

TPACK-in Practice Model: Effects on EFL Students' Professional Knowledge and Online Teaching Practices

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Abstract. In recent years, student teachers have been influenced by the new educational paradigm and the rapid technological developments. This has been seen especially in technological innovations and digitalization to facilitate learning. However, student teachers need to be digitally competent in using savvy techs to achieve the expected learning goals. Acquiring this essential skill requires teacher education programs, stakeholders, and education boards to provide free practical training, mini-workshops, and courses. This prepares students to face the rapidly-growing digital world and, more importantly to understand the post-pandemic pedagogy. Therefore, this mixed-method study examines the impact of the TPACK-in practice model on EFL student teachers' professional knowledge. Additionally, it explores the impact of professional knowledge on student teachers' experiences in using EdTech tools in online teaching. The learning model was designed to facilitate 48 final-year undergraduate students. It involved conceptual and practical knowledge guidelines in using various learning platforms and tools in virtual lessons. Quantitative and qualitative data were collected from closed-ended statements in the questionnaire, classroom observations, interviews, lesson plan reports, and reflective teaching journals. Overall results showed high student scores in each of seven professional knowledge components, implying a successful course implementation. Furthermore, five participants shared their valuable insights on how they applied technological knowledge theoretically in a real classroom environment. These research findings are useful for future researchers, policy-makers, and teacher educators in designing effective programs that best nurture pre-service English teachers' and instill professional knowledge.

Keywords: TPACK-in practice model, EFL student teachers, professional knowledge, online learning, teaching practices.

1 Introduction

Indonesia education system announced that it would temporarily stop most in-person classes and hold them online during unforeseen pandemic situations. With all education now virtual, e-learning has taken over as students were sent home to reduce physical contact and minimize COVID-19 transmission. Consequently, teachers need to quickly adjust their classroom activities to the current situation. Those who with no experience in synchronous or asynchronous teaching should redesign their lesson plans, assessments, and materials and adapt them to several principles of emergency distance learning modes. First, it provides meaningful learning experiences for students with a transformative and constructive learning model. Second, the assignments should be simplified and varied according to students' interests and conditions. Third, it should support students to learn autonomously, happily, and comfortably in a fully online environment. Fourth, it should facilitate students to become

self-directed and lifelong learners focusing on developing cognitive abilities, global competence, and behavior following the values of Pancasila; independence, critical reasoning, global diversity, mutual cooperation, and creativity. Fifth, it should create positive patterns of good interaction and communication among teachers, students, and parents. In reality, the sudden pedagogy transition poses some challenges, multiple barriers, inequalities, and benefits in the educational sector. These include pedagogical changes, course delivery problems, lack of resources, technology readiness, poor infrastructure, students' personal growth, mental health, social presence, and cybersecurity (Oyedotun, 2020; Wilson et al., 2020). Therefore, providing free practical training and workshops would guide pre-and in-service teachers in facing the new teaching-learning paradigm.

The presence of high-quality apps significantly facilitates online distance learning. It provides many benefits during the COVID-19 pandemic, such as initiating and expanding the interaction between teachers and students beyond classrooms, increasing student learning interest, and helping teachers to produce digital teaching materials (Pebriantika et al., 2021). Various e-Learning portals and digital applications are available for free on the Internet. They have been well developed, tested, and accepted by the wider community, such as discussion platforms, assessment applications, and websites for finding learning resources. For instance, some free applications, such as Quizlet, Flash My Brain, and Brainscape could download or create mobile-based vocabulary flashcards for playing, practicing, and sharing. Furthermore, the Indonesian government facilitates distance learning for students through the Ministry of Education and Culture. As a result, teachers and students can access various applications, websites, and digital learning resources for free on the Internet, such as Rumah Belajar, Quipper, Ruangguru, Mobile education, Kemendikbud Repository, and many others. For example, the features in the Rumah Belajar application provide electronic school books, digital classes, cultural maps, and various learning resources. Additionally, there are learning broadcasts to be enjoyed at certain hours based on the agreement of each region through TVRI, TV Edukasi, and Suara Edukasi AM 1440 kHz. The government also provides a free or cheap quota to access learning media and video conferencing.

Previous ELT studies empirically showed that educational apps could support students' deeper learning, promote understanding, and enhance enjoyment, improve achievement, and help students become digitally literate when integrated meaningfully and appropriately in the classroom (Bunting et al., 2021; Chauhan, 2017; Hung & Young, 2015). Literature documents highlight that professional knowledge is required in an increasingly digitalized society. This is because digital tools cannot be successfully integrated into a teaching-learning process when they are unfit for learning goals and students' current needs. Hew and Brush (2007) stated that "the lack of technology knowledge, technology-supported pedagogical knowledge, and technology-related classroom management knowledge could be barriers to effective teaching-learning" (p. 227). It is also stated in the following quotation "Technology can amplify great teaching, but great technology cannot replace poor teaching" (OECD, 2015, p. 4). Therefore, teachers inevitably need appropriate teaching methods and proper strategies in utilizing technology to accomplish fruitful teaching. More specifically, they must understand digital media, Web 2.0 tools best suited with the areas of pedagogy - "how to teach" and the content - "what to teach." This knowledge is commonly called "Technological Pedagogical Content Knowledge (TPACK)" (Mishra & Koehler, 2006; Koehler & Mishra, 2009), as represented in Figure 1. It is a well-constructed framework of describing specific professional knowledge needed for effective teaching. It contains three bodies of knowledge in detail; technology, pedagogy, and content. The TPACK model is

often used in numerous studies to primarily assess teachers' competencies using digital technology for teaching.

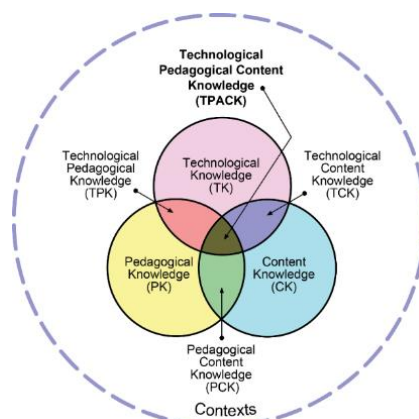


Figure 1. Graphic “representation of the TPACK framework (source: <http://tpack.org/>).
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Therefore, this study uses the TPACK framework to explore the learning model in an initial teacher education program. The initial program provides student teachers with conceptual and practical knowledge as foundations on using, evaluating, and creating digital learning materials and tools for online teaching-learning. This is essential to prepare students to face the rapidly-growing digital world and understanding post-pandemic pedagogy. The specific guiding research questions of the present study are:

- a. How well does the TPACK-in-practice model impact pre-service English teachers' professional knowledge?
- b. What is the impact of professional knowledge on student teachers' experiences in utilizing EdTech tools during online teaching practices?

2 Methodology

In the present study, we used mixed methods approach (Creswell, 2014; Creswell & Clark, 2018; Creswell & Creswell, 2018) to answer the two research as mentioned earlier questions. It was conducted in an educational tech-related course in an English Education study program of a private university in Indonesia. The even semester's elective course has 16 meetings, every Friday 08.30–10.00. The primary learning goal of this course subject is to provide students with theoretical and practical knowledge of the integration of technology in skill-based language teaching practices. Students learn how to implement Web 2.0 tools in their future language classrooms and create interactive digital media for teaching. Materials, instructions, and rubrics are accessed through browsers and Moodle apps, as shown in Figure 2. For the materials, there are six major topics with specific sub-topics and various EdTech tools. The students read the online learning materials independently at their own pace or space before the class started. Moreover, they can decide the learning strategies that best suit their learning goals. The topics include a history of TELL, digital literacy, gamification, collaboration activities, mobile learning, and developing e-learning platforms. The LMS of the present study is well-developed with a mixture of various learning

approaches, such as team/peer learning, project-based learning, independent learning, and collaborative learning.

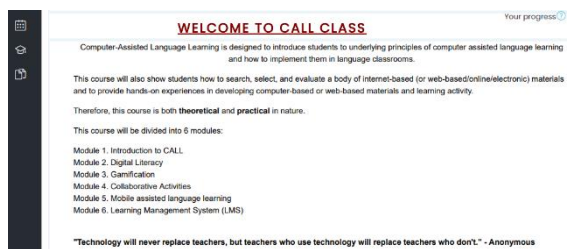


Figure 2. Interface example of the LMS used for the course

In the 12th meeting, the students had a special guest lecturer from a research university in Southampton, United Kingdom, talking about mobile learning. The grading policy uses five essential assessment aspects to obtain good grades, including attendance (5%), online participation (5%), group presentation (15%), six individual and group projects (60%), and final project (15%). The participants who agreed to participate voluntarily were 48 fourth-year undergraduate EFL students. They were 36 female students and 12 male students, mostly aged between 21–25 (93.7%). They were informed to complete an online questionnaire and participate in individual interviews by sending a private message in WhatsApp and Telegram applications. All participants had prior in-service technology courses, such as the Learning Teaching Media course, webinars, workshops. As final-year undergraduate students, they already passed field teaching practices.

This study used closed-ended statements in the questionnaire, classroom observations, interviews, lesson plan reports, and reflective teaching journals as research tools. The questionnaire of professional knowledge was adopted from Al-Abdullatif (2019), Dalal et al. (2018), Archambault and Shelton (2017), Baser et al. (2016), and Tai (2015). Also, some additional statements from the original questionnaire were added. Therefore, the questionnaire in the present study contained eighty closed-ended statements. It consisted of seven main categories, in which each item of the closed-ended questionnaire used a 5-point Likert scale response. The study used the scale of 1 (“SD = Strongly Disagree”) to 5 (“SA = Strongly Agree”). The perceived professional knowledge survey was distributed at the end of the course using an online questionnaire. The results of Cronbach’s alpha values for the seven categories were ranged from $\alpha=.90$ to $\alpha=.92$. Moreover, the interview protocol was designed to hear participants’ voices regarding the implementation of the TPACK-in-practice model and its impact on their teaching practices. The reflective teaching journals were used to understand pre-service English teachers’ lived experiences during teaching practices. The lesson plans scenario was intended to investigate students’ planning capability of integrating educational technologies in the classroom.

The data analysis of this mixed methods research was discussed using quantitative and qualitative approaches. Data from closed-ended statements in the questionnaire were scrutinized quantitatively using SPSS. The data collected from open-ended questions in the questionnaire, interviews, lesson plan reports, and reflective teaching journals were analyzed qualitatively using thematic analysis.

Findings and Discussion

Research question 1: How well does the TPACK-in-practice model impact pre-service English teachers' professional knowledge?

In the present study, participants had the opportunity to enhance their TK about using office programs (e.g., Ms. Word, PPT) and understanding various interactive digital media for educational purposes (e.g., Canva, EdPuzzle, animated video or vlog, Google Form, and Google Classroom). Regarding CK, participants learned the concept of skill-based activities in foreign language learning, such as teaching reading, writing, speaking, and listening. They gained PK about understanding curriculum, making assessments, designing materials, classroom management, choosing appropriate teaching methods, and determining attention-grabbing activities. They had the opportunity to develop TCK in practice about incorporating digital tools effectively to teach English. This included conducting formative or summative quizzes within minutes in a fun and challenging way through free game-based learning platforms, such as Kahoot and Quizziz. Concerning TPK, participants advanced their theoretical and practical understanding of using technology to facilitate student learning. They improved TCK by delivering subject content with a variety of ICT platforms and online tools, such as using Padlet for teaching writing and inviting students to work collaboratively in groups. Participants obtained necessary TPACK about the balanced combination of technology, content, and pedagogy.

The results of professional knowledge in terms of TPACK are displayed in Table 1. The TK showed the highest mean of 4.007, followed by PK with 3.968, TCK with 3.857, PCK with 3.851, CK with 3.826, and TPK with 3.807. The TPACK demonstrated the lowest score of all, with 3.75. Generally, all the components are interpreted as high. This indicated that the student teachers understood how to use digital tools effectively and appropriately for teaching.

Table 1. Descriptive data of pre-service English teachers' professional knowledge survey

Item	N	M	S. D	Credit
Technological knowledge (TK)	48	4.007	0.719	High
Pedagogical knowledge (PK)	48	3.968	0.669	High
Content knowledge (CK)	48	3.826	0.769	High
Technological pedagogical knowledge (TPK)	48	3.807	0.745	High
Technological content knowledge (TCK)	48	3.857	0.722	High
Pedagogical content knowledge (PCK)	48	3.851	0.667	High
Technological pedagogical content knowledge (TPACK)	48	3.75	0.751	High

The highest TPACK was technological knowledge (TK). This finding is empirically in harmony with previous studies, such as Nass and Khan (2018) and Pusparini et al. (2017). Ghora and Bhati (2016) stated that TK is definitely the foundation for integrating ICT in the classrooms. Therefore "studies have shown that raising teachers' technological skills increases the likelihood of them using ICT in the classroom" (Santos & Castro, 2021 p. 3). Essentially, TK component enabled students to understand digital technology integration into the classrooms, such as using Web 2.0, apps, and mobile devices for language learning.

It referred to students' ability to perform basic computer operations and internet usage for pedagogical purposes. This includes operating programs, playing around with various up-to-date and relevant technologies consistently, editing files, producing a variety of documents formats, and creating digital materials. Moreover, students could participate in online discussion forums, choose reliable sources, and join workshops, conferences, or training courses for professional development now and in the future. TK also included how students solve fundamental technical problems. The participants' demographic information showed 37.4% of the student teachers started using EdTech apps for languages before they were ten years. Also, 62.6% started using EdTech aged between 10 and 15. This implied that the students grew up and well-connected with computers, gadgets, and internet access for entertainment, communication, and learning. Moreover, a quick survey through Mentimeter was conducted at the beginning of the first day of the workshop session. The survey showed that students were already familiar with some learning platforms, apps, and websites. These included TikTok, Instagram, YouTube, Liveworksheets.com, EdPuzzle, Rosetta Stone, britishcouncil.org, and many others. Other proofs, during the classroom observation, we could also see that the students actively participated when discussing the latest apps for learning. They received the information quickly, responded, and adapted very fast. More importantly, the students showed their enthusiasm about the topic being discussed. As a result, the majority of participants finished all the workshops' projects successfully and deserved to get good grades.

The lowest level of TPACK was TPACK scores, which is in line with Saltan and Arslan (2017) and Bueno-Alastuey et al. (2018). TPACK covered students' comprehensive knowledge of using technology structurally and systematically for the teaching-learning process of particular classroom lessons. The teaching-learning process included lesson planning, pedagogical methods, teaching strategies and techniques, teacher-student interaction, assessment, and classroom management. Therefore, the findings informed the initial teacher education department to provide more training, especially for improving pre-service teachers' TPACK component.

However, contrary to the present study's quantitative results, Mouza et al. (2014)' study with 88 pre-service teachers of one of the ETE programs in the USA, Omoso and Odindo (2020) 'study with 38 pre-service teachers of the BEd program in Kenya, and Wang et al. (2020)'s study with 232 participants of a university in China found that TK of had the lowest mean score. Merono et al. (2021)'s study with 293 participants revealed that TPACK was the highest score after the treatment. Moreover, in North Carolina, Hofer, and Grandgenett (2012) and in Switzerland, Schmid et al. (2021) reported that the participants' highest scores ratings were content knowledge (CK), while the lowest was technological content knowledge (TCK). Dong et al. (2015)' study revealed the highest score of 390 pre-service teachers' TPACK was technological pedagogical knowledge (TPK), and the lowest was content knowledge (CK). These empirical findings were confirmed by Khine et al. (2017), who conducted a study in Abu Dhabi, UAE, with 67 trainee teachers. In Finland, a longitudinal study by Valtonen et al. (2019) concluded that pedagogical knowledge (PK) of 148 pre-service teachers gained the highest mean value and TCK obtained the lowest score.

Research question 2: What is the impact of professional knowledge on student teachers' experiences in utilizing EdTech tools during online teaching practices?

Participants were involved in the CALL course before they implemented the conceptual knowledge in the school applications. Also, they developed TPACK-based lesson plans and practiced professional knowledge in online teaching practices. Five voluntary participants

were willing to share their experiences of online teaching practices for two months. Therefore, this study engaged them to gain in-depth information on participants' real-class experiences in operating their technology-delivered lessons. Three participants conducted online teaching practices in Yogyakarta, one was in Jawa Tengah, while one was in Jawa Barat. The following are the results of participants' interviews, lesson plan reports, and reflective teaching journals.

Table 2. Summary of students' TPACK-based lesson plans

Teacher	Location (Junior High School)	Material(s)	Teaching Method(s) and Approach(es)	Teaching Media
Teacher 1 (T1)	Private School in Ambarawa, Jawa Tengah Grade: 7, 8, and 9	<ul style="list-style-type: none"> • Greetings, leave-taking, thanking, and apologizing • Checking for understanding and response • Procedure text 	Discovery learning and scientific approach	Google Meet, Google Classroom, Quizziz, Google Form
Teacher 2 (T2)	Public School in Sleman, Yogyakarta Grade: 8	<ul style="list-style-type: none"> • Asking and giving attention • Checking and responding to someone's understanding 	Scientific approach	Google Classroom, Quizziz, Google form, and WhatsApp Group
Teacher 3 (T3)	Private School in Bekasi, Jawa Barat Grade: 7	<ul style="list-style-type: none"> • Greetings – thanking, leave taking, apologizing, and sympathy • Introduction • Possessive adjective and possessive pronoun. 	Scientific approach	Google Classroom, WhatsApp, Video/YouTube, Quizziz, Google Form, and Zoom
Teacher 4 (T4)	Private School in Yogyakarta Grade: 7	<ul style="list-style-type: none"> • Introducing self and others 	Scientific approach	Google Classroom, WhatsApp Group, Instagram, Google Form, Quizziz, and Liveworksheet
Teacher 5 (T5)	Public School in Yogyakarta Grade: 8	<ul style="list-style-type: none"> • Opinion and complementing • Capability and willingness 	Scientific approach	Google classroom, WhatsApp group,

				educational websites, YouTube, Screencast-O-Matic, Canva, and Liveworksheets
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Participants had the opportunity to teach grades 7, 8, and 9, though their experiences differed regarding how they benefitted from teaching with technology. Therefore, they described how they used specific technology and provided some examples. For example, T1 had the moment to teach grade 9 about procedure text. To facilitate this lesson topic, she utilized video-based materials from YouTube and discussed them on Google Meet. Before the class started, she delivered all materials to Google Classroom. Therefore, students could watch the video and read materials to enhance comprehension outside the class. T1 concluded that technology could facilitate meaningful remote learning and grasp students' attention. She vividly said,

“The students were happy when I delivered the material in the form of a video (see Figure 3). They enjoyed learning visually. During the synchronous classroom discussion, I could meet and monitor students' learning in real-time [in the Google Meet app]. I feel the sense of togetherness and could also add extra times for students to understand the materials (T1 – Reflective teaching journal).”



Figure 3. T1's sample of material (Video)

Other participants, T2 and T3, expressed the same attitude and feelings, stating that technology supports the implementation of online learning. Teachers could design assessments using technology and give students individualized feedback immediately. Therefore, they used Google Form to create various assessments, such as quizzes and exercises, in a joyful way (see Figure 4).

T2:

(<https://docs.google.com/forms/d/e/1FAIpQLScbkWLOItlaeMOIF365f41I7p2T028oQSBXMVsg4pgjzP8JcQ/viewform>)

T3: (<https://docs.google.com/forms/d/e/1FAIpQLSc->

[hXNfhXPapLeeWVpc11Yn2bK_eRwmbGz2u5dAXpe4ex4xZw/viewform](https://docs.google.com/forms/d/e/1FAIpQLSc-hXNfhXPapLeeWVpc11Yn2bK_eRwmbGz2u5dAXpe4ex4xZw/viewform))

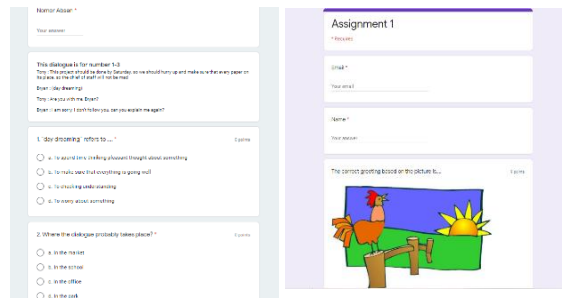


Figure 4. T2 and T3's samples of assessment design (Google Form)

T3 appreciated that technology truly helps her to facilitate asynchronous online remote teaching. She mentioned,

"I have learned to design LMS [Google Classroom] as a final project in the CALL course the previous semester. It was challenging...but then I could use it for fully online teaching practices this semester. This learning platform was really helpful (T3 – individual interview)."

In doing so, T2, T4, and T5 believed that the CALL course successfully improved their conceptual knowledge and practical skills for classroom teaching. This was especially during the sudden pedagogy transition due to the COVID-19 pandemic. Therefore, the course had yielded beneficial results for them. They reported,

"Teaching in the current situation [COVID-19 pandemic] is challenging. [However], I thank to CALL course for making student teachers ready to teach with technology. This course provides detailed guidelines on how to [for example] design speaking-based activities. Instagram Vlog one of the examples to develop students' speaking skills and many others (T4 – individual interview)."

"I was lucky because I took Computer Assisted Language Learning (CALL) course in the previous semester. From this course, I studied various applications and websites for online teaching-learning activities. For example, I used Canva to design lesson plans and <http://www.liveworksheet.com> to make Lembar Kerja Peserta Didik (LKPD) (T5 – Reflective teaching journal)."

"Taking a CALL class is such a good decision. This course helps prospective teachers understand how to use interactive digital media for teaching. Bravo! Keep updated with the new apps (T2 – individual interview)."



Figure 5. T5's sample of material (interactive PPT)

These research findings were in line with prior longitudinal studies documenting that technology-infused courses fostered teacher candidates' TPACK development and ICT skills (Buss et al., 2018; Aktaş & Özmen, 2020). However, in choosing apps, T2 and T4 asserted that they must adjust to the school's policy, conditions, and students' virtual learning environments. They stated,

"I planned to deliver my lessons through Google Meet/Zoom at least once a week. I wanted to invite my students to have a real talk face-to-face virtually. However, the in-service English teacher (my mentor) suggested using WhatsApp Group for classroom discussion and Google Classroom for classwork. The school uses Zoom meetings only to share a moment with students and parents, such as hearing their problems during the online learning and feedback (T2 – individual interview)."

I have to revise my lesson plan, especially on the teaching media part. My 'guru pamong' said that I could not use Google Meet since most students faced internet connection problems. Therefore, I maximize the use of WhatsApp, Google Classroom, and Google Form during two-month teaching practices (T4 – individual interview)."

Al-Kumaim et al. (2021) stated that video-based communication tools in synchronous distance learning, such as Zoom, Google Meet, and Cisco's Webex involve some essential software and hardware and high dependence on stable internet connection. As a result, the study found that Google classroom ranked highest in terms of usage frequency among other online platforms. Both instructors and students preferred using Google online platform for fruitful online teaching-learning. Advanced learning platforms, such as Classdojo, Moodle, or Google Classroom, allow teachers to import existing multimedia content materials, including words, videos, PowerPoint presentations. Therefore, students can access the materials whenever and wherever they are, even when offline.

3 Conclusions

Importantly, the findings of this mixed-method study point to the positive impact of the TPACK-in practice model on EFL student teachers' professional knowledge. The seven scores of TPACK components were high, indicated that participants understood well how to use online learning platforms for teaching. From a practical standpoint, this study revealed that professional knowledge helped teachers to explore, design, and implement ICT into classroom instructions. Accordingly, it should be noted that providing technology-based courses in teacher education programs may develop pre-service teachers' TPACK with all dimensions and guide them in real teaching applications. However, this study was limited by the generalizability of qualitative data. Therefore, future studies could add more participants and new findings to the field.

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