EFL Pre-service vs. In-service Teachers' Perception of TPACK and Promoting its Development in EFL Instruction

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Abstract

The present study aims to use TPACK (Technological Pedagogical and Content Knowledge) framework to assess EFL pre-service versus in-service teachers' perception of technology integration in EFL instruction and promoting its development among pre-service ones. For collecting quantitative data, a total of 84 pre-service teachers enrolled in the English section at Benha Faculty of Education, and 41 in-service EFL teachers were asked to anonymously complete the TPACK Scale. Quantitative data analysis indicated significant differences between the two groups; as EFL pre-service teachers scored higher in TK and marginally better in TCK domain, meanwhile, EFL in-service teachers significantly surpassed in their PK, CK, TPK and PCK. There was no significant difference between the two groups in TPACK sub-domain of the scale. The qualitative study engaged 18 EFL pre-service teachers, recruited to explore the use of TPACK in the EFL classroom during teaching practice. The participants attended three preliminary sessions in which they were introduced to TPACK framework and instructional designs based on its model. They practiced using TPACK-oriented instructional designs with their peers in micro-teaching sessions. Results of qualitative data analysis revealed that the participants benefited from applying TPACK framework to improve the quality of EFL instruction in their teaching practices. These findings promote understanding TPACK framework and its based instruction among EFL pre-service teachers, suggesting the integration of TPACK into the current teacher education programs and stimulating a technologically rich environment to promote quality EFL instruction.
Keywords: Pre-service teachers, in-service teachers, EFL instruction (EFLI), technological pedagogical content knowledge (TPACK)

تصور معلمي اللغة الانجليزية قبل الخدمة مقارنة بالمعلمين أثناء الخدمة لمفهوم دمج التكنولوجيا في اطار (TPACK) و تعزيز تطويره في تدريس اللغة الانجليزية كلغة أجنبية

الـمستخلص

تدور الدراسة الحالية حول استخدام الاطار المرجعي المعروف بـ TPACK (اطار دمج المعارف التكنولوجية و التربوية والمحتوى) و تطبيقاته في مجال تدريس اللغة الانجليزية كلغة أجنبية،

حيث تم استخدامه على نطاق واسع في العديد من التخصصات، الا أن الدراسات التي قامت بتطبيق هذا النموذج في تخصص تدريس اللغة الانجليزية لم تكن من الوفرة بمكان.

لذا تهدف هذه الدراسة إلى تقييم تصور معلمي اللغة الانجليزية قبل الخدمة لمفهوم (TPACK) مقارنة بتصور المعلمين أثناء الخدمة لهذا المفهوم وتعزيز تطويره لدى معلمي اللغة الانجليزية قبل الخدمة. ولجمع البيانات الكمية اللازمة للدراسة ، تم تطبيق مقياس TPACK على 82 من طلاب الفرقة الرابعة شعبة اللغة الانجليزية بكلية التربية جامعة بنها، وكذلك تم تطبيق نفس المقياس على 41 معلما للغة الانجليزية في ادارة بنها التعليمية. وأشارت نتائج تحليل البيانات الكمية إلى وجود اختلافات دالة احصائيا بين المجموعتين؛ حيث كان هناك فارق لصالح الطلاب في مجال TK و كذلك كان الفرق دال في مجال TCK لكن كان هامشيا، وفي نفس الوقت تفوق المعلمون بشكل ملحوظ في PK، CK، TPK وPCK، و لم يكن هناك فروق دالة بين المجموعتين في المجال الفرعي TPACK من المقياس. و لتدعيم الدراسة فقد قامت الباحثة باجراء دراسة كمية /نوعية اشترك فيها 18 من طلاب شعبة اللغة الانجليزية بكلية تربية بنها، حيث تم تقديم اطار TPACK و تطبيقاته في الفصول الدراسية في مجال تدريس اللغة الانجليزية كلغة أجنبية والاعداد له و الاستفادة من مميزاته أثناء ممارستهم التدريسية. و لقد حضر المشاركون ثلاث جلسات تمهيدية تعرفوا فيها على إطار عمل البرنامج والأنشطة التعليمية المصممة وفقا له، كما تدربوا على استخدام تصاميم تعليمية و خطط لاعداد الدروس قائمة على TPACK من خلال القيام بالتدريس العملي لزملائهم في جلسات تدريس مصغر أثناء فترة القربية العملية المتصلة للعام الدراسي 2018/ 2019. وطوال التجربة، أتيحت للمشاركين فرصة التعبير عن آرائهم وتقديم تعليقاتهم. وكشفت نتائج التحليل النوعي للبيانات أن المشاركين استفادوا من تطبيق إطار TPACK في تحسين جودة العملية التعليمية و رفع مستوى الممارسات التربوية في مجال تخصصهم. وتسهم نتائج هذه الدراسة في فهم طبيعة التعليم القائم على TPACK و أهمية دمج المعارف التكنولوجية و التربوية مع المحتوى، و توصي بأهمية التدريب على TPACK في برامج اعداد معلمي اللغة الانجليزية و كذلك برامج تدريب المعلمين الحاليين لتعزيز جودة تعليم اللغة الانجليزية كلغة أجنبية.

الكلمات المفتاحية: معلمواللغة الانجليزية ما قبل الخدمة، معلمواللغة الانجليزية أثناء الخدمة، تعليم اللغة الانجليزية كلغة أجنبية، TPACK (اطار دمج المعارف التكنولوجية و التربوية والمحتوى)

Introduction

The increasing use of technology in the 21st century, the age of millennial learners, has instigated instructional challenges for efficient teachers' preparation and professional development programs to cope with this abundance of technology. Technology tools are at the vanguard of curricular/extracurricular and educational activities which require teachers to hone their skills in multifaceted approaches. They need to tackle their technology skill deficiencies and become lifelong learners, and also to be equipped with technological tools geared toward enhancing the instructional process. The convergence of technology and media in a global world is challenging the very foundations of education in general and infiltrated EFL instruction in particular. According to Healey et al. (2008) and Macaro, Handley, and Walter (2012), the use of technology in teaching at schools and universities has been increasingly invested during recent years and is required now as an urgent demand in all curricula; including EFL instruction. The previous generations' ways of learning are completely

different from those of the new ones, who nowadays think critically and process information substantially different from their forefathers.

Language instruction is a dynamic process influenced by time metamorphosis and the outburst of technological developments. Reading the printed word is not enough anymore; the 21st-century citizens, including EFL learners, need to critically interpret a multimedia culture and express themselves in more creative forms to pave the way for mastering lifelong experiences apt to a persistently changing world. The definition of "literacy", in Kress (2010), is undergoing drastic changes as a disposition of communication channels, such as text messaging, blogging, social networking, which extended the boundaries of communication and forms of knowledge construction. The fact that literacy now encompasses a broader set of practices necessitates a revision of traditional instructional programs in schools (Gee & Hayes, 2011), which in turn requires changes in teachers' education programs. Technology and media literacy education provide a framework and pedagogy for the new qualifying skills required for life, citizenship, work, and teachers of the 21st century. The urge to invest in technology in education, as stated in Sewyn (2012), seems to be stimulated by the conviction that using it will improve instruction and achieve better educational outcomes.

TPACK and teachers' education/training

There is a consensus among researchers, Dong, et al. (2015), Kosnik, et al. (2016), and Luik, et al. (2019),   that there is an urgent need of rethinking many practices in teacher education and in-service training concerning digital technology and literacy education if the target is to prepare student teachers to become more competent and support them to become well prepared for the technological age. Many researchers dealing with TPACK in their studies have focused on either pre-service teachers or in-service ones; however, some of them have compared prospective vs. practicing teachers or novice vs. veteran ones. Dong, Chai, Sang, Koh, and Tsai (2015) in China, for example, compared prospective teachers to practicing teachers based on the seven TPACK constructs and reported statistically significant differences in their TPACK levels. Saltan and Arslan (2017) found significant differences between pre-service and in-service teachers' self-confidence on TPACK in favor of the in-service teachers. Their research finding indicated that prospective teachers' weaknesses were due to a lack of understanding, practicing, and modeling, which should be stressed in teacher education programs. Another study was conducted by Luik, Taimalu, and Laane (2019), in Estonia, comparing pre-service and in-service teachers' perceptions of TPACK framework found significant differences between the two groups and the researchers suggested developing teacher education curricula for pre-service teachers as well as providing professional development for in-service teachers. In the Arab world, Alqurashi, Gokbel, and Carbonara (2017) investigated the TPACK of teachers in Saudi Arabia and compared it to those in the USA and the

findings indicated that those teachers in both Saudi Arabia and the USA scored higher in CK and PK rather than TK.

Along the same lines, the quality of EFL teachers' preparation and their professional development has become an increasingly concerning problematic issue. They are expected to perform according to new and changing standards and the Ministry of Education in Egypt is calling on teachers to reform practices, through training activities; ranging from workshops and seminars, to micro-teaching sessions and classroom modeling via various media, off/online through different platforms. Since the goal of any educational reform is students' improvement, the leading role of teachers in promoting students' performance has to be recognized. EFL teachers encounter growing pressure to enhance their students' performance and upgrade their language level, which promotes an increasing need for adequate preparation of pre-service and professional development for in-service EFL teachers to take up such challenges.

Egypt has recently identified and emphasized the use of Information and Communications Technologies (ICT) as an important instructional tool in schools across the country (Ministry of Education, 2010), in line with the significant educational reform efforts being made by the Ministry of Education. Since English language teaching (ELT) is one of the subject areas in which ICT may play a crucial role, ELT teachers are required to be equipped with the knowledge and skills required to plan/ implement quality teaching, integrating technology to support instructional objectives ample for the 21st century. This means that EFL teachers should be proficient not only in content and pedagogy wise, but they must be ready to efficiently utilize the potentials of technology and integrate it into their teaching as well.

Due to the numerous developments in ICT over the previous decades, teacher education programs had to train the 21st-century teachers in a way that equips them with the necessary knowledge, skills and experience required to proficiently integrate technology into their instruction (Voogt, et al. 2013; Jamieson- Proctor, Finger, & Albion, 2010; Koehler, Mishra, & Yahya, 2007; Mishra & Koehler, 2006). Mishra and Koehler (2006) designed the TPACK framework to interpret the dynamic relationships amongst its components/domains; content knowledge, pedagogical knowledge, and technology knowledge (Figure 1). The TPACK framework adopted the idea of connecting basic knowledge components (i.e., knowledge about technology, pedagogy, and content) to form a new central form of knowledge; TPACK (technological, pedagogical, and content knowledge). In literature, as mentioned in Kim and Lee (2017), TPACK has developed to become the central focus of researchers when studying technology integration.
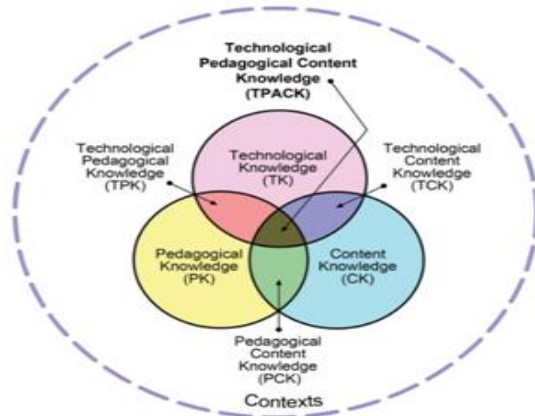
Figure 1 TPACK Framework (Mishra and Koehler, 2006)
Thus, TPACK of Mishra and Koehler (2006), is one of the most adopted models that has been introduced to describe an outline of integrated conceptual framework for the knowledge base that 21-century' teachers must possess to proficiently teach with technology in classroom settings.

TPACK Framework
TPACK is a framework designed to constitute the teachers' ability to integrate technology into instruction throughout the curriculum. TPACK is originated from Shulman's (1986), as cited in Barendsen & Henze, (2019) concept of Pedagogical Content Knowledge (PCK). He came up with the idea of knowledge in teaching, , which is a set of content knowledge that teachers have; specific knowledge about the subject they are teaching, and a set of pedagogical knowledge; knowledge about how to teach, including specific teaching methods. Shulman developed a framework for teachers' knowledge that changed the standards for qualified teachers. As mentioned in Tallvid, Lundin,and Lindstrom (2012), Shulman's perspective of teachers education indicated that successful teachers integrate content knowledge with pedagogical knowledge in their teaching. Shulman (1986, p.10) explained the core notion of his framework, within the intersection of pedagogical and content knowledge, as:

> The most useful forms of representation of the taught topics of a certain subject area, the most powerful analogies, illustrations, examples, explanations, and demonstrations, i.e., the ways of representing and formulating the subject matter that make it comprehensible to the learners.

According to Shulman's (1986) PCK model, the effectiveness of teachers' instruction depends not only on their Content Knowledge (CK) but also on their Pedagogical Knowledge (PK). CK refers to teachers' knowledge of the content of the subject area and how knowledge is structured. On the other hand, PCK refers to teachers' "knowledge (of the subject matter) *for* teaching" (Shulman, 1986, p.9). It includes knowledge of the variety of methods and approaches in which the subject matter might be delivered to promote understanding among learners and raise the teachers' awareness of

the subject matter**.** The qualified teachers have to master not only content and pedagogical knowledge but also the intersection of PCK.

Technology completes Shulman's model of PCK and turns it into Technology, Pedagogy And Content Knowledge (TPACK). The knowledge that teachers need to decide about the potential use of technology in their educational contexts has been referred to as Technological Pedagogical Content Knowledge (TPCK or TPACK as used alternatively by Mishra and Koehler, 2006; Thompson& Mishra, 2007). Mishra and Koehler (2006), based on Shulman's framework, proposed their idea about integrating technology that cannot be separated from PCK. TPACK, as described in Bostancioglu and Handley (2018, p. 4) and Turgut (2017, p.1093), "is a framework designed to describe teachers' ability to integrate technology into the curriculum with all its components". The concept underlying the framework they developed focuses the fact that teaching is an elaborated activity that is built on various kinds of knowledge. Previous theoretical knowledge bases of teacher education, such as in Shulman (1986), and Veal and MaKinster (1999), as cited in Mishra & Koehler (2006), have only considered the content and pedagogical knowledge of the teacher.

Mishra and Koehler (2006) included the component of technological knowledge and added it to Shulman's theory, arguing that teachers' different kinds of knowledge could be derived from the integration of technological, pedagogical, and content knowledge. TK which focuses on how to use technology tools in instruction, together with PK of instructional methods, approaches, and strategies, and CK of subject matter are the integrated forms of knowledge that constituted the seven constructs of Mishra and Koehler's TPACK framework (2006). According to Koh, Chai, and Lee (2015), they are: pedagogical content knowledge, i.e., knowledge of applying appropriate instructional strategies to teach subject content (PCK), technological content knowledge, i.e., knowledge of presenting the subject content with technology (TCK), technological pedagogical knowledge, i.e., knowledge of applying technology to employ instructional strategies (TPK), and technological pedagogical content knowledge, i.e., knowledge of facilitating instruction of a specific content through appropriate pedagogy and suitable technology (TPACK). Technological knowledge, as stated in Tallvid et al. (2012), encompasses technology and its application in education. Mishra and Koehler (2006) highlighted the importance of expanding technological resources but maintained the necessity of all the other three types of knowledge in teaching.

There are many conceptualizations of TPACK in the literature that researchers initiated when working on or with the TPACK framework. The first one from Mishra and Koehler (2006) focuses on TPACK as teachers' understanding of the integrated knowledge domains of technological, pedagogical, and content knowledge in specific contexts. The second conceptualization developed by Angeli and Valanides (2009), considered ICT-TPACK as consisting of separate knowledge domains that can be developed separately and measured apart from each other. Then, Cox and

Graham (2009) conceptualized an elaborated TPACK, which was simply an expansion of the original TPACK framework. In their view, TPACK refers to "the knowledge of how to coordinate the use of subject-specific or topic-specific activities with topic-specific representations using emerging technologies to facilitate student learning" (p. 64).

Review of related literature

The TPACK framework, as claimed by Koehler and Mishra (2009), provided many opportunities for researching in many fields; such as teacher education/ professional development, technology use in teaching/learning, etc. Many studies, as stated in Rosenber and Koehler systematic review of studies (2015), demonstrated that TPACK can enhance teachers' instruction, improve students' learning, support parents, and make education more appealing and relevant to the students. Malik, Rohendi, and Widiaty (2019) affirmed that TPACK can create equal opportunities for all students, taking into consideration their differences, tailoring individualized instruction for each one of them, and contributes to teachers' education and professional development. According to Krolak-Schwerdt, Glock, and Bohmer, (2014), pre-service teacher education programs and in-service professional development initiate learning processes and resulting outcomes, that teachers can draw in their practices and teaching, which in turn form a crucial element of the learning context for the students. Lawless and Pellegrino (2007) claim that those programs are essential in assuring that teachers keep abreast of new methods of instruction in their content areas, learn how to best draw on new instructional technologies for teaching/ learning, and adapt their teaching to increasingly alternating instructional environments. Brown (2014) stated that educational technologies can present an assisting source for professional practice/ development in teacher education programs.

TPACK and EFL instruction

The discussion about technology and the use of digital media in EFL instruction has become omnipresent, as technology in the 21st century plays a major significant role as a tool in helping teachers achieve their instructional objectives. Since the introduction of the TPACK framework in 2006, many researchers have worked on that model trying to dig into its underlying structure (Angeli and Valanides, 2009; Cox and Graham, 2011); and many others used it as theoretical background for data-driven studies (Angeli et al., 2016; Cavanagh and Koehler, 2013). Yet, the question of what TPACK constitutes still remains a source of up to date scholarly debate (Petko, 2020). A review of TPACK literature indicated that even though studies on teachers' perception/application of TPACK have considerably increased in recent years, research mostly focuses on either pre-service or in-service teachers' development of TPACK in content areas like science, mathematics or social sciences (Abbitt, 2011; Al-Abdullatif,

2019, Baran et al., 2019; Bensonand Ward, 2013; Graham et al. 2009; Hofer et al. 2011; Horzum, 2011; Jamieson-Proctor et al., 2010; Jang and Tsai, 2012; Kabakci-Yurdakul, 2011; Kaya, Kaya, and Emre, 2013; Koehler and Mishra, 2005; Lin et al. (2013); Niess, 2009, 2011; Rahman, Krishnanand Kapila, 2018; Schmidt et al., 2009; Tsai Voogt et al., 2013). A few studies were conducted to investigate and analyze the TPACK development of EFL pre-service; Baser et al., 2015; Ekrem and Recep, 2014, in Tukey; Inpengand Nomnian, 2020, in Thailand, and in-service teachers; Alharbi, in Saudi Arabia, 2017and 2020; Cahyono et al., 2016, in Indonesia; Nazari et al., 2019, in Iran; Paneru, 2018, in the Czech Republic; Rayganand Moradkhani, 2020, in Iran, Sointu et al., 2016, in Finland; and most recently Alnujaidi, 2021, in Saudi Arabia, who did a contrastive analysis of Pre/In-service EFL teachers' levels of TPACK.

Some studies in Turkey used the TPACK framework to investigate EFL teachers' knowledge/ skills in technology integration. In one of the distinctive qualitative studies, Kocoglu (2009) explored how pre-service EFL teachers developed their knowledge and skills in integrating technology into EFL teaching. The findings revealed that establishing TPACK's foundation for EFL teachers during their pre-service education program and supporting them in its implementation would help them to successfully integrate technology in their EFL classrooms. Following the same footsteps, Kurt, Mishra, and Kocoglu (2013) examined the TPACK development among Turkish pre-service EFL teachers, as they engaged in a TPACK program based on Mishra and Koehler's (2006) Learning Technology by Design Approach. The findings of the study reported that after a 12-week treatment there was a statistically significant improvement in the participants' scores in TK, TCK, TPK, and TPACK, even though they had no prior training on technology integration into EFL teaching. Besides the TPACK development program assisted the pre-service EFL teachers in choosing the appropriate technologies that enhance their teaching approaches which promote the students' learning.

Internationally, researches addressing EFL teachers' TPACK development have been emerging during the last few decades. In Ansyari's (2012) study, the researcher explored TPACK's development among English lecturers, and technology integration in an EFL teaching setting. The findings revealed that the majority of the participants had positive experiences towards technology integration during the professional development program, but the negative feedback mostly focused on time limitation, the difficulty of technology exploration, and lack of students' active participation. Some of the significant aspects of the intensive program reported were learning technology by design approach, authentic learning experiences, and engagement in a collaborative environment that offers guidance, support, and feedback. Tai and Chuanh, 2012) and Tai's (2013) studies used different perspectives, including teachers' development of TPACK competencies, to explore the impact of TPACK in action through running workshops on EFL teachers. Their findings concluded that

the workshops had a strong positive impact on the participants' competencies, including their choice of the appropriate technology for the content taught and matching between the benefits of its use and their objectives, fulfilling their instructional goals and enriching their pedagogical experience. Wu and Wang (2015) investigated 22 in-service EFL teachers' TPACK at elementary schools in Taiwan. In another study, Hsu (2016) examined EFL teachers' TPACK and how such knowledge affected using mobile-assisted language learning (MALL). A total of 158 Taiwanese EFL teachers participated in the study and the results showed that TPACK was critical to MALL's adoption and was pivotal to teachers' attitudes towards using it in EFL teaching.

In 2017, Cheng explored TPACK's perception among 172 in-service native Hakka language teachers in Taiwan. The researcher conducted a survey of the seven constructs of the TPACK framework. The results revealed that, although the participants were satisfied with their TPACK's level in general, they had relatively low confidence in CK, TK, and TPK. Their teaching experience was positively related to/ associated with their perceived CK, PK, and PCK. Meanwhile, Turgut (2017) conducted a research in Turkey comparing in-service and pre-service EFL teachers' perception of TPACK, reporting significant differences among them, based on the quantitative and qualitative data analysis. The researcher suggested that both teacher education and training programs should go beyond teaching basic computer skills, operational use of software, and the like; focusing instead on modeling and practicing how to deliver content using appropriate instructional pedagogy utilizing technological knowledge properly.

In addition, Bostancioglu and Handley (2017) developed / validated a questionnaire in their study to evaluate TPACK for EFL. The results supported EFL teacher education programs that attempt to integrate TK, PK, and CK, rather than introduce them separately. They emphasized the importance of the emerging and established technologies which can be implemented to represent language and provide opportunities for communication to promote language acquisition. Drajati, Tan, Haryati, Rochsantiningsih, and Zainnuri (2017) examined TPACK literacy; its perception and implementation among 100 EFL pre-service and in-service teachers. The areas tested were PCK for Multimodal Literacy, TPK, and Knowledge about digital media tools, as three components of TPACK literacy. The findings of this research revealed the demographics with TPACK literacy that was studied through investigating EFL teachers' perceived TPACK and its implications as contributing to English teachers' education and professional development.

Many researchers and scholars in the fields of educational technology and Computer-Assisted Language Learning (CALL) (Angeli and Valanides, 2009; Colpaert, 2006; Golonka, Bowles, Frank, Richardson, and Freynik, 2014; Mishra and Koehler, 2006) believe that technology can be effective only when it aligns well with the subject content; CK and associated with

pedagogical theories of instructional practices, PK. Furthermore, Tondeur et al. (2017) argued that it is crucial to train the teachers, not only on how to use technology but also on how to select and adapt it according to the educational contexts and based on the subject content to be taught. As the teachers are one of the greatest influencers in the instructional process, according to West, Swanson, and Lipscomb (2017), it is critical to equip them with competencies and essential practices they have to master for efficiently instructing their students, maximizing their knowledge and skill acquisition. Researchers have identified professional knowledge as one of the main preconditions for successful technology integration. This specific knowledge needs to be tailored around the use of digital technologies purposefully in classrooms. However, some recent studies, Farjon, Smits and Voogt (2019) indicated that teachers still rarely use digital technologies for educational purposes, and if they do, they fail to integrate them into teaching in a didactically meaningful manner.

Alnujaidi's study (2021) aimed to investigate pre-service and in-service EFL teachers' levels of TPACK in relation to their gender, Internet access at school, and technology training in Saudi Arabia. The results showed a statistically significant difference between pre-service and in-service teachers' levels in all the seven domains of TPACK. The pre-service teachers scored higher in TK, TCK, and TPK while in-service teachers' scores were higher in CK, PK, PCK, and TPACK. The analysis of results also indicated that gender, Internet access at school, and technology training had a significant effect on both pre-service and in-service EFL teachers' levels of TPACK. The study deduced that both pre-service education programs and in-service training courses need to focus on TPACK to help EFL teachers integrate technology successfully into their instructional process.

It is necessary to provide a specific definition that fits in language instruction area, to provide teachers and researchers a starting point to achieve technology integration in ESL/EFL settings. PK in EFL teaching may be defined as teachers' knowledge regarding pedagogical practices that promote communicative competence among learners. These pedagogical practices, which may be included in EFL teaching methodology, have to be based on authentic tasks and activities that contain comprehensive input, use authentic material, and deal with some cultural aspects of the target language. CK could be defined as teachers' knowledge about language aspects and standards that are involved in EFL teaching, including grammar, vocabulary, etc., incorporating pronunciation features such as rhythm and intonation. The content has to be aligned with the learners' level standard, providing them the opportunity to develop communicative skills. TK may be defined as teachers' knowledge of current technologies that are available and how they may use them to promote effective teaching and learning inside/ outside the classroom. As most of the technologies available were not designed for teaching purposes, teachers have to develop

the necessary skills to identify, acquire, modify, and apply new technologies in educational settings.

PCK is the EFL teachers' knowledge that permits them to design and deliver language lessons, and to assess their students' performance. This knowledge includes teachers' role in understanding learners' linguistic skills, using authentic tasks, identifying their points of weakness and strength, applying EFL acquisition theories and methodological principles, and providing an encouraging environment where students can develop communicative competence. TCK could be defined as the teachers' knowledge of how to facilitate learning vocabulary, practicing grammar, and pronunciation features with the assistance of technology. This encompasses the teachers' ability to find/ create materials that are based on technology and adapt them according to their instructional objectives.TPK might be identified as the teachers' knowledge of how to adapt/incorporate technology in language activities to promote communicative competence. In this kind of knowledge, teachers have to understand that technology enhances the activities/ tasks, encouraging students to exploit their language skills, and to practice all the communicative skills.

Context of the study

Even though there are some practical applications of TPACK in language teaching, they are not enough compared with other subject areas. It seems that researchers in the field of EFL instruction are not exploring TPACK framework and its implications in their specialization due to the lack of awareness. For this reason, according to the previous studies; Bugueno (2013), Dong, Chai, Sang, Koh, and Tsai (2015), Baser, Kopcha and Ozden (2015), Alghamdi (2017), Alhababi (2017), Alharbi (2013), (2014) and (2020), Saltan and Arslan (2017), Bingimlas (2018), Luik, Taimalu and Laane (2019), Nazari, Nafissi, Estaj and Marandi (2019), Redmond and Lock (2019), and Valtonen, et al., (2017 and 2020), more studies are needed in that field.

TPACK comprises the teachers' knowledge that permits them to integrate technology in EFL instruction to achieve and promote communicative competence among their students. Moreover, it involves teachers' selection of appropriate technology according to the task, language skill, and content. EFL teachers have to understand that they can utilize technology in their classrooms in various aspects; to perform a task, to find information related to the certain topic, to interact with the students and others: e.g., native speakers, to obtain authentic input, to expose students to the target culture, and to assess students' performance. As the TPACK model/framework proved to be of significant value for both pre-service and in-service teachers in the field of EFL, and because of the paucity of studies that dealt with it in Egypt, there is a need to cover this gap. Accordingly, the current study was trying to investigate how

introducing the TPACK framework and applying it in EFL classroom would affect the pre-service teachers' EFL instruction and performance. The main target was to help them to become facilitators who can tackle the issue of individual differences and multi-level classes, capable of adjusting their instructional designs; integrating technology, using differentiated instruction, adaptive learning, and constructivist assessment.

Research Questions

-Is there a statistically significant difference between EFL pre-service and in-service teachers' perceptions of TPACK?
-To what extent do EFL pre-service teachers develop their teaching performance/ practices after introducing/ adopting TPACK framework; combining technology, pedagogy, and content of EFL?

Method
Research Design

The present study adopted mixed approach research design, as a procedure for gathering and analyzing data, combining quantitative and qualitative methods in conducting the study to help deeply understand the research problem. Creswell (2012), Dornyei (2007), along with many other researchers, claimed that the mixed method approach has the advantage of combining the strengths of both qualitative and quantitative research, thus providing more insight into the research problem.

Participants

The participants of the study were two groups; 84 EFL pre-service teachers who were enrolled in their junior year, the English section, Faculty of Education at Benha University in Egypt, and 41 EFL in-service teachers who were working as full-time teachers at various schools under Benha Educational Administration, Qualyubia Governorate, Egypt. The researcher employed a convenience sampling technique in selecting the participants and all of them contributed to the study voluntarily. TPACK scale, was used to explore the participants' perception of TPACK and to compare between their levels, during the second semester of the school year of 2018-2019. A total of 125 participants completed the TPACK scale, responding to 39 statements on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

A group of the EFL pre-service teachers (n=18) was recruited to participate in the experimental qualitative section of the study, as the researcher was supervising them during their actual teaching practice, which is an essential part of their curricula. The experiment had two stages: in the first stage they were introduced to the TPACK framework, they were given examples of how to make an instructional design based on it, and provided by sample activities with suggested technologies as a guide. In the second stage, the participants were prepared to perform their teaching practices,

which were not conducted in the actual schools due to the absence of the students from schools. Instead, the researcher conducted the experiment in the university in the form of peer sessions, meaning that each participant taught his/her colleagues in the classroom.

According to regulations of the faculty of Education, the teaching practices for the pre-service teachers were conducted during the two terms of the academic year, the researcher supervised the same group of participants during the first term and observed their performance, using a preliminary checklist to assess the participants' integration of technology, pedagogy, and content in their teaching, before the introduction of the TPACK framework (Table 4). At the beginning of the second term and before going into their teaching practices, the participants attended three sessions in which the researcher introduced the TPACK framework, demonstrated a teaching process based on it, in order to show them how a teaching session could be conducted with the integrations of knowledge about content, pedagogy, and technology. Following the introduction of the TPACK framework and demonstration sessions, the participants were given three opportunities to have teaching practice sessions to compare their performance with that of the first term, 3 sessions of 20 minutes for each participant, with a total of 54 sessions. The experimental study investigated to what extent the integration of TPACK was promoted and its applications during the second half of the participants' teaching practice and its effect on their teaching performance.

Research Instrumentation

Many researchers have developed several surveys and instruments to examine teachers' TPACK (Archambault and Barnett, 2010; Chai, et al., 2010; Jang and Tsai, 2012; Lee and Tsai, 2010; Lin et al., 2013; Mishra and Koehler, 2006; Koh et al., 2010; Merc, 2015; Sahin, 2011; Schmidt et al., 2009). The original TPACK scale by Mishra et al. (2009) has extensively been used in various subject areas to assess pre-service/in-service teachers' perception of TPACK's framework and its related knowledge domains. Since the original scale did not contain SL /FL specific items, some researchers (Ekremand Recep (2014), Hsu (2016), Aniq and Drajati (2019), Fathiand Yousefifard (2019), Kozikoğlu and Babacan (2019), Nazari et al. (2019), Bagheri (2020), Prasojo, Habibi, Mukminin and Yaakob (2020), and Loi (2021) added items in CK, for example: "I have sufficient knowledge of English, listening, speaking, reading, writing, vocabulary, in PCK, such as "I know how to modify English language content to suit different types of students", and TCK, e.g., "I know about technologies that I can use for teaching English language skills".

The TPACK scale (Appendix 1), was based on the surveys developed by Tseng et al. (2014), and Baser et al. (2015), to assess EFL teachers' TPACK. The scale was in the form of a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and it was administered to a total of 125 participants, responding to 39 statements. The scale includes the seven

constructs/ components of TPACK represented in the 39 items: TK (9 items), PK (6 items), CK (5 items), TPK (7 items), TCK (3 items), PCK (5 items), and TPACK (4 items). The researcher mostly adapted many of the items of Baser, Kopchaand Ozden's scale (2015), which was validated through exploratory factor analysis (EFA) and the researchers also reported high reliability of the scale. The researcher examined the internal consistency using Cronbach's alpha for the seven components as well as the whole scale. Cronbach's alpha coefficients of the scale with seven factors ranging, from .071 to 0.89 (i.e., TK (0.82), PK (0.88), CK (0.79), TPK (0.81), TCK (0.71), PCK (0.79), and TPACK (0.89), and the reliability estimate of the whole scale was 0.94.

For the qualitative data collection, there was a TPACK integration assessment rubric, developed by Harris, et. al (2010), and adapted by the researcher (Appendix 2), that was used for peer, and self-evaluation, for the experimental part of the study. The researcher also used it to observe the participants applying their knowledge/use/usage of TPACK while teaching, to assess their ability to integrate technology into their teaching practices. Additionally, at the end of the experiment, the researcher had semi-structured interviews with the participants, asking for their perception of the benefit of the TPACK's framework and its implementation in improving the quality of their teaching practices. Their responses were analyzed to see how they perceive the application and the effect/benefits of the TPACK framework on their instructional practices.

Procedures for data collection and analysis

In an attempt to realistically investigate TPACK of EFL pre-service/in-service teachers, this study used a mixed-approach research methodology; using a TPACK scale as a quantitative instrument, and experimenting on a group on pre-service teachers to obtain the qualitative data on the effect of adopting TPACK framework on EFL teaching performance. The TPACK scale was distributed and collected in face to face meetings, using traditional pen and paper fashion, and the data obtained were analyzed using SPSS Statistics.

For the scope of the present research, two independent variables were taken into account: pre-service group vs. in-service group, and seven dependent variables (TPACK constructs): TK, PK, CK, TCK, PCK, TPK, and TPACK, were investigated. Data analysis was conducted to address the first previously formulated research question; whether there is a statistically significant difference between EFL pre-service and in-service teachers' perceptions of TPACK. Descriptive statistics were used to examine pre-service and in-service EFL teachers' perceptions of TPACK. A series of independent-sample t-test (inferential statistic test; Levene, ANOVA) was employed. Descriptive analyses such as frequency, mean and standard deviation were obtained to characterize the collected data. The independent-samples t-test was administered to compare pre-service and in-service EFL teachers' perceptions of TPACK, whereas one-way ANOVA was used to

determine if there was statistically significant difference of TPACK perceptions among the participants of the two groups.

The experimental part of the study examined how TPACK-oriented teaching practice benefited the EFL 18 pre-service teachers and to what extent it affected the quality of their instructional performance during their teaching practice. Before the introduction of the TPACK framework, the researcher used a form, during the first semester of teaching practice (TP Pre), to check the participants' knowledge of its components and its existence in their teaching practice, and to compare it with their performance, during the teaching practice of the second semester (TP 1, TP 2and TP 3), after the experiment.

The participants attended three preliminary sessions in which they were introduced to the TPACK framework and instructional designs based on its model, as well as sample activities that integrated technologies, pedagogy with content related to the four language skills. The instructional design replaced the lesson plan format that is usually used at schools. An instructional design is much simpler and more practical, comparing it to a lesson plan, as it focuses only on several aspects, leaving the other facets which are common in a lesson plan, such as presentation, practice, and assessment. The instructional design is based on language competence; beginners, intermediate and advanced learners, rather than grade levels. According to Cahyono et al. (2016), the instructional design consists of seven aspects: goals, language function/use, language focus/usage, level, time, preparation, and steps. The researcher introduced a model of instructional design to be used as a basis for the participants, and then they were asked to make their own, guiding them through to develop it. She also demonstrated an instructional example based on the TPACK framework to show the participants how such a teaching session could be conducted.

The EFL pre-service teachers' participants of the experimental study practiced using TPACK-oriented instructional designs (Appendix 3) and activities (Appendix 4) with their colleagues in micro-teaching sessions. A teacher's guide (Appendices 3and4) (based on Cahyono et al., 2016), and Harris et al. 2011) was provided for the participants, containing sample TPACK activities that could be used in teaching all four language skills, listening, speaking, reading and writing. Throughout the experiment, the participants were given the chance to express their opinions and give their feedback through oral discussions, semi-constructed interviews as well as journal entries, and the researcher was documenting all.

In addition, the TPACK integration assessment rubric was used to observe the participants applying their knowledge/use of TPACK while teaching, to better assess their ability to use technology as an integral part of their teaching practices. Triangulating data from multiple sources helped the researcher to refine and improve the approach used to measure and study TPACK. At the beginning of this study, the researcher's role was a full participant in the experiment because the researcher was an instructor of the methodology course, a supervisor of teaching practice, as well as the trainer

who introduced the participants to the TPACK framework. When starting the data collection and thereafter, the researcher tried to be more of an objective observer to reflect on and evaluate the participants' performance. The researcher observed 54 mini-lessons the 18 participants taught (3 for each participant), 20 minutes each, and took field notes during the observations. The participants were using the TPACK integration assessment rubric for peer evaluation and self-assessment as well.

Some researchers, Abbitt (2011), Virmaniand and Williamson (2016), claim that the TPACK scale, as any self-reporting measure, has some limitations in representing knowledge in the TPACK domains because of the participants' limited ability to self-assess their knowledge and respond appropriately to its items. However, the researcher has tried to collect additional qualitative data, via semi-constructed interviews, journal entries, and classroom observations, along with the quantitative data of the scale, to triangulate data that validate efficient tools for research and demonstrate valid and reliable results and evaluation relating to TPACK.

Results

Question 1: Is there a statistically significant difference between EFL pre-service and in-service teachers' perceptions of TPACK?

Descriptive statistical analysis of pre-service and in-service teachers' data

In order to examine the participants' perception levels of TPACK, descriptive statistical analysis was used to compute mean and standard deviation (Table 1)

Table 1. **EFL Pre-Service and In-service Teachers' mean scores and standard deviation of TPACK**

Domain	G	N	Mean	Std. Dev.
TK	PRE	84	33.89	2.83
	IN	41	29.46	4.59
PK	PRE	84	17.38	6.14
	IN	41	22.51	4.20
CK	PRE	84	15.32	5.62
	IN	41	19.90	2.79
TPK	PRE	84	21.35	5.64
	IN	41	25.61	4.35
TCK	PRE	84	11.13	2.09
	IN	41	9.63	1.61
PCK	PRE	84	14.92	4.90
	IN	41	17.51	3.52
TPACK	PRE	84	14.25	2.50
	IN	41	14.63	3.38
TOTAL	PRE	84	129.25	23.45
	IN	41	140.27	20.54

Results showed that the pre-service participants had the highest mean scores in TK (M= 33.89, SD= 2.83), TCK (M= 11.13, SD= 2.09); and they had the lowest mean scores in PK (M= 17.38, SD= 6.14), CK (M= 15.31, SD= 5.62), TPK (M= 21.35, SD= 5.64), and PCK (M= 14.92, SD= 4.90). The level of pre-service teachers' TPACK component was mediocre (M= 14.25, SD= 2.50) and their total mean score was M= 129.25, SD= 23.45). Whereas the in-service participants had their highest mean scores in PK (M= 22.51, SD= 4.20), CK (M= 19.90, SD= 2.79), TPK (M= 25.61, SD= 4.35) and PCK (M= 17.51, SD= 3.52); and they scored the lowest in TK (M= 29.46, SD= 4.59), and TCK (M= 9.63, SD= 1.61). Their TPACK component score was average (M= 14.63, SD= 3.38). With respect to the total scores, the in-service participants (M= 140.27, SD= 20.54) were higher than those of the EFL pre-service teachers.

Differential analysis of pre-service and in-service teachers' data
Levene's Independent Samples test was conducted to answer the research question whether there were any significant differences between pre-service teachers and in-service EFL teachers' participants' perception levels of TPACK (Table 2).

Table 2. **Differences between EFL pre-Service vs. in-service teachers' perception/level of TPACK**

Domain/Construct	F	Sig.	t	Sig. (2-tailed)
TK	6.55	.012	6.640	.000***
PK	17.51	.000	-3.884	.000***
CK	42.33	.000	-4.927	.000***
TPK	5.40	.022	-4.250	.000***
TCK	.63	.429	4.040	.000***
PCK	13.01	.000	-4.194	.000***
TPACK	2.79	.097	-.717	.475
TOTAL	5.05	.026	-2.565	.012**

*p < .05, **p < .01, ***p < .001

Results showed a statistically significant difference in the scores of the participants' in all sub constructs/domains of TPACK, except the last one; TPACK. They were as follows: TK; t= 6.640, p < .000, TCK; t= 4.040, p < .000 with the pre-service EFL teachers scoring significantly higher than the in-service participants, PK; t= -3.884, p < .000, CK; t= -4.927, p < .000, with in-service teachers scoring significantly higher than pre-service teachers. The results (Table 2) also indicated a statistically significant difference in the scores of the participants' TPK; t= -4.250, p < .000, PCK; t= -4.194, p < .000 in favor of the in-service EFL teachers participants. However, there was no significant difference between the two groups in the TPACK domain; t= -.717, but the in-service EFL teachers were significantly higher than pre-service teachers in the total score of the scale; t= -2.565, p < .01

Table 3. **EFL pre-service and in-service EFL teachers' perception of TPACK**

Domain/Construct		Sum of Squares	df	Mean Square	F	Sig.
TK	Between Groups	540.569	1	540.569	44.085	.000
	Within Groups	1508.231	123	12.262		
	Total	2048.800	124			
PK	Between Groups	470.235	1	470.235	15.086	.000
	Within Groups	3834.053	123	31.171		
	Total	4304.288	124			
CK	Between Groups	578.197	1	578.197	24.273	.000
	Within Groups	2929.931	123	23.821		
	Total	3508.128	124			
TPK	Between Groups	498.270	1	498.270	17.063	.000
	Within Groups	3393.042	123	27.586		
	Total	3891.312	124			
TCK	Between Groups	61.728	1	61.728	16.326	.000
	Within Groups	465.072	123	3.781		
	Total	526.800	124			
PCK	Between Groups	356.177	1	356.177	17.590	.000
	Within Groups	2490.661	123	20.249		
	Total	2846.848	124			
TPACK	Between Groups	4.066	1	4.066	.514	.475
	Within Groups	973.262	123	7.913		
	Total	977.328	124			
TOTAL	Between Groups	3344.889	1	3344.889	6.580	.012
	Within Groups	62523.799	123	508.324		
	Total	65868.688	124			

The quantitative data investigated the participants' perception of TPACK and how it can be used in EFL instruction. The results of the data analysis of variance (ANOVA) (Table 3) revealed that there was a deficiency in the participants' perception of TPACK framework and its applications in EFL instruction. The pre-service EFL participants excelled in TK and TCK constructs, but scored badly in the other constructs, whereas the in-service EFL teachers surpassed in PK, CK, TPK, and PCK, and missed up only in

TK and TCK. Both groups did not significantly differ in the TPACK domain.

Question 2: To what extent do EFL pre-service teachers develop their teaching practices after introducing/ adopting TPACK framework; combining technology, pedagogy and content of EFL?

This study was set out with the aim of investigating the effect of introducing/adopting TPACK framework/model on the participants' performance in teaching practice can be seen when comparing their knowledge components in Table 4, their Teaching Practice before the introduction of TPACK framework (TP pre), with their Teaching Practices after introducing it; the three rounds, (TP 1, TP 2and TP 3) in Table 5.

Table 4. Participants' knowledge/use of TPACK components before the introduction of the TPACK framework (TP pre)

Teacher	TK	PK	CK	TPACK
1			x	
2			x	
3		x	x	
4			x	
5		x	x	
6	x	x	x	x
7			x	
8				
9			x	
10	x		x	
11		x	x	
12				
13			x	
14		x	x	
15			x	

Teacher	TK	PK	CK	TPACK
16	x		x	
17			x	
18		x	x	
Total	3	6	16	1
%	16.7%	33.3%	88.9%	5.6%

As shown in Table 4, before TPACK framework was introduced, from the total of 18 pre-service EFL teachers, only three of them developed their lesson plans on the basis of TK, and 6 of them showed PK, including methods/strategies/techniques in their lesson plans. Most of the participants, 16 of them, had CK in their lesson plans, meanwhile none of them involved TPACK in their teaching practice (TP pre), and none of the participants had demonstrated the integration of TPACK.

Table 5. Participants' knowledge/usage of TPACK components after the introduction of the TPACK framework (TP 1, TP 2and TP 3)

Pre-service teacher	TK			PK			CK			TPACK		
	TP 1	TP 2	TP 3	TP 1	TP 2	TP 3	TP 1	TP 2	TP 3	TP 1	TP 2	TP 3
1	x	x	x	x	x	x	x	x	x	x	x	x
2		x						x	x			x
3	x	x	x	x	x	x	x	x	x	x	x	x
4		x	x	x	x	x	x	x	x			x
5			x				x	x	x			
6	x	x	x	x	x	x	x	x	x	x	x	x
7					x		x		x			
8	x	x	x	x	x	x	x	x	x	x	x	x
9					x		x		x			
10	x	x	x	x		x	x	x	x	x	x	x
11			x					x	x			

Pre-service teacher	TK			PK			CK			TPACK		
12	x	x	x	x	x	x	x	x	x	x	x	x
13							x	x				
14	x	x	x	x	x	x	x	x	x			x
15					x			x				
16	x	x	x	x	x	x	x	x	x	x	x	x
17		x	x			x	x		x		x	
18			x			x		x	x		x	x
Total	8	11	13	9	10	12	14	15	16	7	9	11
%	44.4%	61.1%	72.2%	50%	55.6%	66.7%	77.8%	83.3%	88.9%	38.9%	50%	61.1%

Table 5 reveals that the participants went through a series of developments after the introduction of the TPACK framework; starting from the first (TP 1) to the second (TP 2), and ending with the third round of observation (TP 3), which manifested a development/improvement, more specifically in including the technological knowledge. Before introducing the TPACK framework along with the instructional designs based on it, in (TP pre), only three participants used technological knowledge, whereas, in TP 1 (8), TP 2 (11), and TP 3 (13) made use of it. Meanwhile, the number of participants who applied pedagogical knowledge in TP 1 (9), TP 2 (10), and TP 3 (12), exceeded those who included that construct in the TP pre (6), which indicated that the introduction of the TPACK framework encouraged teachers to adopt PK and use it in their instructional designs and teaching practices. Meanwhile, the number of participants who employed CK in their instructional design decreased from (16) in the TP pre to (14) in TP 1, (15) in TP 2, and went back to (16) in TP 3, which means that almost the same number of participants consistently involved CK before and after the introduction of TPACK. In terms of the application of the TPACK framework, there was only one participant who used TPCK in TP pre, but the number significantly increased in TP 1 when (7) participants used TPACK framework in their instructional designs and teaching practices, and it the percentage kept going up during PT 2 (9), and PT 3 (11), after the demonstrated/ modeled examples introduced to them, combining content, technologies and teaching approaches in a classroom lesson.

The results of the study demonstrated that the participants, EFL pre-service teachers obviously benefited from the introduction of the TPACK framework and its oriented application on their instructional designs and

teaching practices. Many of them have successfully prepared their instructional designs and performed teaching practices based on adopting/ applying the TPACK framework that they were introduced to. To start with, the introduction of TPACK inspired the participants to explore the use of TK and PK in their teaching practices. It is clear that the percentage of its usage went up for TK from 16.7% before the introduction of TPACK to 44.4%, 61.1%, and 72.2% in TP 1, TP 2, and TP 3 respectively, after introducing TPACK. Even though the improvement of PK was not on the same level, as it gradually changed and developed from 33.3% in TP pre to 50% in TP 1, 55.6%, in TP 2, and 66.7% in TP 3, but still there was a considerable development. However, as for CK, most of the participants consistently involved content knowledge before and after the introduction of TPACK, but the percentage of participants who used content knowledge in their instructional design, which was (88.9%) in TP pre decreased in TP 1 (77.8%), and went up to the same level (88.9%) in TP 3, after the TPACK introduction. This might lead to an assumption that the participants were overwhelmed by the types of knowledge that were more novel to them; TK, PK, and TPK, and excited to practice them, than the one type they already use most of the time; CK. Additionally, looking at the notable improvement of the participants' levels in integrating TPACK domain in their teaching practices as well as their instructional designs; going from 5.6% before the experiment to 38.9%, 50%, and61.1%, verified a substantial role that the introduction of TPACK played in developing the technological knowledge (TK), pedagogical knowledge (PK), and TPACK domains.

The qualitative data, collected via discussions during semi-structured interviews and journal entries, investigated and illustrated the respondents' perceptions of how the introduction of the TPACK framework helped them to improve the quality of their instructional designs as well as their teaching practices. However, there were still some areas that need more attention and practice to be improved in terms of the use of TK in teaching practices. Unlike TK and PK, the CK did not change, as it was consistently applied by most of the participants. Additionally, the field notes of classroom observations that were gathered and organized for additional data revealed that there was also a gap where there was a need to improve the use of PK in their teaching practices. Consequently, the results of qualitative data analysis revealed that the participants benefited from applying the TPACK framework to improve the quality of EFL instruction in their teaching practice. Some of them expressed their change of attitude towards using technology, like tablet, smart phones, and the like, as they used to be reluctant to try such technological tools, but after the experiment they were encouraged to integrate different types of technology into their teaching. Many of them were enthusiastic towards using the various platforms, YouTube, and other forms of media to provide their students with authentic language and genuine communicative activities, which could enrich their instructional experiences.

The general impressions of the participants towards the introduction of the TPACK and the instructional designs based on it were positive. They expressed their opinions about the instructional designs by describing them as interesting, flexible, and motivating, as they opened their eyes and minds to a non-traditional creative way of planning their teaching. They found the new instructional design simpler than the traditional lesson plan which facilitated their task of preparing their plans for teaching practice and made it a lot easier. All participants were asked to develop their instructional designs with the original use of technological knowledge and appropriate pedagogical knowledge. They had the advantages in terms of exchanging ideas and being exposed to a unique experience of becoming a teacher as well as the students during the teaching and learning process of the experiment. They appreciate the opportunity of knowing the applications that could be used to support EFL instruction in the classroom. In addition, most of the participants claimed to get more insights into TEFL instruction during the experiment which would enhance the quality of their teaching in their own classrooms in the future.

Some of the participants suggested that the materials, skills, assessment, or rather the instructional design, and technological applications should be gathered in a handbook/teachers' guide for those who are interested in using them, which might ease other fellow teachers' mission to use the design without finding more sources or materials and the lists of various technological applications which were interesting and easy to use in the classroom. Some teachers also expressed their need for more practices and activities to teach each different EFL skills; teaching listening, speaking, reading, and writing, along with EFL aspects: grammar, vocabulary, and pronunciation. In general, the participants realized their urgent need to improve their knowledge on teaching strategies and to brush their ability to use the recent trend of technological knowledge in their teaching practices as well as their regular classrooms after graduation.

Findings from the participants' observations helped to provide a deeper understanding of TPACK in terms of bridging the gap between research and practice. However, since the experiment, especially the last periods of the teaching practice, was in the form of peer teaching where the participants taught each other in mini sessions, to replace the actual students in the class, they thought that it lost the sense of real classroom in actual schools with real students, which would be more contextual. They could not feel the atmosphere of a real classroom, with 30-50 students around, when they were conducting peer micro teaching. Moreover, they thought that actual students would have different language levels, background knowledge, and individual and psychological differences, which would add the flavor of difficulty/pleasure to the experience of teaching in the teaching practices.

Findings and Discussion

Findings of quantitative data analysis revealed that except for the TPACK sub-domain, there were significant differences between ELT pre-service and in-service teachers' perceptions of TPACK. More specifically, the pre-service teachers had significantly higher self-perception in TK component than the in-service teachers. This agrees with Kurt et al., (2014) and Wu and Wang, (2015); meanwhile, in PK and CK the in-service teachers had significantly higher self-perception. Concerning TPK and TCK, in-service teachers had significantly higher self-perception in the first (TPK) than the pre-service (Dong et al. 2015), while the pre-service group surpassed in the second (TCK). As Yan and Yuhang (2012) claimed no matter how much information the teachers know about technology, the knowledge they know cannot be automatically transformed into the ability in utilizing it in teaching. This might be more applicable to pre-service teachers as in-service teachers, who received none/ or limited technology training, outperformed the pre-service teachers in most of TPACK components/ sub-domains. Even though the in-service teachers excelled in PCK, but they needed to strengthen their technology knowledge and to further develop their TPACK, through directly engaging them in more technology-integrated training. However, the in-service teachers' group did not significantly differ from the pre-service group in the TPACK component.

Surveys are commonly used to investigate the development of pre-service and/or in-service teachers' self-perceived knowledge of TPACK (e.g., Archambault and Crippen, 2009; Koehler and Mishra, 2005; Schmidt et al., 2009/10). According to Hofer and Grandgenett (2011), self-report surveys may be prone to participants under/ over-reporting; and therefore, may not provide enough details to examine TPACK. As a result, survey items may need revising or additional items added to strengthen the reliability and validity of existing instruments and their ability to measure each TPACK component. Many researchers, such as Koehler and Mishra, 2008; Harris et al, 2011; Abbitt, 2011; Kwangsawad, 2016, recommended that TPACK should be examined in various ways to be truly indicative of reliable findings. Accordingly, the present study utilized multiple data sources, which enhanced its scope in terms of confirming findings from self-reported investigations. Findings from the participants' observations, in the qualitative data, had helped to provide a deeper understanding of TPACK in terms of bridging the gap between research and practice. Moreover, those findings also suggested that there were certain characteristics identified for each of the seven TPACK components and these characteristics can be observed in practice. Thus, this study illustrates the value of using multiple data sources while examining EFL pre-service/in-service teachers' TPACK.

The qualitative study was used to better understand teachers' TPACK by introducing its framework, modeling for the instructional design, demonstrating an exemplary lesson using technology as an integral part of it, and its application on teaching practices. All participants were observed

(three times) applying their knowledge of each TPACK component while teaching, in addition to self-assessment, EFL participants conducted peer assessment on each other's TPACK development. Additionally, in this present study, the tools used for the qualitative data, such as the classroom observation, showed that pre-service teachers' knowledge and applications of TPACK were more advanced than in-service teachers contrary to the quantitative findings. Nonetheless, most of the participants in the experiment were found to be unsatisfactory, similar to Abera's findings (2014), as they applied their PCK in EFL teaching using technology in a conventional instructional environment, as in Yan and Yuhang's (2012), i.e., teacher-centered classroom/instruction. It also identified the importance of developing a reliable classroom observation tool that could register observable characteristics that align with all seven TPACK components. Such an instrument would be extremely useful in assisting pre-service/in-service teachers, school administrators, and teacher educators with identifying specific TPACK components that need attention when preparing teachers to integrate technology. Similar to previous studies, (Aykac et al., 2015; Oz, 2015), most participants declared that introducing the TPACK framework and its applications, the modeling/demonstration, and the practice was done during the teaching practice which were very limited to provide an example of technology integration in EFL lessons.

One of the most important findings in the present study, regarding TPACK development, was how the participants put it into practice to promote their teaching practices, and how such acquired development actually affected /promoted EFL instructional outcomes. In other words, the mere introduction of TPACK did not necessarily guarantee its application in the EFL classrooms. Moreover, using TPACK framework for EFL instruction as a complex task required high levels of not only technological skills but also high proficiency in all other accompanying skills. It was clear from the assessment that not all participants provide TPACK-based instruction throughout the whole period of class time. For some participants, the link between TK, CK, and PK (TPACK) had not been established yet and although TK is important, it is not enough indicator of utilizing technology in instruction to enhance teaching and learning. This may be attributed to either the insufficient knowledge of TK, CK, and PK, or their lack of competencies in combining the three knowledge components and applying them in their teaching. Studies conducted by many researchers (Harris, Mishra, and Koehler, 2009; Jamieson-Proctor, Finger, and Albion, 2010) have shown that teachers predominantly use technology for low-level tasks such as internet search, and as presentation software (Campbell and Baroutsis, 2011).

Although pre-service teachers' perception of TPACK mean scores were the highest, based on quantitative results, their statements, in the qualitative, showed that they considered technology as only TK rather than TPACK as a whole, which was similar to previous studies findings (Carbova and Betakova, 2013; Aykaç et al, 2015; Liu and Kleinsasser, 2015). Therefore,

according to the quantitative findings, they appeared to be ready to teach/use technology in their classrooms; however, qualitative results indicated the situation was contrary in terms of TPACK, as in Delen et al. (2015). In short, knowing how to use technology and using it for individual/personal purposes all the time does not mean that they can integrate it efficiently into their instruction to improve teaching/learning (Kessler and Plakans, 2008; O'Bannon, 2011). Also, in line with previous studies, teachers who improve their technology learning do not necessarily enhance TPK or TCK unless simultaneously revisiting their PK or CK (Doering et al., 2009; Jang, 2010; Benson and Ward, 2013; Liu and Kleinsasser, 2015).

Many previous studies, (West and Graham, 2007; Goktas et al., 2008; Sahin, 2011; Abera, 2014; Cetin-Berber and Erdem, 2015; Oz, 2015; Tondeur et al., 2017), had similar findings as the participants' TPACK was unsatisfactory despite technology training in their preparation program. This might be because they applied PCK while teaching EFL, but they were using technology the conventional way (Kurt and Ciftci, 2012; Abera, 2014); for instance, Data show projector and PowerPoint were used for only showing pictures, presenting materials, and delivering content in the traditional methods, to make their job easier and to motivate the students (Gulbahar, 2007; Yildirim, 2007; Goktas et al., 2009; Cakir, 2012; Fisher et al., 2012; Unal and Ozturk, 2012; Kurt, 2013). Mishra et al. (2009) explained that one reason new technologies have failed to transform education is because "most innovations have focused inordinately on the technology rather than more fundamental issues of how to approach teaching subject matter with these technologies". The majority of EFL teachers used technology as efficiency aids rather than as a way of transforming instructional practice. Some participants claimed that they were not allowed to use any material except the course books and their PDF versions on the tablet, which might limit and even restrict the technology used in the classroom. By the end of the experiment, many of the participants were more enabled to combine CK, PK, and TK, and some of them used a more integrated approach of TPACK domains.

On the other hand, the difference between "knowing" and "doing" was also demonstrated in some of the participants' performances, similar to Ersanli's (2016) and Kwangsawad's (2016) studies. Although the participants were confident about their knowledge domains, their implementations were limited. Similar to the results of the previous study (So and Kim, 2009), knowing about technology or the content did not necessarily produce efficient technology use in the given context. Even though they might have understood the TPACK framework, developing it through the interactions among its seven components was problematic to some extent, which did occur in previous studies (Marino et al., 2009; Sahin, 2011; Cetin-Berber and Erdem, 2015; Tondeur et al., 2017). Indeed, research into the TPACK development (Campbell and Baroutsis, 2011; Jamieson-Proctor, Finger, and Albion, 2010; Koçoğlu, 2009; Kurt et al.,

2013; Mishra and Koehler, 2006; Watson et al., 2004; Tai and Chuang, 2012; Tai, 2013) has highlighted the significant role of integrating technology into teaching profession and its effects on promoting successful language instruction.

Accordingly, the present study suggested that EFL pre-service teachers needed time to do self-contextualization of TPACK framework they got during the teaching practices to their own specific setting. It was impossible to cover it in the limited time sessions offered in the experiment. The contextualization might take time and need adjustment at some aspects. In addition, the researcher is recommending initiating an online community of practice, focusing on the development of TPACK-oriented instructional designs and teaching practices, because feedback from peers and opportunities for sharing ideas and resources with their fellow teachers across distance would definitely promote deeper understanding of the nature and the use of TPACK. This is especially needed among EFL teachers in the Egyptian context, where TPACK framework had not been implemented largely in the practical scope.

To sum up, the present study, based on both quantitative and qualitative data, has its drawbacks. It started with the aim of unfolding EFL pre-service and in-service teachers' self-perception of TPACK, and then it investigated TPACK development among EFL pre-service teachers' participants with the purpose of assessing their knowledge and skills of integrating technology into EFL instruction, before and after introducing TPACK framework. However, the study did not approach EFL in-service teachers' TPACK in practice. Due to the limitations of the present study, its results must be treated with caution. Future researchers may recruit a larger sample of participants with counterparts in different educational contexts to offer additional perspectives.

Moreover, further research may approach the issue from different perspectives such as pre-service vs. in-service teachers' technological pedagogical content knowledge in practice. These findings paved the way for more possible studies in developing a more systematic approach for assessing teachers' TPACK. Triangulating data from multiple sources appeared promising, to continue refining and improving the existing research approaches being used to investigate TPACK.

Conclusion

This present study tried to provide a holistic picture of TPACK integration in TEFL by different type of teachers. It explored and illustrated the TPACK of EFL pre-service and in-service teachers. Its findings contributed to the field of teacher education and professional training of TPACK. Firstly, it compares pre-service to in-service teachers' perception of TPACK through the self-perceived TPACK scale. Very few of the existing studies have attempted to do such comparison in ELT field. Secondly, this study has revealed the results of introducing TPACK to EFL pre-service teachers taking their teaching practice as part of their pre-service

preparation educational program. The findings of the qualitative study showed that more participants included technological knowledge in their instructional designs in their teaching practices after the introduction of TPACK. They also expressed positive impressions regarding the introduction of TPACK in their teaching practice and the presented ways to develop it, , such as journal entries/portfolios, peer-assessment, holding meetings, etc. However, they still postulated their anxiety towards the implementation of TPACK-oriented instructional designs in their teaching field. Besides, the participants' reflections on how technology is currently used in EFL class intensified the need for TPACK study to be highlighted in their preparation courses. Therefore, integrating technology into classroom instruction means more than teaching basic computer skills and software programs in a separate computer class. Special attention should be given to TPACK, and teaching practice should be taken more seriously. Effective technology integration should happen across the curriculum in ways that deepen and enhance the instructional process.

Based on its findings, this study suggested changes in pre-service teacher education /in-service teacher training programs. Despite the increased availability in computer access and technology training, technology was still under used by both pre-service and in-service teachers to support their instructional process. Pre-service teachers' high score in TK does not necessarily mean the use of integrated innovative technology in subject matter. It is necessary to teach them how to establish the connections between technology, content and pedagogy, and how to use technology to create real interactions, increase cooperation, and promote creativity among students. It also strongly suggested that developing PCK and TCK was an important factor that must be prioritized before the overall technology integration. Besides, the development must be supported with actual teaching experience and the pre-service teachers, with TEFL focus, should be directed to reflect on their TPACK concerning the use of technology and the incorporation of higher-order thinking skills.

Implications and recommendations

Educators at all levels call for creating 21st-century learning environments for the students, the need to strengthen preparation for novice teachers in digital literacy is greater than ever (Darling-Hammond, 2006; Gronseth et al., 2014; Kozma, 2008; Ottenbreit-Leftwich et al., 2012; Voogt, Erstad, Dede, and Mishra, 2013; Tondeur et al., 2017). The use and understanding of technology is rapidly developing, and new teachers are being asked to enter the profession equipped with forever skills and knowledge for effectively integrating technology, pedagogy, and content into their instruction. There are two types of barriers that could impact the use of technology: external barriers; related to access to resources, equipment, software substructure, support, educational e-content, and its management, and pre-service/in-service training programs on TPACK and

its usage/ applications; and internal barriers; including teacher knowledge and skills, confidence, and perceptions about the value of technology.

Recent years have seen a rapid increase in the access to and development of educational technologies that resulted in a decrease in external barriers (Hsu, 2013; Ottenbreit-Leftwich et al., 2010; Sadaf, Newby, and Ertmer, 2012). Similarly, this goes in agreement with the significant educational reforms being made in Egypt by the Ministry of Education has emphasized the use of technology as an important instructional tool within schools nationwide across the country. This reform is aiming to improve technology in schools for the efficient usage of technology tools in both teaching and learning processes through providing tablets, interactive/smartboards besides in-service training for teachers working at all schools. Even though schools are equipped with technology much better than ever before, researchers need to investigate the way they are actually used in the classes.

The internal barriers have remained a challenge, mainly due to teachers' uncertainty about the relationship between pedagogy and technology for instruction (Ertmer et al., 2012; Hsu, 2013). In particular, teachers might not be able to realize how the use of technology could add value to their instruction. They might also resist learning about new technology tools, not thinking of that to be a worthwhile use of their time (Ertmer et al., 2012; Ottenbreit-Leftwich et al., 2010). Some research and experts reported that educators lack awareness about how to use technology productively for classroom instruction and they needed to use their pedagogical lens to better understand how technology could efficiently fit and enrich the instructional processes (Desai, Hart and Richards, 2009; and Philip and Garcia, 2013).

Novice teachers are entering the profession with inadequate preparation for integrating technology with pedagogy and content for developing digitally literate students; they are also entering the field without knowledge of the actual technologies used in school settings. Accordingly, it could be highly recommended to educate the pre-service teachers and train the in-service on TPACK, especially the connections between technology, content, and pedagogy (Abera, 2014), and how to use technology, as in Wu andWang (2015), to create genuine/real interactions, increase cooperation, and promote creativity among students.

Furthermore, the present study, similar to previous studies (Niess, 2006; So and Kim, 2009; Koh et al., 2020; Pamuk, 2012), indicated that the short direct teaching experience the EFL pre-service teachers were offered limited using/ integrating technology effectively into their teaching. Therefore, as supported by a previous study (Aykaç et al., 2015) the period of teaching practice should be extended to cover more experience time. Besides, it is recommended that courses and curriculum for EFL pre-service/in-service programs should be restructured requiring further TPACK incorporation along with its domains, specifically technology integration in EFL instruction.

As for the in-service teachers, as some of the TPACK scale's respondents reported, technology integration in schools was not at the expected/target level; as training sessions are conducted often as seminars, short term and off-site, however this was beyond the scope of the current study. But what emerged from the data collected was that continuous in-service training is in need in an organized collaborative environment, they might observe one another and then discuss their observation. According to Wu and Wang (2015), if the teachers were explicitly taught the different ways to understand their TPACK and reflect on it, they would notice what was missing from their practice.

In-service teachers' perception of technology should be changed from using technology as a facilitating tool and an innovative attention-getter to using it to transform the instructional process providing more opportunities for students to use the language meaningfully, creatively, authentically, and autonomously. They might also need to devote more professional development time for improving their instruction/assessments with technology. Meanwhile, teacher educators could emphasize the teachers' positive experiences they have in teaching with technology, which might help their students to reconsider their instructional beliefs and refine their technology-based/enhanced instructional practices.

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