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Research Article

Pre-service EFL Teachers' Online Language Teaching and Their TPACK Development

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Abstract: The Covid-19 outbreak posed a compelling challenge for teacher education programs regarding preparing pre-service teachers for online language teaching. In this study, nine Turkish EFL pre-service teachers were involved in a six-week online teaching project, which provided them with theoretical and practical training on online language teaching. They were engaged in lesson planning for one synchronous and two asynchronous lessons and taught these lessons to EFL students. This case study explored pre-service teachers' technological pedagogical content (TPACK) development via reflection reports, an online semi-structured interview, lesson plans, recordings of online lessons and posts on the asynchronous platform. The data analysis was conducted through thematic analysis. The findings demonstrated that participation in the online teaching project facilitated the participants' overall TPACK development. However, some pre-service teachers encountered challenges in effectively integrating technology with content and pedagogy. Specifically, lacking contextual knowledge hindered their ability to design and conduct online lessons successfully. The study underscores the importance of adopting a situated learning-by-doing approach to TPACK development, the value of pedagogical mentoring provided by teacher educators and field experience for pre-service teachers to gain competence across all subcomponents of TPACK.

Anahtar Sözcükler:

Covid-19,

çevrimiçi dil öğretimi,

teknolojik pedagojik alan bilgisi (TPAB),

dijital materyaller

İngilizce Öğretmeni Adaylarının Çevrimiçi Dil Öğretimi Uygulamaları ve TPAB Gelişimleri

Özet: Covid-19 salgını öğretmen adaylarının çevrimiçi dil öğretimine hazırlanması konusunda öğretmen eğitimi için zorlayıcı bir unsur teşkil etmiştir. Bu çalışmada, dokuz İngilizce öğretmen adayı çevrimiçi dil öğretimi konusunda kuramsal ve uygulamalı eğitim aldıkları altı haftalık bir çevrimiçi öğretme projesine katılmışlardır. Bu çerçevede, adaylar bir senkron ve iki adet asenkron ders planlayarak İngilizceyi yabancı dil olarak öğrenen öğrencilerle bu dersleri gerçekleşmişlerdir. Öğretmen adaylarının teknolojik pedagojik alan bilgisindeki (TPAB) gelişimleri yansıtıcı raporlar, çevrimiçi yarı-yapılandırılmış görüşmeler, ders planları, çevrimiçi ders kayıtları ve asenkron platformdaki gönderileriyle araştırılmıştır. Veriler tematik analiz yöntemiyle analiz edilmiştir. Bulgular, uygulamanın katılan öğretmen adaylarının genel TPAB'ın gelişimini kolaylaştırdığını göstermiştir. Ancak bazı öğretmen adaylarının teknolojiyi içerik ve pedagojiyle etkili bir şekilde bütünleştirmede zorlandığı gözlemlenmiştir. Özellikle bağlamsal bilgi eksikliğinin, çevrimiçi dersleri başarılı bir şekilde tasarlama ve uygulama becerilerini engellediği bulunmuştur. Çalışma, öğretmen adaylarının TPAB'ın tüm alt bileşenlerinde yeterlilik kazanmaları için yerleşik, yaparak-yaşayarak öğrenme yaklaşımının benimsenmesinin, öğretmen eğitimcileri tarafından sağlanan pedagojik mentörlüğün ve alan deneyiminin önemini vurgulamaktadır.

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1. Introduction

Online language teaching has started to become widespread worldwide, especially with the outbreak of the Covid-19 pandemic (Gacs et al., 2020; Nguyen et al., 2022). This change has prompted language institutions worldwide, including schools and universities, to adapt by offering online language classes (González-Lloret, 2020), consequently underscoring the demand for proficient online language instructors (Murphy et al., 2011). However, teaching online language classes effectively requires teachers to harness the benefits of online teaching and adeptly manage its challenges. This presents a compelling concern since online teaching greatly diverges from traditional face-to-face instruction (White, 2017) and mandates comprehensive training and support (Le et al., 2022).

Prior research underscores that limited knowledge about educational technology and negative perceptions about the efficacy of online teaching act as hindrances to effective online teaching (Aguilar, 2020; Xu et al., 2021). Moreover, language teachers teaching online often face challenges, such as "restricted student engagement, uncertainty about students' comprehension of learning content, technical issues, and insufficient technological skills" (Tao & Gao, 2022, p. 3). Within this context, it becomes an essential need for teachers to have a good understanding of three interlinked domains of knowledge: technology, pedagogy, and content (Koehler & Mishra, 2009) and possess technological pedagogical content knowledge (TPACK) relevant to online language instruction and learning (Tseng et al., 2019).

The TPACK framework emphasizes that teachers must skillfully deliver content by utilizing appropriate technology tools and pedagogical strategies (Tseng et al., 2022). TPACK knowledge is also crucial in online language teaching, in which online pedagogical, technological, management, and interactional competences are at work in a connected way (Moorhouse et al., 2021). Addressing the importance of TPACK for language teachers, prior research illustrates that when teachers have a deficit in TPACK knowledge, they tend to adopt a teacher-centered approach while integrating technology (Tseng et al., 2022). This approach features extant use of drill-and-practice exercises, and technology usage aims to present materials and increase students' motivation (e.g., Hlas et al., 2017; Singh & Kasim, 2019).

Another body of research investigated the effect of different types of interventions on TPACK development. Kharade and Peese (2014) incorporated modeling from teacher educators and a problem-based learning approach that required pre-service teachers to deal with real-life problems in a pre-service course. Likewise, Ansyari (2015) and Tseng et al. (2019) reported TPACK training programs in which pre-service teachers engaged in lesson planning, teaching, and reflective activities. Overall, favorable outcomes in terms of pre-service teachers' TPACK development were found in these studies, which accentuated the value of the learning-by-doing approach, collaborative lesson planning and contextual learning activities for fostering TPACK development.

Despite a recent surge in studies underscoring TPACK's role in language teaching (Qiu et al., 2022; Tseng et al., 2019), research associating TPACK with online language teaching (e.g., Papanikolaou et al., 2022; Tseng et al., 2016) remains limited. Existing studies discuss the advantages of TPACK training in the online language teaching context. However, the need for deeper investigation persists since the comprehensive understanding of the methods and characteristics constituting effective TPACK training for pre-service teachers remains incomplete. (Sun & Zou, 2022). Moreover, no study has specifically examined the TPACK development of pre-service teachers concerning online language teaching in the Turkish context. Considering these research gaps, this study aims to analyze the effect of a six-week

online teaching project integrated into a pre-service course on how these pre-service teachers perceive the integration of technology, pedagogy, and content in a pedagogically effective manner during online instruction.

2. Literature Review

2.1. TPACK as the Theoretical Framework

TPACK is a framework that explicates the knowledge required of teachers for effective technology integration (Koehler & Mishra, 2009). Built on Shulman's (1987) pedagogical content knowledge (PCK), TPACK addresses the interplay between these three types of knowledge: pedagogy, technology, and content. Content knowledge (CK) refers to subject matter knowledge possessed by teachers. Pedagogical knowledge (PK) is a broad concept involving many things, such as teachers' "educational purposes, values, and aims" (Koehler & Mishra, 2009, p. 64), their knowledge about the methods, techniques, and processes of teaching and learning, classroom management and assessment. PCK encompasses teacher knowledge of pedagogy used to teach certain content in a subject matter.

On the other hand, technological pedagogical knowledge (TPK) is a knowledge base that involves a combination of knowledge about teaching and technological knowledge (TK) that informs the domain-general use of educational technology for various teaching and learning processes across contexts (Koehler & Mishra, 2009). TK is a more general term that denotes people's competencies to utilize information technology in different ways to facilitate their lives and do their work more efficiently. On the other hand, technological content knowledge (TCK) pertains to understanding the interaction between technology and content and how they affect or change each other.

TPACK refers to knowledge about effective technology to optimize teaching and learning processes. It represents a grasp of the affordances and limited aspects of technologies and involves making instructional decisions that fit pedagogical purposes, context, and student characteristics to bolster student learning while integrating technology. The TPACK framework has been expanded to incorporate contextual knowledge, which refers to teachers' knowledge of the context, including their knowledge about the "available technologies" in their contexts and "school, district, state, or national policies they operate within" (Mishra, 2019, p. 76). The framework is pedagogically significant for educators aiming to enhance teaching through diverse technological tools.

2.2. Studies on EFL Teachers' TPACK Development

One research strand related to EFL teachers' TPACK has focused on measuring the TPACK levels of pre-service or in-service teachers. You et al. (2014) revealed that Chinese pre-service teachers' lack of TPACK tended to be one of the factors that led them to be hesitant about online language teaching. Similarly, Wu and Wang (2015) suggested that elementary school EFL teachers in Taiwan were most content with their PK while having difficulties with other TPACK components. In other studies (e.g., Chai et al., 2013; Cheng, 2017), the TPACK constructs were found too complex to distinguish for pre-service language teachers.

Related to the current study's focus, relevant research concentrates on enhancing the knowledge and skills of pre-service or in-service language educators for online language teaching or CALL (computer-assisted language learning). For example, Tseng et al. (2016) worked on enhancing TPACK for four Mandarin in-service teachers teaching synchronously, using teacher support groups for professional development. This approach notably

contributed to their TPACK growth. Similarly, Tai (2015) employed TPACK-in-action workshops, offering a learning-by-doing format for 24 EFL teachers in Taiwan, resulting in improved CALL competency.

Liu and Kleinsasser (2015) presented an in-service program for six Taiwanese EFL teachers, including training workshops on online project-based instruction. The teachers engaged in collaborative task design with their colleagues and exchanged ideas and reflections with university professionals. The findings demonstrated an improvement in the teachers' TPK, TCK, and TPACK at the end of this one-year-long professional development (PD) program. Similarly, in Bustamante's (2020) case study, 18 in-service teachers of Spanish as a foreign language learnt about Web 2.0, created online products, and did projects by collaborating with other teachers in a 15-week online PD program focused on the TPACK framework. The findings indicated enhancement in technology, pedagogy and content knowledge of teachers and their technology integration. In the pre-service education context, Tseng et al. (2019) reported using the design thinking approach in a 14-week course, which required six pre-service EFL teachers to design digital materials and activities and be involved in peer discussions related to web-conferencing teaching. Their study revealed that teacher discussions were centered on PCK, whereas discussions on TPK received scant attention.

In the Turkish pre-service education context, Yangın Ersanlı (2016) showed that 5-week training sessions enhanced 59 pre-service EFL teachers' TPACK knowledge. Similarly, in Aşık et al.'s (2018) study, pre-service language teachers who engaged in peer training on preparing digital materials significantly improved in all TPACK domains at the end of the study. Farhadi and Öztürk's (2023) study investigating Turkish EFL pre-service teachers' TPACK levels and needs revealed that pre-service teachers in the study had a relatively high level of proficiency in terms of TPACK. However, findings also revealed they needed support in TK, TCK and TPK development. In another study into the TPACK in the context of pre-service teacher education, Baran et al. (2017) emphasized the need to integrate information technologies into language teacher programs systematically. They indicated that incorporating the synthesis of qualitative evidence (SQD) model into pre-service teacher education will likely foster their TPACK development. Findings revealed the favorable impact of teacher education strategies on pre-service teachers' TPACK. In addition, Pamuk (2012) underlined the crucial role of teaching experience in developing TPACK domains such as PCK, TCK, and TPK in pre-service teacher education programs.

The literature review indicates limited studies on the association between TPACK and online language teaching. Considering this research gap, the research question of the current study is as follows: How did Turkish EFL pre-service teachers' participation in an online teaching project designed with a collaborative and situated approach contribute to their TPACK development?

3. Methods

3.1. Research Design

A case study design was utilized in the current study to delve into the participating pre-service teachers' online language teaching experience and to reach a deep understanding of their TPACK development (Creswell, 2013). A case study is preferred when an in-depth scrutiny of a case is needed to explore a specific issue (Creswell, 2013). The present study aimed to provide a detailed and thick description of the context and report the unique experiences of the participating teachers trained in online language teaching for the first time.

3.2. Participants

The study involved nine pre-service teachers in their final year of a four-year undergraduate teacher education program at a large English-medium state university in Central Anatolia, Turkey. They studied to become EFL teachers and were enrolled in a course, Designing and Using Digital Materials in Language Education, with 40 students. They were selected through purposive sampling when they volunteered to join the study. The project comprised four pairs of pre-service teachers and one individual pre-service teacher instructing online lessons, as indicated in Table 1. Of nine pre-service teachers, seven were male, and two were female, aged between 20 and 22. While eight were Turkish, making Turkish their native language and English a foreign one, one participant hailed from Somalia and spoke Arabic as their native language. Despite this language diversity, the difference in their native language did not pose a problem for the study, and their advanced English proficiency facilitated the study.

Table 1.
Participants

Teachers	Paired with	Group Number
Ian	Sam	Group 1
Sam	Ian	
Andrew	Matthew	Group 2
Matthew	Andrew	
Kate	–	–
Bob	Barbara	Group 3
Barbara	Bob	
Brian	Lucas	Group 4
Lucas	Brian	

The participants signed a consent form to approve that their participation was based on their volunteerism. By doing so, they agreed that the data collected in the study would be used for research purposes only and that their identities would be kept confidential in any publications using these data. Each participant was assigned a pseudonym, considering ethical issues and data confidentiality.

3.3. Research Context

The online language teaching project was part of the 14-week face-to-face course to enhance pre-service EFL teachers' techno-pedagogical skills. The course focused on Web 2.0 tools, digital material creation, and interactive discussions. Participants learned to use these tools, design activities, and give classroom presentations. Tech-enhanced lesson plans were required. The project was 45% of their grade.

The project aimed to enhance the online language teaching skills of pre-service teachers who did not take any online language teaching courses. They became pairs with their classmates to create and deliver synchronous and asynchronous lessons to 7-9 university students taking an associate degree course in Vocabulary and Composition. This course was part of the Foreign Languages department and had 38 students grouped according to the researchers' designations. The students had an almost intermediate proficiency level, participating voluntarily. The role of the second researcher was to deliver the digital material design course embedding the online teaching project. The joint role of the first and second researchers was to provide the pre-service teachers with guidance and feedback during their experiences with online teaching.

3.4. Procedure

A comprehensive wiki was established to present information about different aspects of online teaching, such as fostering online engagement and promoting different interaction patterns. On this wiki, exemplary synchronous and asynchronous lesson plans were provided. Additionally, a set of structured tasks, which ranged from reading and crafting lesson plans to developing digital teaching materials, conducting lessons, and reflecting on the outcomes, was assigned each week.

Edmodo classes were established to implement asynchronous lessons. Each pre-service teacher group were to prepare their asynchronous lesson plan, upload it to a file in Google Drive, and share it with the researchers of the study. The researchers gave them feedback on their lesson plans online through Google Docs by writing comments, asking for necessary changes to be made, checking the changes, and approving the final form of the lesson plans. This process was repeated for the second asynchronous lesson. In implementing the first asynchronous lesson, they also acted as a teacher to scaffold the pre-service teachers and model effective online teaching practices by writing comments or questions on students' posts, summarizing their contributions and the like. After teaching two asynchronous lessons, the pre-service teachers were asked to write a reflection report about these lessons.

Later, the pre-service teachers prepared their synchronous lesson plans to be held on Zoom. Since the pre-service teachers had already used Zoom for their practicum while teaching English online to K-12 students, they were competent in using it. The researchers gave feedback on the prepared lesson plans. They also joined the live session to observe the lesson and provide feedback later. In these sessions, one pre-service teacher carried out teaching practices while the other had responsibilities such as monitoring students and providing technical help. The pre-service teachers shifted their roles in different stages of the lesson. The one who taught solo fulfilled all these on her own. The researchers took notes of the lesson's salient features, focusing on the pre-service teachers' strengths and some parts of teaching that can be improved for future practice. They later held a Zoom meeting with the teachers to discuss their teaching experience and give feedback on their teaching. At the end of the study, the pre-service teachers were asked to write another reflection report concerning their synchronous lesson.

3.5. Data Collection Tools

To triangulate data, the researchers used various data collection instruments. The within-method methodological triangulation was adopted in the study (Creswell, 2013; Denzin & Lincoln, 2018). It refers to a type of methodological triangulation that employs more than one data collection method within one research design in a case study. Investigator triangulation was adopted in the study, which is concerned with investigating the phenomenon in focus by multiple researchers via separate data collection and/or data analysis (Fusch et al., 2018).

The primary data collection tools were two reflection reports (one report for their asynchronous lessons and one report for the synchronous lesson) and an interview. The reflection reports aimed to uncover the pre-service teachers' experiences preparing and integrating digital materials into online lessons. To this end, pre-service teachers used a reflection report template that included questions about the effectiveness of digital material preparation, lesson delivery phases, insights gained, teaching challenges, and their solutions.

Another data collection tool was interviews, which were open-ended and semi-structured. The interview questions were designed to gather information about the pre-service teachers'

overall assessment of the project, the impact of the project on their professional growth, the effectiveness of their lessons, insights gained for improving future teaching practices, and suggestions for future projects. Expert opinion was gathered to achieve content validity for the questions and enhance the quality of the interview questions. Accordingly, two colleagues holding doctoral degrees in ELT evaluated the clarity and relevance of the questions about the study's objectives. Based on their feedback, some questions were rephrased, and more questions were added to gather more detailed participant responses.

Interview sessions were conducted via Zoom after the end of the project. Each session took 20-30 minutes and was held in Turkish to foster a relaxed and stress-free atmosphere. The sole exception was the interview with the Somalian participant, which was conducted in English based on his language preference. Pre-service teachers were interviewed with their peers, while the solo teacher was interviewed individually. Secondary data collection tools included lesson plans, video recordings of the synchronous lessons and student and teacher posts on Edmodo for triangulation purposes.

3.6. Data Analysis

For the trustworthiness of the data analysis procedure, both researchers analyzed and coded the data separately. All the interviews were transcribed verbatim and translated into English for data analysis. These translations were checked by an academician who is an expert in translation and interpreting for reliability. The data analysis was performed through thematic analysis using Murray's (2009) procedure. Firstly, the researchers read and scrutinized the whole data set to identify the data related to the research questions and tagged the data through words, phrases, or complete sentences. Codes were created based on similar meanings. This was followed by categorizing codes, which included comparing all the codes iteratively and combining the related codes into categories. Following the identification and constant refinement of the categories, main themes and sub-themes were derived from these categories. When there were differences between the categories or themes identified by the researchers, they negotiated on the categorization issue until they reached an agreement. For the reliability of the analysis, the inter-rater agreement was calculated and found to be .90, which indicates a high level of agreement between coders (Gwet, 2014). After the data from the interviews and reflection reports were analyzed, they were triangulated with the data from other data sources, including lesson plans, video recordings of the synchronous lessons, and student and teacher posts on Edmodo to further promote the study's trustworthiness. The researchers also analyzed these secondary data separately to identify instances of TPACK development and to associate them with the main themes emerging from the interview and reflection reports.

4. Findings

4.1. Pedagogical Knowledge (PK)

Many pre-service teachers in the study highlighted that they developed their PK concerning asynchronous lesson planning and task design. For example, Andrew stated the following for the asynchronous lessons he conducted in the project during the semi-structured interviews (SSI):

> *I think the most important aspect of asynchronous lessons is maximizing student communication. I will make sure communication is maintained throughout the course.* (SSI)

Quite a few pre-service teachers emphasized the importance of meticulous consideration for online synchronous lesson design features to ensure smooth and effective delivery. To

illustrate, Brian expressed how he was planning to incorporate his new pedagogical insights into his future teaching experiences below:

> *Conducting an online synchronous lesson is so difficult without students' active participation. Next time, I will make the instruction part shorter, alter the role-playing part and include another activity to improve students' motivation for more participation.* (SSI)

In their reflective journals (RJ), the pre-service teachers mentioned that they ameliorated their pedagogical skills for asynchronous teaching thanks to their course instructors' ongoing scaffolding and guidance. Some other participants also mentioned that they found it quite hard to sustain student engagement in the first asynchronous lesson but had improvements in maintaining students' interest and active participation in the following lesson.

Pre-service teachers' gradual progress was noticeable in their asynchronous and synchronous task design and the arrangement of task sequences in their online lesson plans. Although they provided long and complicated instructions for students while designing their first asynchronous tasks, which resulted in students' loss of motivation, they managed to improve their instructions on their second asynchronous task.

4.2. Pedagogical Content Knowledge (PCK)

Many pre-service teachers reported encountering hardships while transferring their teaching skills to online learning environments. They also stated that by participating in this project, they gained substantial experience in tailoring their instructional materials and their teaching style to their students in the online learning environments, as expressed by Mathew below during the semi-structured interview:

> *We need to focus on e-activities instead of standard textbook-style materials. The teacher is not supposed to give a lecture in online classes, but he/she needs to facilitate students' understanding of the topic. We can integrate some funnier materials, which may provide a better classroom environment for the students.* (SSI)

In their reflective journal entries, some participants reported that they tried to achieve content alignment to some extent while teaching synchronously, following their asynchronous lessons. They pointed out that they commenced their synchronous lessons by conducting a content schema activation activity based on the theme of their previous asynchronous lessons through mind-mapping, brainstorming or concept checking. They indicated that engaging students in such a warm-up activity in the initial stage of the synchronous lesson turned out to be motivating for the students and fostered student participation in the synchronous lesson to a certain extent. An analysis of the lesson plans showed that the participants often sought effective ways of teaching certain content by choosing interesting topics or materials to motivate the learners and promote their active participation.

4.3. Content Knowledge (CK)

Pre-service teachers expressed satisfaction with their professional learning experience in adjusting classroom language to students' English proficiency levels during synchronous lessons. They, however, also reported that due to their lack of previous feedback provision experiences for students with low proficiency in English, they initially had difficulty tailoring their language to the level of their students during their synchronous lessons. The following quote by Bob during the semi-structured interview is quite revealing in this respect:

> *It was tough for me to give feedback to my students during my first synchronous lesson. I could not help giving feedback to my students as I was giving feedback to my peers in our course sessions at university. It did not work at all. When I saw the blank look on their faces, I realized that something had gone wrong and tried to simplify my language so that my language was accessible to them.* (SSI)

In their reflective journals, pre-service teachers noted that their participation in the online teaching project aided them in simplifying classroom language, especially when writing down instructions for asynchronous tasks. The feedback sessions they held with their course instructor proved beneficial for them in revising their online teaching strategies and adopting a reflective and critical perspective into their asynchronous and synchronous task design and delivery processes. The following quote is representative in terms of students' pedagogical gains related to CK in the study:

> *I found that only a couple of students completed the first asynchronous task on Edmodo, which disappointed me as I worked on it for a while. Initially, I could not understand why my first online task design failed until my instructor told me the instructions were too complicated for my A2-level students. I paid a lot more attention to employing simplified language while giving instructions for my second asynchronous task, and it was really encouraging to see an increase in student participation.* (RJ)

When the pre-service teachers' posts in the asynchronous platform were examined, the participants were found to simplify their feedback language in alignment with their learner profiles. They also seemed to navigate the online student interaction by successfully manifesting their presence as teachers on Edmodo. An analysis of their videotaped lessons indicated that they had varying degrees of challenge in adjusting their language to match the proficiency level of their students during their online teaching engagement.

4.4. Contextual Knowledge (XK)

Findings revealed that the online teaching engagement contributed to the pre-service teachers' development of XK and raised their awareness in this respect, while these teachers also noted some challenges. Due to their lack of knowledge about students' interests and proficiency levels, all the participants in the study found it hard to align the relevant content, tasks, and technological tools with students' age, proficiency levels, and interests. Therefore, they struggled to establish a dynamic and interactive learning environment and to promote student engagement and participation, particularly during the asynchronous sessions. The following quotes from the interviews by Lucas and Brian presented, respectively, are representative in this respect:

> *… The biggest challenge came from not knowing about the levels of our students. The tasks would have been a lot better if we had had a chance to meet with the students before designing them.* (SSI)

> *…we were unsure of students' proficiency levels until we met them in synchronous lessons. I believe that we could eliminate this problem if we met them personally and had a chit-chat in a Zoom meeting beforehand.* (SSI)

The pre-service teachers mentioned in their reflective journals that knowledge about the learner profile contributed to their agency regarding technology integration and boosting their technological self-efficacy. They reported benefiting from their instructors' pedagogical and technical mentoring regarding XK development for synchronous and asynchronous lessons. The following reflective journal entry by Ian reflects this sentiment effectively:

> *In our first synchronous lesson, I prepared a warm-up activity based on their future professional goals. Not having sufficient background knowledge about the students, I assumed they would be interested in working as translators after graduation as they were studying in the translation and interpretation department. However, it turned out to be that their motivation to study at the department was to be English teachers. Even though I made instant changes in the activity structures, the warm-up part did not go as successfully as I expected.* (RJ)

An examination of the pre-service teachers' lesson plans revealed their enhanced awareness towards the characteristics of the learner profiles in their own context in the study. It was seen that they considered the motivation and proficiency levels of their students and made informed pedagogical choices as to how to incorporate technology into their lessons efficaciously and how to design level-appropriate online tasks for both types of lessons.

4.5. Technological Knowledge (TK)

Some participants expressed that their project engagement enhanced their digital literacy skills. This was concisely revealed in the following quote by Barbara:

> *Using Edmodo with a teacher account was a new experience for me. I have gained some abilities, such as assigning homework, adding class members to be enrolled in the classes, and posting materials for asynchronous classes.* (SSI)

Some pre-service teachers expressed their favorable opinions on the awareness-raising impact of the project towards the advantages and limitations of different Web 2.0 tools. The following comment by Matthew was quite revealing in this respect:

> *I was looking for a formative assessment tool to evaluate students' understanding of countable and uncountable nouns. Before my project engagement, I was familiar with Kahoot as a game-based learning platform, but I knew that it was hard to monitor the students' replies and focus on the right and wrong options as the students were carried away with the excitement of getting more points than others. While searching for a better alternative to use, I discovered Quizizz. It also uses game-based elements but is a much more effective tool for formative assessment.* (SSI)

Even those with a slightly lower TK than others reported raising their familiarity with the e-tools and websites while designing their synchronous and asynchronous activities. Sam illustrated this in his reflective journal:

> *While designing our asynchronous classes on Edmodo, I used Piktochart to create posters. … It was a web tool that I had used before.* (RJ)

Participants expressed in their reflective journals that exploring different features of digital tools for lesson planning processes was an empowering professional learning experience for them, enhancing their technological self-efficacy. It was also noted that they generally designed their online lessons using the e-tools with which they were already familiar. The following reflective journal entries by Sam and Andrew provided respectively were revealing in this sense:

> *Piktochart is a tool that I used in previous courses, and this familiarity from prior semesters was the reason behind my choice of poster task.* (RJ)

> *For my asynchronous lesson, I used Google Docs as a platform for students to work on the same sheet simultaneously. I faced no challenges since I am very familiar with Google Docs.* (RJ)

Some pre-service teachers who perceived themselves as more equipped in terms of TK preferred to adopt a problem-solver attitude when faced with technical challenges using Web 2.00 tools, as seen in Bob's reflective journal entry given below:

> *I had struggled a little while extracting the video from Screencast-O-Matic, but then I learned that the program uploads it directly to Drive. I found it extremely simple to learn.* (RJ)

An analysis of the lesson plans showed that some pre-service teachers refrained from integrating the digital tools they learned in the course into their lesson plans. It appeared that they had varying degrees of TK. Those with a relatively low degree of TK preferred to incorporate only the e-tools and websites they were already familiar with and were not interested in discovering new tools during the project. On the other hand, those with more TK were adept at incorporating new tools into their lesson plans.

4.6. Technological Pedagogical Knowledge (TPK)

The findings indicated that the project engagement provided pre-service teachers with significant affordances in TPK development. They emphasized the affordances of peer collaboration during the processes of the online lesson design, the teaching material and the e-tool selection, and the lesson implementation. However, they also voiced various pedagogical and technological challenges they encountered in online teaching. They expressed their difficulty integrating technology and pedagogy in their lesson planning process. They found it hard to align the pedagogical goals with the teaching materials and e-tools, prepare teaching materials related to the topics of their synchronous and asynchronous lessons, and organize the staging of different activities in the lessons. The following comment by Matthew regarding his asynchronous lesson is quite revealing in this respect:

> *… I had difficulty integrating the materials with the topic. I tried to overcome this problem by working just like a tailor because I organized the activities and materials harmoniously and solved the problem.* (SSI)

As opposed to some who were relatively successful at preparing and implementing asynchronous lesson plans, some had challenges implementing them. These participants remarked that they had difficulty integrating the asynchronous instructional strategies that their researchers shared with them into their lesson plans. They felt discouraged when they failed to obtain responses from students to their questions and when there was no active student engagement. Sam made the following comment in this respect:

> *I reckon that one of my activities was not clear enough for my students as I neglected to give the instructions in a more structured way. When it is online, it is not as straightforward as it is face-to-face. We need more guidance in such things.* (SSI)

Some participants also stated they had challenges employing online classroom management strategies to foster student engagement and participation. Many participants highlighted their role as facilitators in online learning environments. In fact, regarding their synchronous lessons, Bob expressed his disappointment with the lack of student participation in his class during the semi-structured interviews:

> *Student participation was not as high as we had hoped…We tried a few things for that, but it was difficult. I did not know what else to do.* (SSI)

The analysis of the reflective journals revealed the favorable impact of e-tool integration on their pre-service teachers' management of the synchronous learning environment. They

remarked that although the students were happy to have the interactive online atmosphere on Zoom with the teacher and their peers, they observed a relatively low level of peer interaction overall. They pointed out that although they tried to benefit from the breakout facility of Zoom, it failed to produce a noticeable change in the quantity of student exchanges. They revealed that integrating Padlet and a Google Jamboard into the breakout room activities, where students are asked to present their pair/group work in written form and to comment on the work of their peers, seemed to benefit the level of peer interaction during synchronous lessons.

An analysis of the asynchronous and synchronous lesson plans indicated the pre-service teachers' endeavors to engage students in active learning via various technological tools. They used certain strategies to nurture and sustain student motivation in both lesson types. Some of these strategies included the following: integrating engaging videos such as TEDTalks and interactive videos (e.g., ED-puzzle videos), incorporating Google documents for collaborative writing, and adding gamification elements to the lessons to support learning outcomes via the use of Kahoot, Quizzes, and Quizlet. Other strategies included leading their students by using examples, setting rules for participation, and using names while commenting on students' posts. The following quote during the semi-structured interview displays Andrew's experience in the asynchronous lessons:

> *Designing an interactive video assignment via ED-puzzle was a real professional learning experience. I saw in my asynchronous lesson that an interactive video task was far more effective and more motivating for students than a traditional video task, where students first watch the video and then reply to a set of questions based on it. As a teacher, integrating an interactive video into my class helped me achieve the learning outcomes I set for the task more easily.* (SSI)

The following quote displays Andrew's experience in the asynchronous lessons as he reflected in his journal:

> *I learned that one must be more descriptive and exact with instructions, especially in asynchronous lessons. Since students will not have direct access to the teacher, they may misunderstand the prompt and not have the chance to ask the teacher for clarification. If I could prepare the materials for the same lesson again, I would use simpler language for the instructions and try to be more descriptive.* (RJ)

Some pre-service teachers were also observed to maintain teacher presence in the synchronous lessons by guiding and monitoring the student interaction through various questions and allowing them to personalize to a certain extent. They often established a link between the topics of their asynchronous lesson and the synchronous lesson. Ian, for instance, commented regarding the teacher's presence in online lessons in the following way in his reflective journal:

> *I learned that in an online medium, the students do not always feel engaged and actively participate in the classroom. I learned that we, as teachers, always have to be there for them, checking what is going on and engaging them with different activities.* (RJ)

4.7. Technological Content Knowledge (TCK)

The pre-service teachers emphasized that they gained valuable insights into choosing appropriate technologies to tackle specific content and the affordances and constraints pertinent to the technological tools available for asynchronous and synchronous lessons. They

also pointed out the importance of teachers' competence related to the TCK in delivering effective online lessons. The following quote by Barbara indicates this insight concisely:

> *Using online platforms for knowledge sharing and interaction is important in teaching in an online environment. Teachers must master such digital materials before implementing them in the lesson.* (SSI)

However, some pre-service teachers' lack of TCK seemed to interfere with choosing appropriate Web 2.0 tools in alignment with the content of their activities while teaching synchronously. For instance, Brian expressed this below during the semi-structured interviews, referring to the need to carefully consider the interactivity-generating potential of the e-tools in synchronous lessons.

> *I decided to use VoiceThread to create an engaging, interactive and collaborative online discussion about the pros and cons of living with the family and staying in the dormitory. I thought its multimodality feature enables students to interact with one another in different ways. However, due to its interface, some students could not easily follow their peers' responses. Also, some could only use the written but not the audio comment feature due to their computers' lack of an in-built microphone feature. Therefore, the activity did not generate much interaction. I regretted not using the Tricider, which allows them to comment on each other more interactively and organizedly due to its relatively easy-to-use interface.* (SSI)

Some pre-service teachers also pointed out the insights they developed related to the link between the content and technology in their reflective journals. They stated that in asynchronous and synchronous lessons, the topic and material choice should be considered along with the technological tool choice. The following quote by Sam during the interviews illustrates this point:

> *Most of the videos regarding the topic were aimed at children. I believe that from this task, I learned the topic itself and its materials are factors in choosing that topic. If I hadn't managed to find a suitable video, I would simply have changed the topic.* (SSI)

The participants also revealed in their reflective journals that their online teaching project engagement promoted their TCK. To illustrate, Kate shared her asynchronous and synchronous experience in the following quotes respectively:

> *I used a TED-ed video for one of my asynchronous lessons. I believe this video helped my students visualize the content more deeply.* (RJ)

> *I used Ed-puzzle to provide an interactive video during my synchronous class to grab my students' attention in the first place. The video involved some basic unusual jobs and some comprehension check questions. In particular, the quiz helped me see the appropriateness of the material I brought to my audience as they gave it enthusiastically.* (RJ)

An analysis of the students' asynchronous and synchronous lesson plans also reflected that pre-service teachers improved how they used technology to convey the content in the project progressively. This improvement was evidenced by their ability to align the choice of technological tools with the lesson content. Moreover, raising awareness about the affordances and limitations of digital tools resulted in the professional empowerment of pre-service teachers as they designed and implemented both asynchronous and synchronous lessons.

4.8. Technological Pedagogical Content Knowledge (TPACK)

The participants reported that their online teaching engagement fostered their general integration of technologies, content, and pedagogies. However, they were also found to have varying levels of TPACK development.

Some teachers established the link between technology, pedagogy, and content more efficiently. The following quotes from Matthew and Ian illustrate that they were aware of the relationship between different components of TPACK during the interviews.

> *I think the students enjoyed the tasks because their participation was high, and the topic was interesting for them, which attracted them. The e-tools helped the students be active in the tasks because they are familiar with the cyber world, which is an interesting topic for them.* (SSI)

> *Student participation is quite important for the asynchronous lessons, and I believe we have achieved substantial participation. We selected a topic that the students generally knew. They enjoyed the tasks as they could share their opinions with others and comment on others. All of these affected the quality of the lesson.* (SSI)

Some pre-service teachers indicated in their reflective journals that they dealt with technology, pedagogy, and content in isolation while preparing their lessons. They remarked that they found it hard to merge technology appropriately with content and pedagogy and needed more scaffolding and guidance on achieving this integration. They tended to use some technological tools without considering their pedagogical affordances or specific contributions to teaching certain content. This is reflected in Bob's quote given below:

> *I did not think much about how students could benefit from the online quiz I created. I thought it could be interesting, and that's it. I am not sure if the students learned the topic.* (RJ)

In their first synchronous lessons, some pre-service teachers acknowledged their difficulty in achieving a smooth transition between the asynchronous and synchronous lessons and the unfavorable effect of the lack of active student engagement on student participation in the synchronous lessons. However, they achieved active student involvement in both types of lessons in their second implementation.

Regarding the pre-service teachers' challenges with the TPACK development, they also remarked that they initially found it challenging to achieve the learning outcomes of both asynchronous and synchronous lessons as they were unfamiliar with teaching in online learning environments. They did not foresee how students' participation in the asynchronous lessons was likely to influence their participation in the synchronous lesson. They also mentioned that in the initial stages of the project, they found it hard to decide on the most appropriate Web 2.0 tool among similar tools aligned with the activity's pedagogical goals. However, as they gained more familiarity with the Web 2.0 tools in the course, their technology knowledge developed, and they started to integrate technology into pedagogy along with the content via the choice of an appropriate online task design.

The project engagement facilitated pre-service teachers' general pedagogical and digital competency development. The pre-service teachers' training related to the asynchronous and synchronous lesson plan preparation and sharing sample lesson plans with them had a beneficial impact on their asynchronous and synchronous lesson design and implementation process. Other activities in the departmental elective course where the project was integrated also facilitated the pre-service teacher participants' TPACK development. These activities include classroom presentations on various Web 2.0 tools, digital material design activities and the introduction of several theoretical frameworks regarding technology integration into language classes, such as Blooms' digital taxonomy and universal design for learning. The participants' implementation of the synchronous and asynchronous lessons acted as a catalyst in their TPACK development.

4. Discussion

The study suggested that an online teaching project, designed with a learning-by-doing (experiential learning) approach, had many benefits for the pre-service teachers' TPACK development. This finding was in line with past research (e.g., Chapelle & Hegelheimer, 2004; Hubbard, 2008; Sert & Li, 2017; Tondeur et al., 2018; Tseng et al., 2019; Yangın Ersanlı, 2016). These studies also highlight the benefits of offering pre-service teachers hands-on situated practice opportunities.

Another salient finding of the present study is related to the importance of developing XK for pre-service teachers to enhance the quality of instruction in online teaching environments and to facilitate their digital material design process. This finding aligned with that of Koehler and Mishra (2009) and Kurt et al. (2014), underlining contextual factors' significant role in effectively integrating content, technology, and pedagogy. In other words, the findings further contributed to our understanding of how their XK-mediated pre-service teachers situated TPACK enactment, which echoed Tseng et al. (2019).

A further highlight of the current study is the pivotal role teaching experience plays in developing pre-service teachers' TPACK knowledge in an integrated fashion. In fact, like the pre-service teachers in Pamuk's (2012) study, those in the current study found it hard to effectively enact their TK knowledge in their asynchronous and synchronous lessons due to their lack of pedagogical experience. In the same vein, the significance of field experiences in facilitating technology integration was accented by Bullock (2004), Kurt et al. (2014) and Niess (2008). These experiences help pre-service teachers better understand the interconnection between technology, pedagogy, and content intricacies.

As another prominent finding, the difficulty pre-service teachers in the study encountered in gaining competence in all components of TPACK in the current study is consistent with Chai et al. (2013), Cheng (2017), Farhadi and Öztürk (2023) and Tseng (2018). The pre-service teachers' lack of competence in all TPACK domains might be related to the relatively short duration of the study, which might be regarded as a hurdle for pre-service teachers' development of a holistic focus on the interplay between technology use, pedagogical goals, and the lesson content. Another reason can be the insufficient incorporation of information technologies into mainstream EFL pre-service teacher education departments, corroborating the findings of Aşık et al. (2018) and Mouza et al. (2014). It might also be linked to teaching CK and PK in teacher education programs separately from one another (Hobbs, 2013), which are indicated to be interrelated (Segall, 2004). As also emphasized by Cheng (2017), gaining competence in different components of TPACK in an isolated fashion is not likely to effectively promote the pre-service teachers' TPACK development. Likewise, the present study underlined the importance of avoiding such an isolating approach and demonstrated a compelling need for teacher educators to adopt a holistic and context-sensitive perspective in integrating the TPACK framework into pre-service teacher education (Candlin & Widdowson, 1987; Kumaravadivelu, 2001).

The study demonstrated pre-service teachers' challenges regarding various TPACK dimensions, such as TPK, TCK, and TK, which might interfere with their lack of TPACK development. The pre-service teachers' concerns about enacting the abovementioned TPACK components in an integrated fashion were also consistent with Farhadi and Öztürk (2023). As suggested by Liu and Kleinasser (2015), developing pre-service teachers' TK does not guarantee their TPACK development and may not indicate their success in pedagogically effective technology integration. The current study also pointed out that without developing TPK and TCK, pre-service teachers could not effectively implement their TPACK

knowledge in online teaching/learning environments. The need to address each component of TPACK is vital in teacher education programs to foster the pre-service teachers' TPACK development, as also stressed by Baran et al. (2017). The challenges encountered by pre-service teachers underscored the importance of scaffolding and modeling provided by teacher educators for effective linking of PK, TK, and CK.

Finally, the study pointed out the value of peer collaboration for TPACK development, aligning with earlier research by Nguyen et al. (2022) and Taghizadeh and Ejtehadi (2023). Working collaboratively during online lesson planning and implementation processes appeared to help pre-service EFL teachers manage online classes better and handle their online teaching anxiety levels more easily (Taghizadeh & Ejtehadi, 2023). This finding accentuated the essence of including activities based on peer collaboration while preparing pre-service teachers for technology-enhanced teaching practices, which can help to promote their self-efficacy of technology integration and teacher agency (Taghizadeh & Ejtehadi, 2023).

5. Conclusions and Implications

The study underlined the significance of pre-service teachers' engagement in collaborative online technology-enhanced lesson plan preparations and the implementation of these plans with the support and scaffolding of teacher educators in the Turkish tertiary context. One significant implication of the study is that to enable pre-service teachers to enhance their techno-pedagogical competence and technological self-efficacy, teacher education programs should integrate the TPACK framework into the four-year curriculum. As of the freshman year, a technology-enhanced learning component should be integrated into methodology courses and other content area courses in the pre-service language teacher education programs. Effective online interaction strategies and e-tools to foster online student interaction, online formative and summative assessment, and various strategies for establishing online teacher presence and cognitive and affective presence in online learning platforms can be included in the curriculum of teacher education programs. These topics can be addressed in a stand-alone or elective course or incorporated into ELT methodology and practicum courses.

The methodology courses in teacher education programs should incorporate an online micro-teaching module. To fully internalize the framework, pre-service teachers should also be provided with opportunities to display their TPACK knowledge via TPACK-based lesson plans while implementing their teaching tasks throughout the practicum in their final year. Here, teacher educators can play a facilitator role, modeling the required skills and providing continuous guidance, scaffolding, and feedback. These are particularly important for pre-service teachers with few or no online teaching experiences to alleviate their online teaching anxiety levels. Teacher educators may also provide collaboration opportunities between pre-service and in-service teachers in communities of practice. Additionally, a reflective component can be integrated into the teacher education programs to facilitate the pre-service teachers' internalization of their hands-on and situated online teaching practices and their peer learning experiences.

As a limitation of the study, the results cannot be generalized due to the short duration of the implementation and the small number of participants. Further studies can include longer duration and more participants. Additionally, the pre-service teachers can be given a chance to teach for a more extended period to practice their online language teaching skills better, and they can be allocated additional time to familiarize themselves with their students,

facilitating better orientation for both parties involved in the project. Further studies could investigate how the knowledge and skills gained in this project transfer to other teaching contexts for these pre-service teachers. This could involve examining their application in their future practicum courses or the first years of their teaching career.

Note on Ethical Issues

The authors confirm that ethical approval was obtained from Middle East Technical University on 16/8/2023 with the decision number 0377-ODTUİAEK-2023.

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