practices are closely connected, further research is needed to identify if teachers' beliefs about technology in supporting EFL learners' interests influence their pedagogical preferences, language choice, and application of particular technology. Although the scope of this study is limited to a small number of participants, it provides a clear picture of the phenomenon investigated. Further research can be carried out to make comparisons among users and develop training programs that help teachers not only to gain computer literacy and technology competence, but also to better understand the integration of the TPCK framework in language teaching. These findings suggest several courses of action for fostering learners' positive attitudes toward collaborative learning, and web-based language learning.

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