Pre-Service EFL Teachers' Knowledge and Practices of TPACK at Edu-Tech Classrooms: Preparation for Real-Teaching Practices

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Abstract. Technological Pedagogical Content Knowledge (TPACK) has become a prominent educational issue, particularly in ELT. Although TPACK is identical to in-service teachers' tasks, pre-service teachers are also demanded to learn how to incorporate technology into language instruction using effective teaching strategies. This study aimed to investigate pre-service EFL teachers' knowledge of TPACK and explore their practices of TPACK at educational technology (Edu-Tech) classrooms for the preparation of teaching practices. The study involved 57 pre-service English teachers (PSETs) taking part at Edu-Tech classroom in one of the state universities in Surabaya, East Java. This study employed a sequential mixed-methods approach using both survey and reflective practice. The results of data analysis revealed that all 57 pre-service teachers (100%) showed a high level of knowledge concerning Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), and TPACK. Meanwhile, the TPACK practices in Edu-Tech classrooms showed that pre-service teachers utilized various digital applications such as Canva, Quizziz, Proprofs, Mentimeter, Arcademics, Blooket, and Wordwall. However, PSETs tend to use the same teaching method, which is a scientific approach in teaching the materials although they have a level of knowledge about pedagogy. In short, it can be concluded that pre-service teachers are ready to conduct teaching practices at partner schools. This research implies that pre-service teachers need to be equipped with the knowledge and skills to effectively incorporate technology, pedagogy, and content in English language teaching, particularly using more diverse teaching strategies.

Keywords: Pre-Service EFL Teachers, Knowledge, Practices, TPACK, Edu-Tech Classroom.

1 Introduction

TPACK, which stands for Technological Pedagogical Content Knowledge, has become a prominent issue in education for the last two decades, particularly in English Language Teaching (hereafter, ELT). Technological Pedagogical Content

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Knowledge (hereafter, TPACK)'s popularity has attracted researchers' attention to conduct studies in various academic contexts. It is reported there have been over 315 dissertations and 28 books, over 1200 journal articles, and book chapters with TPACK as the central issues since 2009 [1]. Although TPACK is identical to the job of in-service teachers at schools, pre-service teachers (hereafter, PSETs) taking part in teacher education are also demanded to be able to deliver materials by integrating technology, pedagogy, and content knowledge during teaching simulation. PSETs in university are trained and prepared to become professional teachers possessing five competencies: pedagogical, professional, personal, social, and technological competencies. To achieve these competencies, PSETs are required to apply TPACK in their teaching simulation for preparation before conducting real teaching practice at schools. According to Gill and Dalgarno [2], pre-service teachers nowadays find themselves immersed in the integration of cutting-edge technology inside their teacher training programs.

TPACK refers to a conceptual framework that delineates the various types of knowledge that teachers need in order to effectively incorporate technology into their instructional practices [3], [4]. TPACK emphasizes the importance of possessing comprehensive knowledge of technology, pedagogy, and content for PSETs. Technology integration should be learner-centered and facilitate the construction of learners' knowledge. PSETs are required to design technology-rich learning environments that promote active learning and engage learners in constructing their knowledge. In addition, integrating technology should promote collaborative learning and communication among learners and facilitate social interaction and collaborative learning.

Although TPACK has three main components, it encompasses seven interrelated components that are crucial for effective technology integration in education. The first component is Technological Knowledge (hereafter, TK). It refers to understanding various technologies, their functions, and how to use them effectively. It includes knowledge of tools, software, and hardware devices that support teaching and learning. The second component is Pedagogical Knowledge (hereafter, PK). It refers to teachers' knowledge and skills about teaching and learning. It encompasses instructional strategies, classroom management techniques, assessment methods, and understanding of students' learning. The third is Content Knowledge (hereafter, CK). It is about teachers' subject matter knowledge in their specific content areas. It includes a deep understanding of a particular discipline's concepts, theories, and skills.

The fourth is Technological Content Knowledge (hereafter, TCK). This component represents the understanding of how technology and content intersect. It involves knowing how to use technology to teach specific content effectively. The fifth component is Technological Pedagogical Knowledge (hereafter, TPK). It represents the knowledge of how technology can be used to support and enhance pedagogical approaches. It involves understanding the best practices and strategies for integrating technology into teaching. The sixth component is Pedagogical Content Knowledge (hereafter, PCK). It focuses on how to teach specific content in a pedagogically

effective way. It involves understanding the instructional strategies, approaches, and methods that are most suitable for teaching a particular subject.

The last component is TPACK. This is the integration of all the previous components. It refers to the knowledge and understanding of how technology, pedagogy, and content intersect and interact with each other [5]. It involves effectively integrating technology into teaching practices to support meaningful learning experiences. The seven interrelated components of TPACK can be seen in Fig. 1.

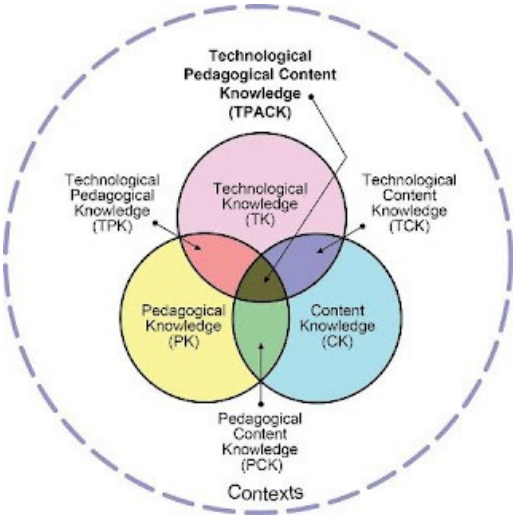

Fig. 1. Seven interrelated components of TPACK

In the field of language education, there has been a recent categorization of trends in TPACK studies into four comprehensive areas: exploration, assessment, development, and application of TPACK [6]. The examination of TPACK is approached through quantitative, qualitative, and mixed methodologies in order to investigate teachers' TPACK [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22]. Second, in assessing TPACK, several instruments have been developed to highlight the context of language teaching seen from the teachers' perspectives [23], [24], [25], [26], and assessing TPACK seen from students' viewpoints [27], [28].

Thirdly, much study has been undertaken to explore the development of TPACK through the implementation of Professional Development (PD) programs aimed at supporting teachers in enhancing their TPACK competencies gradually. Two empirical investigations examined the pivotal role of teachers inside teacher education programs [29], [30], while twelve studies developed TPACK models for effective teaching practice [31], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [42]. Among all research about TPACK development models, Kharade and Peese [34] focus on investigating PSETs who learned to solve authentic problems by observing the modeling demonstrated by teacher educators. It is found that PSETs have

developed their TPACK, as seen from the results of pre-survey and post-survey TPACK scores. Unlike the previous research focusing on PSETs, Ansyari [31] proposed a professional development program emphasizing the integration of TPACK framework and technology-based teaching for in-service teachers. English teachers were introduced to the TPACK construct, which encompassed technology integration. They were actively involved in the process of planning and implementing lesson plans, and were encouraged to engage in reflective practices to evaluate the outcomes. The results indicate that there was a significant gain in teachers' TK, CK, PK, TCK, TPK, PCK, and TPCK as evidenced by the pre- and post-TPACK questionnaires.

Fourth, in terms of applying teachers' TPACK, Tai et al. [39] have applied the TPACK model for teaching online English writing for nursing students in Taiwan. This course is designed to help students develop their writing skills (content) through multiple revisions (pedagogy) using the internet (technology). It shows that students' writing skill improves significantly using this instructional model. Similarly, a study conducted by Abu-Hardan et al. [43] about the effect of TPACK-enhanced instructional programs revealed that secondary EFL students' reading comprehension significantly improved from the pre-test and post-test results, as seen from the experimental group that received instruction by applying TPACK framework.

Some other research studies have been done concerning the application of TPACK in ELT. All these studies suggest that applying the TPACK framework in ELT effectively improves teaching quality, teacher ICT literacy, and ICT integration in the classroom. First, a study conducted by Nazari et al. [44] investigated the effects of an online professional development course with a focus on TPACK on English as a Foreign Language (EFL) teachers' TPACK. Additionally, the study analyzed the perspectives of these instructors on their participation in the course. The results indicated that every English as a Foreign Language (EFL) teacher exhibited favorable dispositions towards the instructional program, and their feedback highlighted the specific areas of TPACK in which they had made advancements. Furthermore, Valtonen et al. [45] have provided a comprehensive overview of the outcomes derived from the developmental phase of the TPACK-21 instrument. The results of this study offer valuable insights into the hurdles encountered during the development process and propose new strategies to address these obstacles.

Although many studies have investigated the exploration, assessment, development, and application of TPACK [6], the focus of the subjects is mostly on in-service teachers, while PSETs' knowledge and their TPACK practices have not been sufficiently explored. Thus, this present study is essential to be carried out to bridge the research gap. The findings will give insight for English lecturers to provide better preparation for PSETs before they conduct teaching practice at schools.

To investigate PSETs' knowledge and their TPACK practices during teaching simulation in Edu-Tech classroom, two research questions are formulated: (1) What is pre-service EFL teachers' knowledge of TPACK for the preparation of real-teaching practices? and (2) How are pre-service EFL teachers' practices of TPACK during teaching simulation at Edu-Tech classrooms?

2 Methods

TPACK practices during teaching simulation at Edu-Tech EFL classroom as preparation for conducting teaching practices at partner schools. This research was a mixed-methods study, as the data were in the form of numbers and words. The quantitative data were obtained from a closed-ended questionnaire to answer the first research question about PSETs' knowledge of TPACK, while the qualitative data were gathered from PSETs' reflective practice to answer the second research question about PSETs' TPACK practices during teaching simulation at Edu-Tech classroom. Specifically, the researcher undertook a mixed-methods sequential explanatory design [46] so that quantitative results could be further explored through the collection and analysis of the qualitative phase.

The present research involved 57 university students called PSETs as respondents taking part in Edu-Tech EFL classroom in one of the state universities in Surabaya, East Java, Indonesia. They were taken as the research subject because they were trained and prepared to become highly competent English teachers by integrating technology, pedagogy, and content knowledge into their teaching simulation.

To answer the first research question about the pre-service teachers' knowledge, a questionnaire developed by Schmidt et al. [47] was used. This instrument has been tested for validity and reliability with very good results. Meanwhile, to answer the second research question about PSETs' TPACK practices in Edu-Tech EFL classrooms, the reflective practice described PSETs' activities during teaching simulation while integrating technology, pedagogy, and content in their teaching activities. Three PSETs were selected randomly and asked to write reflective practices concerning their practices in teaching English using the TPACK framework.

After collecting data, they were analyzed in two successive phases, quantitative and qualitative phases.

2.1 Quantitative Phase

The gathered data from questionnaires were analyzed using simple descriptive statistics in the form of percentages and mean scores using SPSS 22. The level of PSETs' knowledge of TPACK was measured by dividing 5 points of the Likert scale (*strongly disagree, disagree, undecided, agree,* and *strongly agree*) by three categories: high (M= 3.5 – 5), medium (M= 1.8 – 3.4), and low (M = 0 – 1.7).

2.2 Qualitative Phase

In the qualitative phase, students' reflective practice was used and analyzed using thematic analysis with three stages suggested by Ary et al. [48]. The stages are as follows.

Familiarizing and Organizing. After collecting PSETs' written reflections, the researchers familiarized the paragraphs by reading them repeatedly. After that, the data were classified into three categories: technology, pedagogy, and content knowledge.

Coding and Elimination (Coding and Reducing). The coding process was carried out on the PSETs' reflective practice, which was written in the form of paragraphs. In addition, some unimportant words, phrases, or sentences were eliminated to produce valid data.

Interpreting and Representing. The last stage is interpretation and presentation. In this stage, qualitative data about the implementation of TPACK in the teaching simulation obtained from PSETs' reflections were interpreted and presented in the form of excerpts and tables.

3 Results and Discussion

This section provides an exposition of the findings and analysis derived from the conducted research. The sub-heading were categorized according to the research questions. The initial sub-heading focused on the pre-service teachers' knowledge of TPACK, whereas the subsequent sub-heading examined pre-service teachers' implementation of TPACK in educational technology EFL classrooms in connection to their readiness to conduct teaching practicum.

3.1 Pre-Service EFL Teachers' Knowledge of TPACK

The data on PSETs' knowledge of TPACK was collected through a closed-ended questionnaire consisting of seven components: TK, CK, PK, PCK, TCK, TPK, and TPACK.

TK (Technological Knowledge). It concerns understanding various technologies, their functions, and how to use them effectively. It includes knowledge of different tools, software, and hardware devices that can support teaching and learning. The questionnaire of this component consists of six items.

Table 1. TK (Technological Knowledge)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
1	I know how to solve my own technical problems.	58	4.1	.47	High
2	I can learn technology easily.	58	4.1	.53	High
3	I keep up with important new technologies.	58	4.0	.73	High
4	I frequently play around the technology.	58	4.1	.64	High
5	I know about a lot of different technologies.	58	3.7	.87	High
6	I have the technical skills I need to use technology.	58	3.7	.77	High

Based on the presented data concerning TK (see Table 1), pre-service teachers revealed high technological knowledge. They knew how to solve their technical problems (M=4.1), could learn technology easily (M=4.1), kept up with important new technologies (M=4.0), frequently played around the technology (M=4.1), knew a lot about different technologies (M=3.7), and had the technical skills they needed to use technology (M=3.7) respectively. Among all items, the three highest levels concerned the knowledge of solving technical problems, easily learning technology, and playing around with technology (M=4.1).

CK (Content Knowledge). It refers to pre-service teachers' subject matter knowledge in their specific content areas. It includes a deep understanding of a particular discipline's concepts, theories, and skills. This component consists of three questionnaire items.

Table 2. CK (Content Knowledge)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
7	I have sufficient knowledge of English language teaching (ELT)	58	3.8	.56	High
8	I can use a literary way of thinking.	58	3.8	.66	High
9	I have various ways and strategies of developing my understanding of English language teaching (ELT).	58	3.8	.66	High

According to the presented data about CK (see Table 2), pre-service teachers showed a high level of all questionnaire items concerning having knowledge about ELT, using a literary way of thinking, and having various ways and strategies of developing an understanding of ELT. In this regard, all questionnaire items have the same mean score (M=3.8).

PK (Pedagogical Knowledge). It refers to teachers' knowledge and skills about teaching and learning. It encompasses instructional strategies, classroom management techniques, assessment methods, and an understanding of how students learn. This component contains seven questionnaire items.

Table 3. PK (Pedagogical Knowledge)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
10	I know how to assess student performance in a classroom.	58	3.7	.63	High
11	I can adapt my teaching based on what students currently understand or do not understand.	58	3.7	.55	High
12	I can adapt my teaching style to different learners.	58	3.6	.69	High
13	I can assess student learning in multiple ways.	58	3.8	.64	High
14	I can use a wide range of teaching approaches in a classroom setting.	58	3.6	.74	High
15	I am familiar with common student understandings and misconceptions.	58	3.5	.62	High
16	I know how to organize and maintain classroom management.	58	3.6	.78	High

From the presented data about PK (see Table 3), pre-service teachers showed their high knowledge of pedagogy concerning assessing student performance in a classroom (M= 3.7), adapting their teaching based upon what students currently understand or do not understand (M= 3.7), adapting their teaching style to different learners (M= 3.6), assessing student learning in multiple ways (M= 3.8), using a wide range of teaching (M= 3.6), being familiar with common student understandings and misconceptions (M= 3.5), and organizing classroom management (M= 3.6). Pre-service teachers showed the highest level in the part of assessing student learning in multiple ways (M=3.8).

Pedagogical Content Knowledge (PCK). It represents the knowledge of how to teach specific content pedagogically and effectively. It involves understanding the instructional strategies, approaches, and methods that are most suitable for teaching a particular subject. This component consists of one questionnaire item.

Table 4. Pedagogical Content Knowledge (PCK)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
17	I can select effective teaching approaches to guide student thinking and learning in English language teaching (ELT)	58	3.6	.67	High

According to the collected data about PCK (see Table 4), pre-service teachers showed a high level of knowledge concerning selecting effective teaching approaches to guide student thinking and learning in ELT (M= 3.6).

Technological Content Knowledge (TCK). It represents the understanding of how technology and content intersect. It involves knowing how to use technology to teach specific content effectively. This component has one questionnaire item.

Table 5. Technological Content Knowledge (TCK)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
18	I know about technologies that I can use for understanding and do English.	58	4.1	.51	High

From the collected data (see Table 5), it is known that pre-service teachers had a high level of knowledge concerning technologies that they can use for understanding English (M=4.1).

Technological Pedagogical Knowledge (TPK). It represents the knowledge of how technology can be used to support and enhance pedagogical approaches. It involves understanding the best practices and strategies for integrating technology into teaching. This component has nine questionnaire items.

Table 6. Technological Pedagogical Knowledge (TPK)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
19	I can choose technologies that enhance the teaching approaches for a lesson.	58	4.0	.37	High
20	I can choose technologies that enhance students' learning for a lesson.	58	4.0	.41	High
21	My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	58	4.2	.53	High
22	I am thinking critically about how to use technology in my classroom.	58	4.0	.47	High
23	I can adapt the use of the technologies that I am learning about to different teaching activities.	58	4.0	.47	High
24	I can select technologies to use in my classroom that enhances what I teach, how I teach, and what students learn.	58	4.1	.47	High
25	I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom.	58	4.0	.49	High
26	I can provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at my school and/or district.	58	3.6	.63	High
27	I can choose technologies that enhance the content of a lesson.	58	4.0	.45	High

According to collected data about TPK (see Table 6), pre-service teachers showed high level of all nine items including choosing technologies that enhance the teaching approaches for a lesson (M= 4.0), choosing technologies that enhance students' learning for a lesson (M= 4.0), thinking more deeply about how technology could influence the teaching approaches they use in their classroom (M= 4.2), thinking critically about how to use technology in their classroom (M= 4.0), adapting the use of the technologies that they are learning about to different teaching activities (M= 4.0), selecting technologies to use in their classroom that enhance what they teach, how they teach and what students learn (M= 4.1), using strategies that combine content, technologies and teaching approaches in their coursework in their classroom (M= 4.0), providing leadership in helping others to coordinate the use of content, technologies and teaching approaches at their school and/or district (M= 3.6), and choosing technologies that enhance the content for a lesson (M= 4.0).

Technological Pedagogical Content Knowledge (TPACK). It is the integration of all the previous components. It refers to the knowledge and understanding of how technology, pedagogy, and content intersect and interact with each other. It involves effectively integrating technology into teaching practices to support meaningful learning experiences. This component has one questionnaire item.

Table 7. Technological Pedagogical Content Knowledge (TPACK)

No	Statements	N	Mean	Std. Deviation	Level of TPACK
28	I can teach lessons that appropriately combine English, technologies, and teaching approaches	58	3.9	.57	High

From the collected data on TPCK (see Table 7), it is known that pre-service teachers have a high level of teaching lessons that appropriately combine English, technologies, and teaching approaches (M= 3.9). It can be concluded that pre-service teachers have a high level of knowledge concerning all seven components of TPACK.

To prepare technology integration in teacher education program, PSETs need to be equipped with the knowledge of technology, pedagogy, and content in which all aspects are interrelated with each other [3]. To measure PSETs' TPACK, a valid and reliable instrument is required. Several instruments can be used to evaluate PSETs' TPACK in teacher education programs. The present research applied PSETs' TPACK instrument in the form of a closed-ended questionnaire developed by Schmidt et al. [47] concerning their knowledge of TPACK. This instrument has been tested for validity and reliability with very good results.

From the results of the questionnaire about PSETs' knowledge of TPACK, it is known that PSETs have a high level of knowledge concerning all seven aspects of TPACK: TK, CK, PK, PCK, TCK, TPK, and TPACK. However, the discussion of this section will focus only on three main components of TPACK: Technology, Pedagogy, and Content knowledge.

Unlike the results of Irwanto's et al. [49] study that PSETs' perception show the lowest level in technology knowledge, PSETs' technology knowledge concerning technology in this study is considered high. Most of them agree that they know how to solve technical problems, such as network connectivity issues. Network problems can disrupt internet access, making it difficult to connect to websites, send/receive emails, or access online services. It can be caused by issues with routers, modems, network cables, or Internet Service Provider (ISP) problems. Another problem can be slow performance. Technology can sometimes run slow, whether it is a slow computer, a lagging internet connection, or applications that take a long time to load. It can be due to insufficient hardware resources, excessive background processes, or network congestion. However, it is found in Tyarakanita et al.'s [50] study that the challenges encountered by the pre-service teachers were mostly due to the lack of teaching experiences.

PSETs also said that they learn technology easily. Students often have a natural affinity for technology and tend to learn it more easily. Many students today belong to

the digital native generation, meaning they have grown up surrounded by technology. They have been exposed to smartphones, tablets, computers, and the internet from a young age, making them more comfortable and familiar with technology. Next, students, especially younger ones, tend to be more adaptable and open to learning new things. They are willing to explore and experiment with technology, making it easier for them to grasp new concepts and functionalities. In addition, technology allows for personalized learning experiences tailored to individual student needs. Adaptive learning platforms, intelligent tutoring systems, and personalized content recommendations help students learn independently and address their specific learning styles and preferences.

PSETs argue that they know a lot about digital technologies. Students have been exposed to technology from an early age, growing up in a digital era where technology is pervasive. They have likely interacted with smartphones, tablets, computers, and other devices since childhood, which has given them a head start in understanding and using technology. In addition, the internet has made a vast amount of information and resources readily available to students. They can access online tutorials, educational websites, forums, and video platforms to learn about various technologies and explore their interests. Students can acquire knowledge about coding, web design, graphic design, video editing, and other technologies through self-study and online resources. Knowing a lot about digital technologies can help PSET deliver materials in the classroom much easier.

Second, concerning pedagogical knowledge, PSETs show high knowledge of how to plan, carry out and assess instruction. In planning the instruction, PSETs usually develop a systematic lesson plan consisting of basic competence, indicators, learning objectives, learning materials, methods, teaching scenarios, and a rubric of assessment. PSETs have learned how to develop lesson plans in course design subjects. After making a lesson plan, PSETs are demanded to be able to carry out the plan written in the lesson plan into real action. In this phase, PSETs must be able to apply effective teaching strategies. The next job of teachers is to be able to assess the students' learning achievement. It is reported that PSETs have a high knowledge of assessing students' performance in the classroom. The assessment may include process assessment emphasizing the process of giving feedback and product assessment focusing on the outcome or the results.

It is also known that PSETs have high knowledge of how to adapt their teaching style to different learners. PSETs realize that students have different interests and learning styles. Some students might be visual learners who learn well by watching videos, seeing PowerPoint presentations, and working with other visualized media. Other students who are categorized as auditory learners might learn well by listening to music, listening to teachers' explanations, or learning language through drilling. The last learning style is kinesthetic learners. In this type of learning style, students learn better through demonstration, experiments, and outdoor learning, enabling them to use their body movement for learning. PSETs, as candidates for teachers, must accommodate all students' learning styles during the teaching and learning process.

PSETs also argue that they can use a variety of teaching approaches. In this regard, PSETs have learned various teaching methods in the ELT Method subject. The

teaching methods that they already learn are, for example, Audio-lingual Method, Total Physical Response (TPR), Grammar Translation Method (GTM), Direct Method (DM), Genre-Based Learning, Task-Based Language Learning (TBLL), Project-Based Learning, Case-Based Learning, Scientific Approach, Problem-Based Learning, and many others. This pedagogical knowledge can be implemented based on the condition of the class and the characteristics of the materials being taught.

Third, regarding content knowledge, PSETs claim that they have sufficient knowledge about ELT. During their study in university, PSETs have acquired knowledge in four fundamental language abilities, namely speaking, listening, writing, and reading. Additionally, they have also gained proficiency in many language components, such as grammar and pronunciation. PSETs learn other English for Specific Purposes (ESP) knowledge and skills in various disciplines such as natural science, economics, sports, arts, business, tourism, engineering, social science, etc. These show that PSETs have sufficient knowledge and skills for teaching at schools.

Based on the study's results, it is known that PSETs have various ways and strategies for developing their understanding of ELT. Developing a strong understanding of ELT involves combining theoretical knowledge, practical experience, and continuous professional development. PSETs may engage in reading materials related to ELT, such as books, research papers, academic journals, and online resources. They can continue to update their knowledge with the latest developments, trends, and best practices in ELT theory and practice. PSETs can participate in ELT conferences, workshops, and seminars to enhance their ELT competencies. These events provide opportunities to learn from experts, network with professionals, and gain insights into innovative teaching approaches and research findings.

3.2 Pre-Service EFL Teachers' TPACK Practices at Edu-Tech Classrooms

This section describes the implementation of TPACK performed by pre-service teachers. The data were collected through reflective practices, which were written by pre-service teachers. Using convenience sampling, three pre-service teachers were selected. The data about the integration of technology, pedagogy, and content are presented below. Pre-service teachers were coded with PSET 1, PSET 2, and PSET 3.

PSET 1, Excerpt 1.

The applications that I used for peer teaching are Canva, Quizziz, and Proprofs. Canva can be used for a variety of academic and non-academic purposes, such as creating documents, posters, Instagram uploads, and so on. On this occasion, I used Canva's presentation feature to create teaching materials. I put all the materials to teach on some slides including a video. The second application is Quizziz. It is an app to make a quiz and the type of quiz can be multiple choices and short answers. In the stages of making the Canva teaching media, first I choose the template for our presentation that is related to Dream Job. I put the

teaching material that is also related to Dream Job in some slides. While the stages of making the Quizziz are kind of similar.

Methods or techniques that I implemented in peer teaching are scientific approaches. The stages in the learning process are: First, observing. On the first slide of Canva, I put a picture of a train operator and asked the students to observe the pic. The second step is questioning where students can ask any questions related to the material. The third step is collecting data, the students need to collect the information from the video that I played to answer the questions. The fourth step is associating, and in this session, we do a quiz using the Quizzez application and played a game called Hangman where the students need to guess a word and tried to connect the clue to make a word or choose an answer related to job or occupation. The last one is communicating where I asked students to tell me about what have they learned during the learning process.

The content that I taught in the peer teaching is a descriptive text about jobs and occupations. I mostly emphasize the listening and reading skills in this learning. In the first meeting, students learn from audio text and Quizizz about common jobs, so they mostly knew and heard about these jobs e.g. teacher, baker, diver, doctor, etc. In the second meeting, I give an assessment consisting of two descriptive written texts about jobs or occupations that are rare, they are sculptor and stuntman, so the students can gain more knowledge about the kind of job that they may have never heard of before.

In PSET 1, Excerpt 1, it is known that PSET utilized three types of digital applications: Canva, Quizziz, and Proprofs. PSETs were skillful in utilizing those three digital applications. He could describe the stages of using this application in his peer teaching practices. In terms of the methods or techniques used, PSET used a scientific approach, a popular teaching method in English language teaching. He could also describe the stages of this approach in his peer-teaching practice. Lastly, He successfully incorporated the use of three digital applications and a scientific approach in teaching descriptive text about jobs and occupations.

PSET 2, Excerpt 2.

I use three applications. They are Mentimeter, Arcademics, and Blooket. Mentimeter (www.mentimeter.com): Mentimeter is an online presentation tool that allows presenters to engage their audience through interactive features like polls, quizzes, and Q&A sessions. Participants can respond using their devices, and the results are instantly displayed on the presenter's screen, promoting real-time engagement and feedback. It's commonly used in classrooms, meetings, and events to make presentations more interactive and engaging. The reason why I use mentimeter: Mentimeter is highly regarded as a valuable tool for several reasons. Firstly, it enhances presentations by fostering interactivity

and engagement among the audience. Participants can actively contribute their thoughts and opinions, creating a more dynamic and captivating environment.

I used the Scientific method. Scientific method teaching is an approach that teaches students how to think like scientists. It involves asking questions, making observations, forming hypotheses, designing experiments, gathering data, analyzing results, and drawing conclusions based on evidence. Students learn to think critically, ask questions, and solve problems systematically. It emphasizes the importance of evidence-based reasoning and communication of findings. Scientific method teaching helps students develop skills in scientific inquiry and understand the world through a logical and structured approach.

I taught English grammar, specifically simple present tense for seventh graders. What I need when teaching English grammar to middle students is creating an engaging and interactive learning experience. I started the lesson by providing clear explanations using examples and visuals. Connect grammar concepts to real-life situations and incorporate contextual learning through meaningful texts. I also used interactive activities, such as games to make grammar lessons enjoyable. I also provided them with online resources for reinforcement. I also encourage them to do peer collaboration and incorporate technology for interactive quizzes. By implementing these strategies, teaching grammar to middle students can be effective and engaging, helping them develop a strong foundation in English grammar skills.

In PSET 2, Excerpt 2, it is identified that PSET was able to integrate technology, methods, and content successfully. She utilized three types of digital applications: Mentimeter, Arcademics, and Blooket. She was able to describe how to use Mentimeter, Arcademics, and Blooket in her peer-teaching practice in detail. Meanwhile, she also applied a scientific approach to teaching grammar as one of the language components. She incorporated all three components of TPACK (technology, pedagogy, content) in effective teaching.

PSET 3, Excerpt 3.

In this subject, I was given 2 assignments by my lecturer to use technology in teaching English. For the first assignment (midterm) I used a website-based application called Wordwall (https://wordwall.net/resource/55077995/how-to-procedure-text). This application is used to create learning media such as quizzes, anagrams, random words, etc. The reason I use this application in learning is that this application features 18 templates that can be accessed for free and easily, and users can also provide access to media they have made online or can also be downloaded and printed on paper.

In the peer-teaching approach implemented in the Edu-Tech class, I incorporate the scientific method to enhance the learning experience. The scientific method provides a structured and systematic approach to inquiry and problem-solving.

By incorporating the scientific method into peer-teaching in the English class, students develop critical thinking skills, become active participants in their language learning journey, and gain a deeper understanding of the language. It empowers them to experiment with different techniques, evaluate their progress objectively, and make informed decisions about effective language learning strategies.

The theme we use is transportation, and the material in it is about procedure text where most of the procedure text is about how to make food or how to use something. However, we use the theme of transportation so students can learn how procedure text is used in other themes besides food and others. The language skill being taught is reading skill. By teaching reading skills, students learn to recognize text structures, conclude information, identify main ideas, and make connections between information in the text. I use Canva, YouTube videos, and game applications to teach materials that aim to enable students to develop a comprehensive understanding of procedure texts, especially those related to transportation.

In PSET 3, Excerpt 3, it is identified that PSET utilized a website-based application called Wordwall. This application is used to create learning media such as quizzes, anagrams, and random words. This website application was used to teach procedure text. It is conducted by applying the scientific method as a teaching strategy. She was able to describe the stages and procedures in teaching procedure text using an interesting website-based application. She added that besides teaching procedure text, she taught reading skills to identify text structures, conclude information, identify main ideas, and make connections between information in the text. Besides using e-website applications, she also used Canva, YouTube videos, and game applications in teaching the materials.

After understanding PSETs' knowledge of TPACK, this session discusses their practices of TPACK in Educational Technology (Edu-Tech) EFL classrooms during teaching simulation. Unlike a study done by Tyarakanita et al. [50], who observed the domains of TPACK from PSET's lesson plan, this research observed the coverage of the three aspects of TPACK from PSETs' written reflective report. It is found that the digital applications that PSETs most use in teaching English are Canva, Quizziz, and Proprofs. They argue that Canva can be used for various academic and non-academic purposes, such as creating documents, posters, Instagram content, etc. PSETs used Canva's presentation feature to create teaching materials. They put all the teaching materials on some slides, including a video. In using Canva for developing teaching media, they choose an appropriate template for making a presentation. Then, they make interesting content through the slides of the presentation. The second application they use is Quizziz. It is an app to make a quiz. The type of quiz can be multiple-choice and short answers. Meanwhile, the stages of making the Quizziz are quite similar to those of using Canva.

Although PSETs show high knowledge concerning teaching methods and techniques, their favorite teaching method used in teaching simulation is the scientific

approach, which has five stages: observing, questioning, experimenting, associating, and communicating. PSETs seem to enjoy using this method as it is easy and practical to be implemented. In university, lecturers who teach ELT tend to emphasize the use of a scientific approach for students as it is widely used by teachers at school. During the simulation, PSETs explained in detail the stages of how technology and content are integrated with appropriate teaching methods.

Regarding the content, PSETs deliver materials using types of texts. In the Indonesian context, the teaching of English is based on text type, including interpersonal, transactional, short-functional, and long-functional texts. Interpersonal text refers to communication that takes place between individuals or groups. It involves exchanging information, ideas, opinions, emotions, and other forms of messages through various means of communication, such as face-to-face conversations, written texts, phone calls, emails, social media interactions, and more. The purpose of interpersonal text can vary widely, ranging from casual conversations and social interactions to more formal or professional exchanges. It plays a crucial role in maintaining relationships, resolving conflicts, negotiating agreements, expressing emotions, and sharing information with others.

Unlike interpersonal text, which involves individual interaction and engagement, transactional text typically follows a more formal and structured approach. It often adheres to specific conventions, such as standardized language, professional terminology, and a clear and concise writing style. Transactional text is primarily focused on conveying information or completing a specific task. It is characterized by its functional and straightforward nature, where the main objective is to exchange or transact specific content rather than establishing social connections or expressing personal emotions.

The next type of text taught by PSETs is Short functional text. It refers to brief written pieces of text that serve a specific purpose or function. These texts are designed to convey information or perform a specific task concisely and straightforwardly. They are typically used in everyday situations and can be found in various contexts, such as personal, professional, or public settings. Short functional texts come in different forms and formats, including signs, labels, notices, memos, messages, reminders, invitations, directions, schedules, menus, and similar brief written materials. They are characterized by their brevity and focus on efficiently delivering essential information or instructions.

The last type of text taught by PSETs during teaching simulation is long functional text. The long-functional text refers to written pieces of text that are extensive in length and serve a specific purpose or function. These texts are typically more detailed, comprehensive, and in-depth compared to short functional texts. They are designed to convey complex information, provide thorough instructions, or present detailed explanations of a particular subject. Several types of long-functional text taught in secondary EFL classrooms are narrative, recount, report, descriptive, news items, procedure, hortatory, analytical, and argumentative. PSETs seem skillful in teaching those four types of texts during simulation.

4 Conclusion

This section points out the conclusions concerning PSETs' knowledge about TPACK and their implementation of TPACK in Edu-Tech classrooms to prepare teaching practices. Two conclusions are drawn based on the findings and discussion presented in the previous chapters.

The results of data analysis revealed that all 57 pre-service teachers (100%) showed a high level of knowledge in all seven components of TPACK: TK, PK, CK, TCK, TPK, PCK, and TPACK. Meanwhile, concerning PSETs' TPACK practices in Edu-Tech classrooms, it showed that PSETs utilized various digital applications such as Canva, Quizziz, Proprofs, Mentimeter, Arcademics, Blooket, and Wordwall. However, it seems that PSETs tend to use the same teaching method, which is a scientific approach to teaching language skills. From this study, it can be concluded that pre-service teachers are ready to conduct teaching practices at partner schools.

This research implies that pre-service teachers need to be equipped with the knowledge and skills to effectively incorporate technology, pedagogy, and content in English language teaching, particularly using more diverse teaching strategies.

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