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Tracing preservice English language teachers' perceived TPACK in sophomore, junior, and senior levels

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Abstract: Many teacher education institutes (TEI) are expected to provide preservice teachers (PTs) with the necessary knowledge, skills, and attitudes to teach with information and communication technology (ICT). To address this challenge, many TEIs have included introductory ICT courses in their curriculum to develop technological knowledge and skills. Although several existing studies have focused on detecting whether a course or a short-term training program can make an improvement on PTs' TPACK, none of the existing studies have attempted to investigate in a longitudinal process whether PTs' perceived development of TPACK skills follow an increasing linear pattern through years as planned in four-year-long teacher education programs, especially in ELT. This study therefore intends to address this gap in the literature. Based on TPACK survey with open-ended questions, results of the study indicated a nonlinear pattern of TPACK development over time. In line with these findings, suggestions for teacher educators, policy-makers, and future research were made.

Subjects: Educational Research; Education Studies; Higher Education; Teachers & Teacher Education; Teaching & Learning; Technology in Education; English & Literacy/Language Arts

Keywords: TPACK; teacher education; preservice teachers; ELT; technology integration; cross-sectional method

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PUBLIC INTEREST STATEMENT

Preservice teachers (PTs) are expected to gain the necessary knowledge, skills, and attitudes to teach with information and communication technology (ICT) in teacher education programs. In the programs introductory ICT courses are offered to develop technological knowledge and skills. Meanwhile, several researchers investigated the impact of a course or a short-term training program on PTs' Tecnological Pedagogical Content Knowledge (TPACK) development. However, two points are missing: The first one is PTs' TPACK development in a longitudinal process, and the other one is whether PTs' TPACK skills follow an increasing linear pattern through years as planned in four-year-long teacher education programs especially in ELT. This study therefore intends to address this gap in the literature. Based on TPACK survey with open-ended questions, results of the study indicated a nonlinear pattern of TPACK development over time. In line with these findings, suggestions for teacher educators, policy-makers, and future research were made.

1. Introduction

Since the creation of personal computers and the launch of the Internet, many educators and governments have advocated education reforms that take advantage of the affordances of ICT (Greenhow, Robelia, & Hughes, 2009; Jonassen, Howland, Marra, & Crismond, 2008). In the classrooms of many developed countries personal computers have become more readily available but teachers' use of ICT continues to be criticized. It has been widely cited that teachers have been using ICT infrequently and when used, it is for information transmission rather than the facilitation of students' knowledge construction (Gao, Choy, Wong, & Wu, 2009; Harris, Mishra, & Koehler, 2009; Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010; Sang, Valcke, Braak, & Tondeur, 2010). These observations put more emphasis on teaching teachers ways of integrating ICT in teaching (Angeli & Valanides, 2009; Goktas, Yildirim, & Yildirim, 2009; Polly & Brantley-Dias, 2009).

In shaping teacher use of ICT in the classroom preservice education plays an important role (Gao et al., 2009; Lim, Chai, & Churchill, 2010). Literature to date has reported that preservice teachers (PTs) who have acquired higher level of technological skills are more willing to use technology in classroom (Hammond et al., 2009; Paraskeva, Bouta, & Papagianni, 2008) and they possess a stronger sense of self-efficacy with respect to computer use (Brown & Warschauer, 2006; Lee, Chai, Teo, & Chen, 2008). Also, it can help to counter the possibilities of transmission-oriented school practices in the assimilation of beginning teachers (Jordan, 2011). Given that PT education has good potential to influence teachers' future use of ICT (Hammond et al., 2009); therefore, preparing PTs for ICT integration in the classrooms is a key focus for many teacher education institutes (TEI).

TEI are expected to provide PTs with the necessary knowledge, skills, and attitudes to teach with ICT. To address this challenge, many TEIs have included introductory ICT courses in their curriculum (Polly, Mims, Shepherd, & Inan, 2010). Focusing on the development of technological knowledge and skills, these courses aim to equip PTs with a set of basic competences they can transfer to their future classroom practice. However, empirical evidence shows that PTs still do not feel adequately prepared to effectively integrate ICT into their classrooms (Kay, 2006; Swain, 2006). Preparing PTs for ICT integration is a complex job given the fast changing nature of ICT and the multiple sources of knowledge which need to be synthesized. Moreover, the effectiveness of ICT in PT education is influenced by a host of contextual factors such as university instructors' use of ICT, school readiness, mentor teachers' attitude etc. (Lim et al., 2010). One common problem in preparing PTs for ICT integration is that many PTs do not have enough exposure to pedagogical use of ICT (Brown & Warschauer, 2006; Lim et al., 2010). Many TEIs offer only one technology course for teacher preparation (Hsu & Sharma, 2006), which may focus on ICT skills (Mishra, Koehler, & Kereluik, 2009; Steketee, 2005). However, teaching ICT skills alone does not adequately prepare PTs to integrate ICT (Lawless & Pellegrino, 2007). Mishra et al. (2009) highlight 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" (p. 49). That is, it is not about giving teachers a standardized technological training and focusing on the tools domain/knowledge in itself, but on a modular training put in context and linked to what is the teacher's pedagogic activity and to the age level of the students with whom she/he works (Coutinho & Bottentuit Junior, 2009). Meaningful use of ICT in the classroom requires teachers to integrate technological affordances with pedagogical approaches for the specific subject matter to be taught (Jonassen et al., 2008). This integrated form of contextualized knowledge has been referred to as TPACK (Mishra & Koehler, 2006; Thompson & Mishra, 2007). Building on the notion of pedagogical content knowledge (Shulman, 1986), Mishra and Khoeler introduced the concept of TPACK as a theoretical framework to strengthen the study of teachers' use of ICT for education. Based on this framework, many researchers (e.g. Tondeur, Roblin, van Braak, Fisser, & Voogt, 2013) recommend integrating TPACK across the TEI curriculum, and thereby provide PTs with the opportunity to experience how ICT can support teaching within specific content areas. Such recognition has prompted many preservice ICT courses to be designed as integrated courses where content teaching and/or method courses are part of the curriculum (Angeli & Valanides, 2005; Chai, Koh, & Tsai, 2010; Lisowski, Lisowski, & Nicolia, 2006).

Many studies have shown TPACK to be developed through design projects (e.g. Angeli & Valanides, 2009; Koehler & Mishra, 2005), microteaching activities (e.g. Cavin, 2008), and participation in communities of practice (e.g. Chai et al., 2010; Rodrigues, Marks, & Steel, 2003). The literature on TPACK focuses on detecting whether a course or a short-term training program can make an improvement on participants-preservice or in-service teachers' TPACK. So far, to the best of the researcher's knowledge, there is a scarcity of a longitudinal study that has attempted to investigate whether PTs' self-perceived development of TPACK skills follow an increasing linear pattern through years as planned in the curriculum of teacher education programs, especially in English Language Teaching. To address this gap in literature, this paper aims to depict the current picture of self-perceived TPACK development of PTs enrolled in four-year ELT program through cross-sectional design (Creasey, 2006; Miller, 2007). The overarching research question is as flows: how does the TEI curriculum prepare PTs for the integration of ICT at different years of the ELT program. Under this broad question there are two sub-questions:

(1) Does the self-perceived development of PTs' TPACK skills follow an increasing linear pattern through sophomore, junior, and senior years as planned in ELT curriculum?
(2) From PTs' perspective, how does the TEI curriculum prepare PTs for the integration of ICT?

Answering to these questions will shed light to the field of teaching TPACK to teacher candidates, specifically preservice English Language teachers, and will provide insight into the content of technology courses and their placement sequence in the curriculum of teacher education programs.

2. Literature review

2.1. Technological pedagogical content knowledge (TPACK)

TPACK is an extension of pedagogical content knowledge (Shulman, 1986). While pedagogical content knowledge focuses on the development of understanding of how students learn specific content areas, TPACK focuses on "the connections, interactions, affordances, and constraints between and among content, pedagogy, and technology" (Mishra & Koehler, 2006, p. 1025).

The relationships of the knowledge domains of TPACK are "illustrated" with the Venn diagram in Figure 1. Firstly, three main forms of knowledge are: (1) Pedagogical Knowledge (PK i.e. knowledge about the processes, practices or methods of teaching and learning and knowledge about

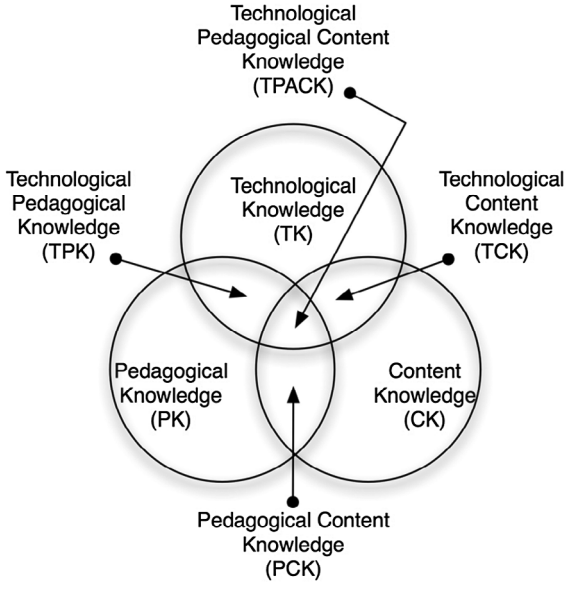

Figure 1. The TPACK framework and its knowledge components.

Source: TPCK (2010).

educational aims, values and purposes), (2) Content Knowledge (CK i.e. knowledge about the subject matter that is to be learned or taught), and (3) Technological Knowledge (TK i.e. knowledge about more commonplace technologies, including overhead projectors, blackboards, and modern technologies, such as computers, the Internet, and interactive whiteboard). Secondly, TPACK converges complex interplay of three bodies of knowledge: (1) Pedagogical Content Knowledge (Shulman, 1986), (2) Technological Content Knowledge (knowing what kind of technology tools is available for teaching what), and (3) Technology Pedagogical Knowledge (able to choose an ICT tool based on its affordances to address a particular teaching/learning need (Mishra & Koehler, 2006, p. 6).

Despite shown in a Venn diagram, the TPACK framework interpreted as a dynamic equilibrium between the different categories of knowledge with no domain totally distinct or separate from the other (Mishra & Koehler, 2006; Niess, 2011). Hence, TPACK emphasizes "the connections among technologies, curriculum content, and specific pedagogical approaches, demonstrating how teachers' understandings of technology, pedagogy, and context can interact with one another to produce effective discipline-based teaching with educational technologies" (Harris et al., 2009, p. 396) to provide transformative teaching and learning experiences (Angeli & Valanides, 2009).

2.2. Studies on TPACK with PTs

When empirical studies related to TPACK are analyzed in detail, it can be seen that there is limited research conducted on PTs in language education area. For instance, Wu (2013) examined 24 empirical studies related to TPACK published from 2002–2011. Regarding the distribution percentages of the sample groups analyzed, PT has the highest ranking (54.2%), followed by high school teacher (20.8%), elementary school teacher (16.7%), and university or college teacher (8%) in sequence. Wu further reports that more than half of the empirical TPACK studies (66.7%) focused on teachers' domain-general TPACK, and relatively fewer studies explored teachers' domain-specific TPACK. Moreover, science (20.8%) and mathematics (12.5%) are the two major subject domains that were explored in those domain-specific TPACK studies. Social studies (4.2%), Language (4.2%), and Geography (4.2%) subject domains are the least examined ones.

In teacher preparation programs, teacher candidates can develop their TPACK in a variety of courses and field experiences. The three ways for developing TPACK are through a dedicated educational technology course, content-specific teaching methods or practicum courses; and through the duration of coursework in a teacher preparation program (Hofer & Grandgenett, 2012). In this section a selection of research studies that track PTs' development of TPACK are presented.

2.2.1. Educational technology courses

One primary way that teacher educators can help PTs develop their TPACK is through focused work in an educational technology course. In fact, majority of teacher preparation programs accredited by the National Council of Accreditation for Teacher Education (NCATE) require at least one educational technology course (Kleiner, Thomas, Lewis, Greene, Institute of Education Sciences (U.S.), & National Center for Education Statistics, 2007). A number of researchers have explored the efficacy of different approaches to TPACK development in the educational technology course. One strategy to determine growth in TPACK over time is to employ assessments before and after exposure to a treatment. Koh, Chai, and Tsai (2010) administered an adaptation of the Survey of Preservice Teachers' Knowledge of Teaching and Technology (Schmidt et al., 2009) to PTs, who enrolled in Postgraduate Diploma in Education program, at the beginning and conclusion of a three-credit educational technology course. Koh et al. (2010) conclude that participants (n = 365) made significant gains in CK, PK, TK, and most substantially in TPACK with moderately large effect sizes. In analyzing interactions between the domains, the findings suggest that PK had the largest impact on TPACK.

Hu and Fyfe (2010) conducted a similar study using a modified version of Schmidt et al.'s (2009) instrument in an educational technology course with PTs enrolled in a postgraduate entry teacher preparation program. The course included a series of problem-centered design tasks based on TPACK

principles. Post-course survey results indicate that the teachers' confidence in their ability to connect their use of technology with content and pedagogy increased significantly.

Moreover, Koh and Divaharan (2011) explored the efficacy of a new instructional model in an educational technology course designed to help students develop their TPACK through series of three phases: fostering acceptance of a new ICT tool through faculty modeling, building technical proficiency, and developing technology integration experience through design projects. This study focused on 74 PTs' TPACK development in their design project that involved using interactive white boards (IWBs) to support classroom instruction. Data for the study consisted of short, structured student reflections at the end of each of the three phases of the instructional model as well as pre/post surveys focused on participants, confidence and attitudes toward the use of the IWB. The reflections were coded according to the different domains of the TPACK construct. The researchers suggest that the model helped students build their confidence in integrating whiteboard technology into their teaching. Their positive attitude toward IWBs was high at the beginning of the study and remained high throughout. Initially, participants' reflections focused on developing technical competency, or TK (58%), slightly less so with TPK (33%), and only minimally on TCK (7%) or TPACK (2%). In Phase 2, students emphasized TPK-related reflections (52%) and de-emphasized focus on TK (35%). Comments related to TCK and TPACK remained limited (5 and 3%, respectively). These percentages held true at the end of the third phase, with a slight growth in TPK (55%) and a decrease in TCK (5%).

2.2.2. Content-specific and teaching methods course experiences

Increasingly, researchers have been exploring development of TPACK in the context of content-specific teaching methods and field experience courses. For example, Koçoğlu (2009) conducted a qualitative study on 27 preservice EFL teachers at the Department of Foreign Language Education, which offered a four-year undergraduate program in Turkey. The purpose of the study was to explore how preservice EFL teachers developed the knowledge and skills in integrating technology into L2 teaching through a semester-long Computer-Assisted Language-Learning (CALL) course. The findings revealed that the course was confirmed as being helpful in developing PTs' TPACK and supporting them in practicing their TPACK.

Similarly, Kurt, Akyel, Koçoğlu, and Mishra (2014) examined the TPACK development of Turkish preservice EFL teachers as they engaged in an explicit TPACK development program based on Learning Technology by Design approach (Mishra & Koehler, 2006). The findings of their study revealed that after a 12-week treatment there was a statistically significant increase in TK, TCK, TPK, and TPACK scores of participants without prior training on technology integration into L2 teaching. Another significant finding of their study was that the TPACK development program helped preservice EFL teachers to gain high confidence in choosing technologies that enhance the teaching approaches and students' learning in a lesson.

In an ELT Methodology Course, Ersanli (2016) explored the effectiveness of a five-week workshop and training sessions on TPACK to Junior 59 preservice English language teachers enrolled at a state university in Turkey. The study employed a mixed-method design Data were gathered through TPACK Scale developed and validated by Solak and Cakir (2014). Also, participants kept journals prior to and after the training and workshops. The results indicate a statistically significant improvement in TPACK scores of both male and female participants. The journal entries clearly indicate an increase in several possible applications or websites that can be used in the classroom with more effective and to the point objectives. Participants have also displayed better performance in manufacturing and tailoring language learning/teaching materials with specific goals.

2.2.3. Longitudinal and integrated coursework studies

Studies reviewed here explored TPACK development either throughout or at the end of teacher preparation programs. For instance, one of the studies investigating changes in TPACK during integrated coursework was conducted by Sahin, Akturk, and Schmidt (2009). They used the Survey of Preservice Teachers' Knowledge of Teaching and Technology in a one-group, pretest–posttest design with

participants from a graduate teacher preparation course. With 17 participants, this study also reveals that TPACK positively affected PTs' vocational self-efficacy. However, significant differences were found only in the TK, CK-L, PCK, TCK, TPK, and TPACK domains. The authors further explain the findings by stating, "except for PCK, there was no change on those topics that the course did not address" (p. 4156). The results from the study suggest that changes in TPACK knowledge can be influenced separately from each other and that courses focusing specifically on technology may expect changes focused more distinctly in the domains that intersect with technology knowledge (TK).

As a technology integration mini grant program, Terpstra (2009)'s study included seven PTs, two secondary and five elementary. The participants' technology implementations and their perspectives on how they learned to teach with technology were analyzed for evidence of TPACK and its components. Using activity theory, the PTs' perspectives on learning to teach with technology were examined for settings and mediating tools that enabled the interns to learn to teach with technology. Terpstra reported that the PTs demonstrated more TK than TPK and TPACK. Interestingly, Terpstra (2009) found that, while the PTs used digital technologies in their daily lives, they did not connect this TK with their own teaching.

Hofer and Grandgenett (2012) examined how PTs' TPACK develops throughout a typical three-semester teacher education program in terms of TCK, TPK, and TPACK; and how TPACK development is reflected in PTs' lesson/unit planning materials and reflections upon planning. Data collected through participants' self report surveys, structured reflections and lesson plans. The results show that PTs' PCK, TCK, TPK, and TPACK develop throughout the program and different domains show different development patterns.

Solak and Cakir (2014) examined preservice EFL teachers' TPACK competencies at the end of four-year teacher education program in Turkey in terms of gender and academic achievement. Participants were 137 senior preservice English teachers who were attending at an English Language Teaching Department of a state university in Turkey. TPACK Competency Survey (Archambault & Crippen, 2009) was used in this study. The results of the research suggest that males' technological knowledge was higher than females; however, females were better than males in pedagogical knowledge. Moreover, no significant difference was found between TPACK mean and academic achievement.

Lastly, Oz (2015) assessed 76 preservice English as a foreign language teachers' technological pedagogical content knowledge at the end of four-year teacher education program in Turkey. Based on the adapted version of Technological Pedagogical Content Knowledge Scale with some open-ended questions, the findings revealed a highly developed knowledge of TPACK (Mean > 3.5; 81%). The findings of qualitative data analysis revealed that compared with cooperating teachers, faculty members in the department used more TPACK in a classroom lesson. Thus, these findings contribute to understanding the nature and development of TPACK-based instruction among preservice English teachers, suggesting that the integration of content, pedagogy and technological knowledge into the existing teacher education paradigm and fostering technologically rich environment for language learners will contribute to quality learning and teaching.

To sum up, the studies reviewed here investigate the effectiveness of different course structures with an emphasis on PTs' approaches and abilities to integrate technology into their teaching. PTs begin to develop their TPACK in both single courses and through more integrated approaches of infusing technology in teacher preparation programs. What is unclear in research so far is how knowledge develops in different domains (i.e. TCK, TPK) and how this knowledge develops over time throughout an entire teacher preparation program. There are studies examining TPACK development of PTs in long terms, such as by Hofer and Grandgenett (2012) for 11 months, by Niess (2005) for one-year, by Keeler (2008) for two years, and by Yan (2010) for four semesters. Besides, through a four-year teacher education programs, ELT PTs' development of TPACK was examined only at a specific point of time: at junior level (Solak & Cakir, 2014), and at senior level (Kurt et al., 2014; Oz, 2015).

However, there are very limited studies, if any, investigating TPACK development of PTs in a four-year teacher education program, specifically English Language Teaching program. In this present mixed-methods study, I sought to trace the development of preservice ELT teachers' TPACK over time. The focus was on how PTs' knowledge for technology integration develops during four-year teacher preparation program and which areas of their knowledge develop most naturally, and which areas require more scaffolding.

3. Methodology

3.1. Theoretical background

In this present study, the TPACK framework was used as a theoretical background because it has already been embraced as theoretical basis for structuring ICT curriculum in teacher education programs (Angeli & Valanides, 2009; Chai, Ling Koh, Tsai, & Lee Wee Tan, 2011; Mishra & Koehler, 2006).

3.2. Context of the study and participants

Through a cross-sectional design (Creasey, 2006; Miller, 2007) a total of 174 PTs- sophomore (n = 66), junior (n = 55) and senior (n = 53)- enrolled in a four-year English Language Teacher Education program at a state university located at the southern part of Turkey participated in the study. In the program the courses and in which order they will be offered is decided by Higher Education Council. In that, there is standardization among the programs around the country; however, to what extend the technology will be integrated into content courses might vary among universities. In the program there are three ICT courses: Computer I and II, and Computer-Assisted Language-Teaching. The first two courses are offered at freshman year to provide knowledge and experience on basic uses of computers, whereas Computer-Assisted Language-Teaching provides technology integration into ELT. In addition to these three ICT courses, through other content courses and subject-specific methods courses PTs are provided an opportunity to gain TPACK skills. The same instructors taught the courses offered in the ELT program.

3.3. Data collection methods

In this mix-method study, data were collected through TPACK survey (Schmidt et al., 2009). The survey included multiple items related to each of the seven types of knowledge represented in the TPACK construct: technological (TK), pedagogical (PK), content (CK), technological pedagogical (TPK), technological content (TCK), pedagogical content (PCK), and technological pedagogical content knowledge (TPACK). Within the survey categories, a five-point likert confidence scale with a score of 1 representing low confidence and five representing high confidence was used (Table 1). As a measure of internal consistency, an alpha reliability coefficient was calculated for each subscale and ranged from 0.75–0.92. The survey also included open-ended items that focused on the respondents' perceptions of how TPACK was modeled by faculty, practicum teachers and participants'

Table 1. Number of items and possible scores for each domain of the TPACK scale

Subscale	Number of items	Possible minimum-maximum scores
TK	7	7–35
CK-literacy	3	3–15
PK	7	7–35
PCK	4	4–20
TCK	4	4–20
TPK	5	5–25
TPACK	8	8–40
Model of faculty	8	8–40
Model of TPACK	3	3–12

Table 2. Comparison of the participants based on TPACK self-report scores

	Group	*N*	Mean rank	Sum of ranks	*U*	*Z*	*p*	*r*	Median
TK	Junior	55	43.34	2,383.50	843.500	−3.782	**0.000***	0.363	*Sop* = 26
	Senior	53	66.08	3,502.50					
	Total	108							
	Sophomore	65	68.98	4,483.50	1,236.500	−2.910	**0.004***	0.265	*J* = 24
	Junior	55	50.48	2,776.50					
	Total	120							
	Sophomore	65	56.92	3,700.00	1,555.000	−0.910	0.363	0.083	*S* = 27
	Senior	53	62.66	3,321.00					
	Total	118							
CK Literacy	Junior	55	46.80	2,574.00	1,034.000	−2.658	**0.008***	0.255	*Sop* = 12
	Senior	53	62.49	3,312.00					
	Total	108							
	Sophomore	65	61.11	3,972.00	1,748.000	−0.215	0.830	0.019	*J* = 11
	Junior	55	59.78	3,288.00					
	Total	120							
	Sophomore	65	51.62	3,355.00	1,210.000	−2.868	**0.004***	0.264	*S* = 12
	Senior	53	69.17	3,666.00					
	Total	118							
PK	Junior	55	40.75	2,241.50	701.500	−4.693	**0.000***	0.451	*Sop* = 28
	Senior	53	68.76	3,644.50					
	Total	108							
	Sophomore	65	66.38	4,314.50	1,405.500	−2.032	**0.042***	0.185	*J* = 27
	Junior	55	53.55	2,945.50					
	Total	120							
	Sophomore	65	52.62	3,420.50	1,275.500	−2.440	**0.015***	0.224	*S* = 29
	Senior	53	67.93	3,600.50					
	Total	118							
PCK	Junior	55	45.58	2,507.00	967.000	−3.031	**0.002***	0.291	*Sop* = 13
	Senior	53	63.75	3,379.00					
	Total	108							
	Sophomore	65	66.10	4,296.50	1,423.500	−1.932	0.053	0.176	*J* = 12
	Junior	55	53.88	2,963.50					
	Total	120							
	Sophomore	65	54.66	3,553.00	1,408.000	−1.715	0.086	0.157	*S* = 14
	Senior	53	65.43	3,468.00					
	Total	118							
TCK	Junior	55	45.78	2,518.00	978.000	−2.964	**0.003***	0.285	*Sop* = 14
	Senior	53	63.55	3,368.00					
	Total	108							
	Sophomore	65	68.43	4,448.00	1,272.000	−2.737	**0.006***	0.249	*J* = 12
	Junior	55	51.13	2,812.00					
	Total	120							

(*Continued*)

Table 2. (*Continued*)

	Group	*N*	Mean rank	Sum of ranks	*U*	*Z*	*p*	*r*	Median
	Sophomore	65	57.31	3,725.00	1,580.000	−.778	0.436	0.071	*S* = 14
	Senior	53	62.19	3,296.00					
	Total	118							
TPK	Junior	55	46.40	2,552.00	1,012.000	−2.798	**0.005***	0.269	*Sop* = 21
	Senior	53	62.91	3,334.00					
	Total	108							
	Sophomore	65	67.87	4,411.50	1,308.500	−2.577	**0.010***	0.235	*J* = 20
	Junior	55	51.79	2,848.50					
	Total	120							
	Sophomore	65	58.54	3,805.00	1,660.000	−.345	0.730	0.031	*S* = 21
	Senior	53	60.68	3,216.00					
	Total	118							
TPACK	Junior	55	41.09	2,260.00	720.000	−4.547	**0.000***	0.437	*Sop* = 29
	Senior	53	68.42	3,626.00					
	Total	108							
	Sophomore	65	69.44	4,513.50	1,206.500	−3.071	**0.002***	0.280	*J* = 27
	Junior	55	49.94	2,746.50					
	Total	120							
	Sophomore	65	53.85	3,500.50	1,355.500	−1.993	0.046	0.183	*S* = 30
	Senior	53	66.42	3,520.50					
	Total	118							
Model faculty	Junior	55	48.03	2,641.50	1,101.500	−2.192	**0.028***	0.210	*Sop* = 27
	Senior	53	61.22	3,244.50					
	Total	108							
	Sophomore	65	69.87	4,541.50	1,178.500	−3.217	**0.001***	0.293	*J* = 25
	Junior	55	49.43	2,718.50					
	Total	120							
	Sophomore	65	61.38	3,989.50	1,600.500	−.662	0.508	0.060	*S* = 28
	Senior	53	57.20	3,031.50					
	Total	118							
Model TPACK	Junior	55	47.23	2,597.50	1,057.500	−2.479	**0.013***	0.238	*Sop* = 8
	Senior	53	62.05	3,288.50					
	Total	108							
	Sophomore	65	71.42	4,642.00	1,078.000	−3.758	**0.000***	0.343	*J* = 6
	Junior	55	47.60	2,618.00					
	Total	120							
	Sophomore	65	64.85	4,215.00	1,375.000	−1.894	0.058	0.174	*S* = 8
	Senior	53	52.94	2,806.00					
	Total	118							

*$p < 0.01$.

themselves in the program. The TPACK survey was administered to sophomore, junior and senior level preservice ELT teachers at the end of the spring semester of 2014.

3.4. Data analysis method

The results of Shapiro-Wilk test showed that the data did not have normal distribution. Therefore, for comparisons of three groups Kruskall–Wallis H test was employed. When significant differences were found among the groups, for two-group comparisons Mann–Whitney U test was conducted. As the participants were ELT PTs, only Literacy subcategory of Content Knowledge (CK) domain in the survey was included into the analysis.

The qualitative data, the open-ended question part of the survey, was analysed through Phenomenological Data Analysis (Moustakas, 1994). The first step in the analysis is the process of horizonalization, in which specific statements are identified in the open-ended questions parts that provide information about the experiences of the participants. These significant statements are simply gleaned from the parts listed so that a researcher can identify the range of perspectives about the phenomenon. Then, those statements irrelevant to the topic and others that are repeated or overlapping were deleted. The remaining statements are the horizons or textural meanings. The researcher examined the identified significant statements and then clustered the statements into themes or meaning units (Table 2). From the thematic analysis, the researcher provided a description of "what" was experienced in textural descriptions, and "how" it was experienced in structural descriptions. The textual and structural descriptions of the experiences were then synthesized into a composite description of the phenomenon through the research process referred to by Moustakas (1994, p. 100) as "intuitive integration." This description becomes the essential, invariant structure of ultimate "essence" which captures the meaning ascribed to the experience, which were reported in Findings. Regarding to the researcher's role Punch (1998) states that it can be emic- an insider, who is a full participant in activity, program, or phenomenon, or the role is more etic- from an outside view, more of an objective viewer. There could be a great deal of variations in between- sometimes a researcher starts as an outsider and then becomes a member of the group. Or the reverse can occur- the researcher starts as a member of a group then becomes a more objective observant (Punch, 1998). At the beginning of this study the researcher's role was emic- an insider, who was a full participant in activity, program, or phenomenon because the researcher was an instructor at the department. Then, starting from the data collection and forward the researcher's role became an outsider, more of an objective viewer to reflect only the participants' perspectives on the phenomenon through phenomenological analysis. To increase credibility, codes and themes emerged from the data were checked by a colleague. Inter-rater reliability was assessed using Miles and Huberman's (1994) formula and found to be 0.93. Moreover, the data were triangulated by applying different collection methods: The results collected through an open-ended question and the TPACK self-confidence scale were compared and validated.

Regarding the TPACK Survey, two limitations were reported in related literature. The first one was that this instrument was context-dependent as it was specifically designed for PTs majoring in elementary or early childhood education with a focus on four content areas of social studies, mathematics, science, and literacy. However, in this present study this context limitation doesn't apply because in a four-year ELT program a standard curriculum is administered, which doesn't allow any specialization to teach at different levels. In other words, after graduation, preservice English language teachers can teach English at all levels. The other limitation reported was that it was designed as a self-assessment tool; therefore, it may be prone to student under- or over-reporting (Hofer & Grandgenett, 2012). As with any self-reporting measure, the ability of the instrument to accurately represent knowledge in the TPACK domains is limited by the ability of the respondents to assess their knowledge and respond appropriately to the survey items. However, when it is used as a longitudinal measure to reveal the changes in TPACK throughout a program and when it is used along with additional data, the survey has been demonstrated to be valid and reliable and provides an efficient tool for research and evaluation relating to TPACK (Abbitt, 2011). This limitation also doesn't apply in this present study as the survey scale was used as a longitudinal measure to track the changes in

TPACK throughout a four-year PT preparation program. Furthermore, open-ended question part of the survey was utilized to collect additional data for triangulation purposes.

3.5. Ethical issues

It was taken great care to obtain all data in this article in accordance with guidelines of ethical conduct. Since the researcher was also the lecturer of the course, participants used pseudonyms while filling the instruments to maintain confidentiality and the data were analysed after the participants graduated from the program. Moreover, all PTs participated in the study voluntarily.

4. Findings

4.1. Does the self-perceived development of PTs' TPACK skills follow an increasing linear pattern through sophomore, junior, and senior years as planned in ELT curriculum?

A Kruskal-Wallis H test showed that there was a statistically significant difference in all TPACK subdomains among sophomore, junior, and senior PTs, (with $p < 0.05$) for TK $\chi^2(2) = 15.41$, $p = 0.0001$, with a mean rank TK score of 101.75 for Senior, 92.90 for Sophomore and 65.82 for Junior. CK Literacy $\chi^2(2) = 10.08$, $p = 0.006$, with a mean rank CK- Literacy score of 104.66 for Senior, 79.72 for Sophomore and 78.72 for Junior. PK $\chi^2(2) = 20.67$, $p = 0.0001$, with a mean rank PK score of 100.70 for Senior, 86.00 for Sophomore and 66.31 for Junior. PCK $\chi^2(2) = 10.31$, $p = 0.006$, with a mean rank PCK score of 102.19 for Senior, 87.66 for Sophomore and 71.46 for Junior. TCK $\chi^2(2) = 11.101$, $p = 0.004$, with a mean rank TCK score of 98.74 for Senior, 92.74 for Sophomore and 68.91 for Junior. TPK $\chi^2(2) = 9.58$, $p = 0.008$, with a mean rank TPK score of 96.58 for Senior, 93.41 for Sophomore and 70.19 for Junior. TPACK $\chi^2(2) = 22.194$, $p = 0.0001$, with a mean rank TPACK score of 107.84 for Senior, 90.29 for Sophomore and 63.03 for Junior. Model Faculty $\chi^2(2) = 10.48$, $p = 0.005$, with a mean rank Model Faculty score of 98.25 for Sophomore, 91.42 for Senior and 69.45 for Junior. Model TPACK $\chi^2(2) = 20.67$, $p = 0.0001$, with a mean rank Model TPACK score of 103.26 for Sophomore, 87.99 for Senior and 66.83 for Junior. In TPACK subdomains the mean rank follow the Senior > Sophomore > Junior sequence whereas in Model Faculty and Model TPACK the mean rank sequence is Sophomore > Senior > Junior.

As a follow-up tests, Mann–Whitney *U*-tests, were conducted (Table 3) to evaluate pairwise differences among the three groups, comparing self-rated TPACK scores of Sophomore vs. Junior, Sophomore vs. Senior, and Junior vs. Senior, controlling for Type I error across tests using the Bonferroni approach, $\alpha = 0.01$.

With regard to TK, TCK, TPK, and TPACK, the results (Table 3) indicated a significant difference between Senior–Junior and Sophomore–Junior. Further, Cohen's effect size values suggested small to medium significance (Cohen, 1988). However, there isn't any statistical difference between Senior and Sophomore. In these TPACK domains the mean ranks follow as Senior ≥ Sophomore > Junior (Figure 2).

Related to CK and PK there is a significant difference between Senior–Sophomore and Senior–Junior but there is no significant difference between Sophomore and Junior. In CK and PK the mean ranks follow as Senior > Sophomore ≥ Junior.

In PCK there is a significant difference only between Senior and Junior. The mean ranks of Senior and Junior were 14 and 12, respectively; $U = 967$, $p = 0.002$, $r = 0.291$. The sequence of mean ranks is Senior ≥ Sophomore ≥ Junior.

In Model Faculty there is only a significant difference between Sophomore (Mdn = 27) and Junior (Mdn = 25), $U = 1178.5$, $p = 0.001$, $r = 0.293$. The mean ranks follow as Sophomore ≥ Senior ≥ Junior. Also, in Model TPACK there is a significant difference between Junior–Senior and Sophomore–Junior with small to medium effect size, but there is no significant difference between Sophomore and Senior. The sequence of mean ranks is Sophomore ≥ Senior > Junior.

Table 3. Themes based on open-ended questions of the survey

Theme levels	Practicum school	Faculty modeling	Own experience
	Receiving inefficient modeling	Taking steps to understand faculty's technology use	Progressing from TK to TPACK
Sophomore	• no use ◦ Lack of knowledge of technology (*n* = 68) ◦ Course book dependency (*n* = 18) ◦ Crowded classrooms (*n* = 12) ◦ Malfunctioning devices (*n* = 9)	• Listing technological hardware and some software they have learned without any connection to teaching/learning context ◦ Hardware (*n* = 58) ◦ Software (*n* = 8)	• TK ◦ Listing technological hardware and some software ▪ PowerPoint, videos, MS Word, handouts (*n* = 66)
Junior	• use as a efficiency aid ◦ PowerPoint to teach grammar (*n* = 60) ◦ Laptop for listening activities (*n* = 10) ◦ Projector for movies, fill-in-the-blanks (*n* = 33)	• Made us aware (*n* = 7) • Learning how to ◦ create educational website (*n* = 5) ◦ video recording (*n* = 17) ◦ use Internet usage in ELT (*n* = 12) • using PowerPoint, videos to present content (*n* = 28)	• TK, CK, PK ◦ Computer, PowerPoint, word to teach grammar (*n* = 37) ◦ Using audio and picture (*n* = 10) ◦ Enjoyable for ss (*n* = 6) ◦ Motivating online ELT games for ss (*n* = 2)
Senior	• DynEd ◦ Mandatory (*n* = 5) ◦ For playing (*n* = 2)	• Making connection btw aim and technology use ◦ PowerPoint to present theoretical knowledge (*n* = 38) ◦ Internet for showing (*n* = 3) • Provided us many kind of technology and theoretical knowledge and practice examples ◦ Taught me how to integrate (*n* = 7) ◦ Guided me for technology integration for specific contexts (*n* = 5)	• TPACK ◦ Make lesson effective ▪ Presentations, videos (*n* = 34) ▪ Meaningful, real-life input (*n* = 4) ▪ Attract ss' attention (*n* = 4) ▪ Easy (*n* = 6) ◦ Awareness of ss' backgrounds ▪ Songs and cartoons for lower grades (*n* = 5)

4.2. From PTs' perspective, how does the TEI curriculum prepare PTs for the integration of ICT?

There were three open-ended questions at the end of the survey (Schmidt et al., 2009). These questions asked participants to describe a specific episode, where their professors at their department, practicum teachers, and the participants themselves effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson. For these questions, the participants were asked to describe what content was being taught, what technology was used, and what teaching approach(es) was implemented. Through Phenomenological data analysis (Moustakas, 1994), reflecting essences of the experience from participants' perspective, three themes emerged (Table 2), which are explained below under the subheadings of Receiving

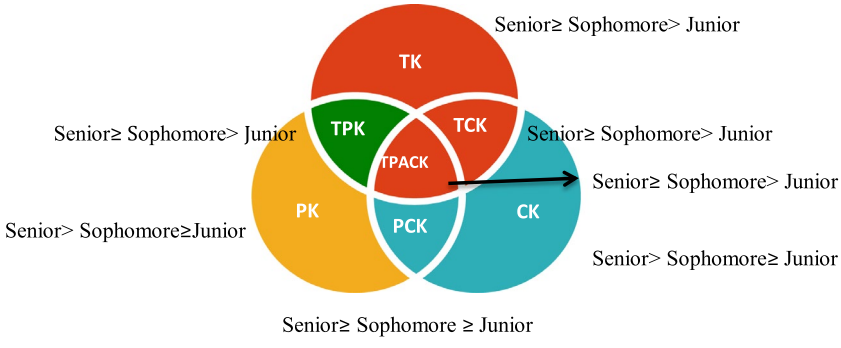

Figure 2. The pattern showing TPACK development overtime.

inefficient modeling, Taking steps to understand Faculty's technology use and Progressing from TK to TPACK.

4.2.1. Receiving inefficient modeling

In all levels, several participants stated that during their practicum and school visits, practicum teachers rarely use technology in their lessons. Besides reporting that, some participants explained the reasons for it as "Although it is necessary to use technology in public schools, many teachers lack of knowledge about how to use it. They generally think that crowded classes hinder using technology in class" (Senior participant 5), and "In schools there are just some technological equipment such as computer and projector. However, as they're not working we can't use them" (Junior participant 12). On the other hand, in some cases even though the technological equipment was ready, it wasn't used during the class. One sophomore level participants shared "There are computers, projectors and smart boards but I have never observed such a course using those technologies." Similar point was shared by a Sophomore participant: "Also, they don't have a tendency to use technology. They don't want to use technologies. They only use course books. Course books are very important. They study on these books but the other activities aren't studied."

Regarding technology integration modeling in practicum schools, few participants mentioned DynED, an English learning program that Ministry of Education mandate all schools to practice English for at least two-hours per week in labs. About this practice, a participant noted "My teacher in the practicum school doesn't use any kind of instructional technology. They only let the students play, not use, with DynEd for an hour. It is not useful!" (Senior participant 19). This quotation indicates that even the mandatory use of technology in ELT classes might not be effective.

At schools technology is often used to assist school-teachers to do their job easier rather than to transform learning and teaching practice. At all levels some participants reported that practicum teachers use PowerPoint to teach grammar points and do exercises, a laptop to do listening and fill-in the blanks activity, and a projector to watch a movie. One of the participants explained, "the teacher used laptop projector and audio speakers in order to show some animals' pictures and let students hear their sounds. In this way he could teach their names to the students easily (Senior participant 45)."

In summary, regardless of their level, all participants reported that practicum schools and teachers were limited to provide an example of technology integration in English lessons at schools. Moreover, some teachers used DynEd software as it is mandatory in English lessons at schools and the rest of the teachers use technology as efficiency aids rather than as a way of transforming learning and teaching practice.

4.2.2. Taking steps to understand faculty's technology use

When the sophomore PTs were asked to describe a specific episode where their professors at their department effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson, participants considered technology integration as technological devices rather than transforming teaching and learning. Several Sophomores answered to that question through writing a list of technological devices: Computer, projector, camera, flash memory, TV, Internet, social sites, online services, video, office programs (word, ppt), laptop, voice recorder, DVD players, and CD players. Few of them provided a context:

> Speaking, Oral Skills, Writing, Listening and Pronunciation were some of my lessons involving using technology in English teaching. For example, [in freshmen year] in listening and speaking lesson we took advantage of using camera, PowerPoint and Google Earth etc. We prepared some short movies using video camera. In another activity we prepared slides with a music background. This lesson was very useful for us. We also made up a film using movie-maker. I learned everything about technology in this class. (Sophomore participant 23)

As one can notice, instead of writing technology integration episodes, they wrote names of hardware and applications they were introduced and used. In that, Sophomores consider Faculty's technology use as only TK.

In junior level, participants provided more details about a specific episode of modeling of their professors:

> In freshman year, we have some lessons which content, technology, teaching approaches are combined. For example, we used PBwiki, we upload video and podcast, we used camera, computer, Internet very much. We prepared a lesson video for common pronunciation mistakes in freshmen year. We used camera, computer, movie-maker, uploading file to the Internet. Also, we worked in PBwiki. via Internet we used to publish our writings in a writing class. We shared our writings in this website and edited each other. In PBwiki, the content was academic writing and the approach was cooperative in addition to communicative. Also this year we prepare a lesson for 4th, 5th, 6th 7th 8th class. We use Internet for video, song and other documents. We prepare PowerPoint etc. Also, we have chance to watch our lesson and make self-evaluation. (Junior, 18)

Through these descriptions it is clear that through making connections between TK, CK and PK, Juniors have started to developing awareness of Faculty's use of technology.

Compared to sophomores and juniors, while describing their professors' demonstration, senior participants mentioned technological devices the least and gave specific details about the application of technology in their courses and language skills:

> The technological devices are usually used in the lessons, especially for teaching skills. For listening skills, the videos, songs or e-stories are used. For speaking skills, a film is watched and talked about it. For writing skills, a story is shown on the computer and the students write the end of the story. For reading skills newspapers or stories can be read as online. (Senior, 35)

Seniors' statements of PTs highlight the shift from TK-based technology integration to a more balanced TPACK in Faculty members' integration of technology into the courses offered at the four-year ELT program.

4.2.3. Progressing from TK to TPACK

The last question asked participants to describe a specific episode where they effectively demonstrated or modeled combining content, technologies and teaching approaches in a classroom lesson themselves. Participants' statements indicate that they depend on TK more in sophomore level than junior and senior levels.

In sophomore year, the limitation of technology integration might be shown through the following quote: "We use projector, laptop for our PowerPoint presentations and we used CD player or TV for our listening lessons" (27). This quotation indicates that Sophomores consider technology integration as TK rather than TPACK.

In junior year, participants gave similar examples of technology modeling. For instance, one of the participants reported: "I taught country names to the students of fourth and fifth grade. While teaching, I used projector, computer, speakers, worksheets, and board. I tried to implement CLT in my teaching" (13). Another said, "I made a micro-teaching presentation about shopping dialogs to elementary students integrating listening and speaking. I used a projector, PowerPoint and video. I used communicative language teaching approach" (44). These quotations show that the participants have started to combine CK, PK, and TK.

In senior year, data analysis shows that participants used more integrated approach of TPACK domains. For instance, one of the participants explained the use of technology in his/her teaching practice as

> Teaching the topic "Global Warming" I used projector in order to show some pictures about it and did some activities. During a course in practicum I used smart-board to do some activities about Simple Present Tense to attract students' attention. (52)

Another one gives this example: "While I was teaching 'body parts,' I used communicative language teaching. I used videos, PowerPoint show and music while teaching the body parts" (38). These quotations show that participants are more enabled to combine CK, PK, and TK in senior level than junior and sophomore levels.

In summary, according to the participants, how they integrate technology differs through the four-year program. While in sophomore level TK was dominant, toward the senior year TPACK became a more dominant factor.

5. Discussion

The quantitative data analysis of the self-report survey showed that at senior level PTs self-rated themselves the highest having the subskills of TPACK. This result is in general agreement with previous research that the TPACK approach helps improve PTs' confidence and skills in productive technology integration over time (Hu & Fyfe, 2010; Kurt et al., 2014). Different from previous studies (Chai et al., 2010, 2011; Hu & Fyfe, 2010), the findings in this present study demonstrated increase in PTs' self-reported ratings not only in TK, PK, and CK, but in all seven knowledge domains.

Furthermore, this present study revealed a nonlinear pattern of development of technology domains through years based on the preservice ELT teachers' self-rated scores. The qualitative data reveals an increasing linear pattern of TPACK development from TK to TPACK from Sophomore to Senior. While the domains including technology (TPK, TCK, TK, and TPACK) considered to be developed most in Senior level followed by Sophomore year and the least in Junior level; however, there isn't any significant difference between Seniors and Sophomores (Senior ≥ Sophomore > Junior). The domains without technology (PK, PCK, and CK) considered to be developed most in Senior level followed by Sophomore level and the least in Junior level (Senior > Sophomore ≥ Junior). Different from technology related domains, there is no significant difference between Sophomores and Juniors. In Modeling of Faculty and Modeling of TPACK Sophomores rated the highest score. Therefore, there isn't an increasing linear pattern of TPACK development in technology related domains.

There might be two reasons for the difference in patterns: TPACK domains develop at different times and ways and participants might over-rate their TPACK skills. The first reason might be that various elements of TPACK (such as TPK and TCK) do not necessarily develop at the same time and in the same way. When Hofer and Grandgenett (2012) examined TPACK development through an 11-month-length study, they found that some elements of TPACK (such as TPK and TCK) didn't necessarily develop at the same time and in the same way. It might be due to the fact that changes in TPACK knowledge can be influenced separately from each other and courses focusing specifically on technology may expect changes focused more distinctly in the domains that intersect with technology knowledge (TK) (Abbitt, 2011; Sahin et al., 2009). As a further research they suggested further scaling this approach across more students and a program of longer duration, such as a four-year licensure design. By examining a four-year ELT PT education program, this present study highlighted that in longer duration programs TPACK domains develop at different times and in different ways, similar to Hofer and Grandgenett's (2012) study. In this present study, the internalization of the TPACK integration into practice took time for the participants, which was reflected in participants' answers to the open-ended questions of the survey. The descriptions of specific episodes of TPACK modeling both by their professors at their department and by the participants themselves showed

that the participants in sophomore year tended to depend more on TK, rather than TPACK. However, the shift from TK to TPACK was observed throughout the four-year program. Firstly, the descriptions of specific episodes of TPACK modeling by faculty members indicated that participants experienced a shift from TK-based technology integration toward more balanced TPACK in the program. While at the beginning of the program they considered the courses as only technology courses, overtime they started to see TPACK dynamics in the courses. That is, in sophomore year participants encountered with Google Earth and PbWiki activities which required participants to record a sound file introducing a historical site and to embed it to the Google Earth and writing essays and editing their peers' work online though PbWiki. Despite being exposed to transformative use of technology both in freshmen and sophomore years, participants reported only hardware and software as well as the easiness of technology use both their faculty members' and their own technology use episodes in sophomore year. Toward the senior year the episodes included more TPACK integrated descriptions. Secondly, similar shift was also observed in the participants' descriptions of their modeling of TPACK in micro-teaching and practicum lessons. In general, descriptions of technology uses early in the sophomore year focused more on the separate constructs, whereas descriptions of technology uses that integrated the content, pedagogy, and technology together were more evident later, in junior more specifically in senior levels. These results are in general agreement with previous research that the changes in thinking about TPACK occur over time as students are engaged in design-based activities (Ersanli, 2016; Koçoğlu, 2009; Koehler, Mishra, & Yahya, 2007; Kurt et al., 2014). Data analysis showed that participants' thoughts about using technology tools have shifted to more conceptual level while modeling TPACK themselves, indicating a growth in their TPACK similar to Cavin's study (2008).

The other reason for the pattern difference between technology related domains (TPK, TCK, TK, and TPACK) and other domains (PK, PCK, and CK) might be related to what teachers think they know, or what they can do, may not be consistent with their real practice or knowledge level (Lawless & Pellegrino, 2007; Tseng, 2014). From the qualitative data it can be inferred that the participants in this present study had none or very limited knowledge about technology at the beginning of the freshmen year. They started to gain more knowledge on TK during the freshman year through the ICT courses, Computer I and II. Also, through both freshmen and sophomore years, content courses such as Listening and Pronunciation I–II and Oral Expressions and Public Speaking provided technology integration samples. In these courses, the participants have learned to use technological tools such as camera, movie-maker, blogs, wikis, Google Earth, and office programs. At Junior and Senior levels the subject specific method courses, micro-teaching practices, and practicum were offered. At junior level, the participants might not have had enough time to internalize use of technology into their teaching practice. Hence, what participants thought they knew, or what they could do might not have been consistent with their real practice or knowledge level. Therefore, the sophomores might have overrated items in the scale compared to the juniors.

Furthermore, when the participants' descriptions about the use of technology at practicum schools were examined, it was clear that practicum teachers' TPACK modeling was very limited. Therefore, unfortunately practicum school experiences might not have provided enough modeling for TPACK integration into ELT for the participants similar to Oz's (2015) study. These results are in general agreement with previous research that technology is often used for information transmission rather than facilitating and transform learning and teaching practice (Gao et al., 2009; Harris et al., 2009; Ottenbreit-Leftwich et al., 2010; Sang et al., 2010; Tondeur et al., 2013).

6. Implications and future research

While several studies reviewed in the literature review part have inconclusive results on the development of TPACK domains, this present study provided a pattern of the development of seven domains of TPACK within the longest duration- a four-year ELT teaching program. The first one is that senior level was the highest self-rated in all seven domains. While in technology related domains (TK, TCK, TPK, and TPACK) there isn't any significant difference between Seniors and Sophomores, in CK, PK, and PCK domains there is no significant difference between Sophomores and Juniors. The other pattern emerged through qualitative data analysis is a shift from TK to TPACK. That is, in sophomore

level participants approach the components of technology, pedagogy, and content as separate concepts, but over time the trend become toward more integrated approach. Being aware of these patterns, instructors at universities, practicum teachers, PTs and researchers might adjust their teaching and learning processes.

Moreover, this study might also set a sample for the field in terms of its design. Previous studies in the field tended to examine TPACK development through either qualitative or quantitative studies. There were few studies based on mix-method design. That provided data triangulation as well as in-depth knowledge on the research questions. Hence, within the context of this study, it appeared that the methodology was useful for examining TPACK development in a four-year ELT teaching program through cross-sectional design. There is potential to further scale across more students and for a longer period of time including participants' in-service teaching after they graduate from the program. Additionally, there may well be an opportunity to expand data collection sources to include additional assessments, such as teacher observations, content tests, curriculum products, and perhaps even case studies of individual students. As Hofer and Grandgenett (2012) suggest, with the rapidly changing context of technology today, some of these assessments may even be able to be automated or embedded within a teacher preparation program to provide a more rapid and periodic glimpse of TPACK development that is aligned with its courses and experiences.

This present study also highlighted that more collaboration should be established among practicum teachers, faculty members and PTs. In this study, practicum teachers provided insufficient modeling of technology integration for the participants. Between 2010 and 2015 the Turkish Government has invested on Movement of Enhancing Opportunities and Improving Technology (FATIH) Project. About 18 million tablets and 620,000 LCD Interactive Boards were provided to schools for efficient usage of ICT tools in the learning–teaching processes by appealing to more sensory organs in all 42.000 schools and 570.000 classes (State Planning Organization, 2010–2015). Also, Ministry of National Education has organized several in-service training for teachers in the preschool, the primary and the secondary education for the project (State Planning Organization, 2010–2015). Despite these efforts, technology integration in schools wasn't at expected level as participants reported. There might be several reasons for this result, which is beyond the scope of this study. However, what emerged from the data were that in-service teachers' perception of technology should be changed from using ICT as a facilitating tool to using them to transform teaching and learning process. This change might be achieved through collaboration among practicum teachers, faculty members and PTs. Similar projects have been conducted in Australia 'Teaching Teachers for the Future' (TTF) (see Parr, Bellis, & Bulfin, 2013) and Preparing Tomorrow's Teachers for Technology (PT3) project in the US (see Polly et al., 2010). Also, studies (e.g. Margerum-Leys & Marx, 2002) investigating the exchange of knowledge of technology between student/ mentor pairs prove that mentor teachers often learned about technology from student teachers, and then the mentor teacher would incorporate this knowledge with pedagogical knowledge to inform classroom practices. One of the limitations of FATIH project is that in-service trainings are conducted often as seminars, short term and off-site, rather than as a continuous process of experiential learning. Instead, continuous in-service training should be designed among faculty members, practicum teachers and PTs. During four-year education program PTs might spend more time at schools with their practicum teachers who might learn about technology from student teachers. Faculty members might also facilitate the TPACK integration process for both the preservice and in-service teachers.

In line with the FATIH project for in-service teachers, there should have been a revision in the PT education programs. The curriculum of teacher education programs haven't been revised since 2007. Even though the curriculum and courses are same in the English Language Teaching programs in Turkey, how and what kind of technology will be integrated into content/method courses depends on the Faculty members. In this present study, technology integration was provided through both ICT courses and content/method courses for the preservice ELT teachers; however, technology integration might not be the same at other universities. Therefore, this revision should be done in no

time so that standardization for technology integration across the country. Due to the possible difference, the survey might be administered to the larger sampling size as a further research.

7. Conclusion

This study involved 176 preservice ELT teachers attending to a four-year teacher education program and their self-assessment of their TPACK knowledge through the TPACK survey. Different from previous research in terms of investigating the TPACK development through a four-year teacher education program, more specifically in ELT program, and including both qualitative and quantitative part of the same TPACK survey, this study provided two patterns of development of seven domains of TPACK. The first pattern is a nonlinear pattern that senior level was the highest self-rated in all seven domains; however, ranking changes depending on the domains. While in technology related domains (TK, TCK, TPK, and TPACK) there isn't any significant difference between Seniors and Sophomores (Senior ≥ Sophomore > Junior), in CK, PK, and PCK domains there is no significant difference between Sophomores and Juniors (Senior > Sophomore ≥ Junior). The second pattern emerged from the qualitative data is that in sophomore level the preservice ELT teachers approached the components of technology, pedagogy, and content as separate concepts, but over time the trend became toward more integrated approach. Furthermore, this study suggests that cooperation among in-service teachers, PTs and faculty members should be improved and the courses in the ELT curriculum at teacher education programs should be revised in terms of technology integration. As well, how in-service teachers' perception of use of technology could be changed from information transmission to facilitating to the transforming of teaching and learning process, where they can use technology in productive and meaningful ways to support student-learning remains as a problem to be investigated in future research.

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