PRE-SERVICE EFL TEACHERS AS DIGITAL MATERIAL DESIGNERS: A CASE STUDY INTO THE TPACK DEVELOPMENT IN THE TURKISH CONTEXT

by **Işıl Günseli Kaçar**

Middle East Technical University, Ankara, Turkey

isil @ metu.edu.tr

Abstract

Pre-service teachers of the 21st century are expected to be equipped with both pedagogical and digital competence. In fact, teacher education programs should give prospective teachers the opportunity of becoming the designers of their own lessons instead of dictating them certain ways of integrating technology. The pre-service teacher education programs tend to fail to equip prospective teachers with a sound TPACK knowledge base, which is likely to pose a challenge for them in the way of effective technology integration. The aim of the 10-week qualitative study was twofold: (1) to examine the TPACK development of the English as a Foreign Language (EFL) pre-service teachers of English in Turkey at a private K-12 school and 2) to investigate how Turkish pre-service teachers' TPACK knowledge was reflected in their digital materials. 24 pre-service EFL teachers who took the elective course "Designing and Using Digital Materials for ELT" in the spring semester of the 2020 and 2021 academic year and 9 in-service EFL teachers at a private K-12 school participated in the study. Purposeful sampling was used for the participant selection. The data were collected via pre-service teachers' reflective journals as well as a technology integration observation instrument (for in-service teachers) (Harris et al., 2010) and analyzed via content analysis. The findings revealed that the pre-service teachers reported gains in terms of all the components of the TPACK framework (Koehler & Mishra, 2009) in varying degrees, with an enhanced awareness towards the purposeful integration of technology, content, and pedagogy.

Keywords: technology integration; digital literacy; technological pedagogical content knowledge (TPACK) development; pre-service teachers; digital materials

1. Introduction

Today's language teachers are expected to possess "more than just so-called 21st century skills" such as creativity, collaboration, critical thinking, and problem-solving" (Tafazoli, 2021a, p. 604). Being proficient in digital literacy is regarded as "a survival skill" for the 21st century teachers (Eshet-Alkalai, 2004, p. 101). In this paper, digital literacy is defined as "an ability to interpret, manage, share and create meaning in the growing range of digital communication channels" (Tafazoli et al., 2017, p. 716). It is essential not only to enhance the future teachers' digital skills but also to teach them how to transfer these skills into real classroom contexts (see Tafazoli, 2021a, 2021b). There seems to be a shift in emphasis on recent Computer-Assisted

Language Learning (CALL) research from "*whether or not* to integrate language instruction to language teaching to "*how, when* and *for what purpose* technology can be effectively integrated (Nami, 2021, p. 578) (see also Labbas & El Shaban, 2013). Today's teachers are supposed to integrate their CALL-related literacy into their course/lesson planning, implementation, and evaluation (Nami, 2021). To manage students who "have access to anything they want to learn on their own, at any time" (Baskerville, 2012, p.119). 21st century teachers are expected to provide effective technology-enhanced instruction (Egbert et al., 2011).

The above-mentioned language teacher profile is also expected in the Turkish context (Kımav & Kürüm-Yapıcıoğlu, 2021). In fact, the Council of Higher Education stated that teacher candidates are supposed to operationalize their content-area and pedagogical knowledge via their Information Communication Technology (ICT) skills and to use these ICT skills effectively in teaching (Brittingham et al., 1999). Turkish pre-service teachers are expected to be equipped with well-developed technological pedagogical content knowledge (TPACK) to be able to effectively integrate technology into their future teaching practices. The Turkish Ministry of National Education also included digital competencies as one of the general competencies for teachers in the K-12 context (Directorate General for Teacher Training and Development, 2017). However, since Turkish pre-service teacher education programs fail to provide teacher candidates with a sound TPACK basis for effective technology integration, the pre-service teachers tend to encounter considerable challenges in this regard. Although technology integration has been investigated in teacher education and professional development (Nazari & Xodabande, 2020), there seems to be a lack of concentration on the pre-service teachers' technopedagogical development (Tafazoli, 2021b). Considering the paucity of research on the pre-service teachers' digital literacy development in the Turkish context (e.g., Koçoğlu, 2009; Kurt et al., 2014), the current study investigates the TPACK development journey via a digital material design project as well as how the Turkish pre-service EFL teachers' TPACK knowledge is reflected in these digital materials.

The current study addressed the following research questions:

1. In what ways did a digital EFL material design project contribute to the TPACK development of Turkish pre-service EFL teachers in a pre-service language teacher education program?
2. How was the Turkish pre-service EFL teachers' TPACK knowledge reflected in their digital EFL materials in the project?

2. Literature review

2.1. The theoretical framework: Technological Pedagogical Content Knowledge (TPACK)

TPACK is an extended version of Shulman's (1986) categorization of knowledge for teaching content via technology (Mishra & Koehler, 2006). It has been introduced as a conceptual framework for teacher knowledge for effective technology integration (Mishra & Koehler, 2006). It focuses on "the integration of content, pedagogical and technological knowledge" which is mostly neglected in teacher education and professional development programs (Tafazoli, 2021b, p.6). It is considered "context-bound" (Mishra & Koehler, 2006, p.1032). Thus, it contributes to the integration of technology into education significantly by adopting content knowledge as the basis (Tafazoli, 2021b).

TPACK is acknowledged to have "a transformative perspective" as it views learners and context as an integral component of the TPACK teachers have (Rosenberg & Koehler, 2015, p. 188). It includes several knowledge components as follows (Rosenberg & Koehler, 2015, p. 187): the knowledge of technology (TK), the knowledge of pedagogy (PK), the knowledge of content (CK).

The abovementioned knowledge components combine to form the following parts of the framework (Rosenberg & Koehler, 2015, p.187): technological pedagogical knowledge, pedagogical content knowledge (PCK), and technological content knowledge (TCK) (See Figure 1).
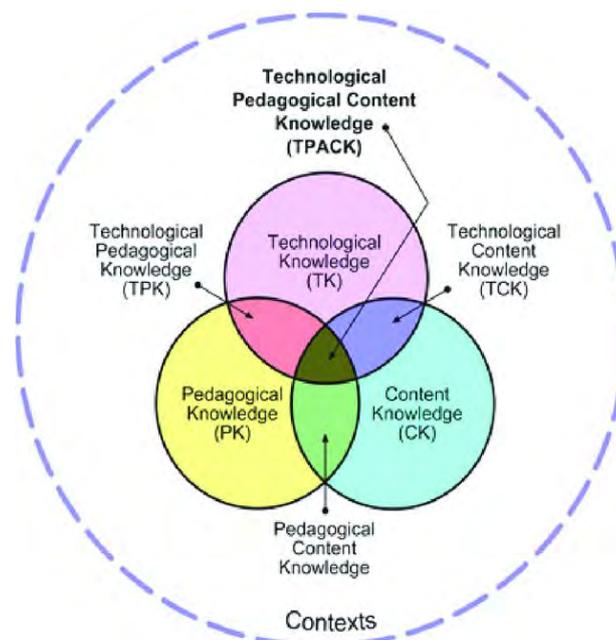

Figure 1. The TPACK framework (used with permission from http://tpack.org)

TPACK facilitates teachers' understanding of technology use regarding the following issues (Harris et al., 2009):

a) Gaining a basic understanding of the relevant concepts

b) Customizing content teaching in line with the learners' needs

c) Developing familiarity with the challenges regarding teaching concepts

d) Raising awareness of the students' understanding of technological and content-related issues

e) Constructing knowledge to support student learning.

Although TPACK provides a theoretical framework for technology integration for teachers, it "offers no specific directives about *what* content to teach… *which* pedagogical approaches are useful… and *what* kinds of technologies to use in teaching" (Mishra et al., 2011, pp. 23-24). It fails to provide a clear road map for teachers as to how to benefit from it for professional development purposes (Mouza, 2011). Recently, a further dimension has been added to the TPACK Framework: Contextual Knowledge (XK) (Mishra, 2019), which is of "critical importance to teachers" (Mishra, 2019, p. 2). The lack of contextual knowledge is argued to constrain the sphere of the effectiveness of TPACK development or effective technology integration (Mishra, 2019). In the current study, XK was added as an additional dimension of TPACK.

2.2. TPACK and technology integration in the English language pre-service teacher education context in Turkey

The studies into technology integration and TPACK in the Turkish pre-service language teacher education were limited. While some studies focused on the TPACK development and perspectives of pre-service EFL teachers, others concentrated on the design and evaluation of computer-assisted courses and training programs for prospective teachers of EFL or the pre-service teachers' TPACK levels. Regarding the studies on the TPACK-related perceptions and TPACK development of pre-service teachers, Koçoğlu (2009) suggested that the pre-service teachers' engagement in a CALL language learning course in the Turkish higher education context promoted their TPACK development and the integration of TPACK into classroom practices. In a similar vein, Kurt et al. (2013) investigated the TPACK development of Turkish pre-service teachers of EFL engaged in collaborative technology-integrated lesson design and implementation in authentic classroom settings. The study revealed a statistically significant rise in TK, TPK, TCK, and TPACK scores of prospective teachers. However, Çetin-Berber and Erdem (2015) pointed out that while CK and PK had a significant contribution to pre-service

teachers' TPACK development, TK was not found to predict TPACK development significantly.

Regarding the studies concerning technology-enhanced course design and evaluation in the pre-service language teacher education context in Turkey, Ekmekçi (2021) investigated the impact of a CALL syllabus design aligned with the TESOL Technology Standards for Language Teachers for pre-service teacher training in a state university. The findings demonstrated a statistically significant improvement in the prospective teachers' ICT competencies and TPACK knowledge. In another study, Solak and Çakır (2014) revealed no significant difference concerning the participants' academic achievement level and their TPACK knowledge, but a significant impact of gender on the participants' TPACK competency. On the other hand, Aşık et al. (2020) highlighted insufficient preparation of pre-service EFL teachers for technology integration and ICT competencies in the undergraduate programs in Turkey. They emphasized the restricted access to technology resources and inadequate training of pre-service teachers regarding technological competencies along with the scarcity of institutional support and teacher educators who successfully integrate technologies into their classroom practices.

In a recent study on the impact of teacher education strategies on pre-service teachers' TPACK, Baran et al. (2017) found that the implementation of the strategies outlined in the Synthesis of Qualitative Evidence (SQD) model was likely to be useful in teacher education programs to maximize pre-service teachers' TPACK-practical levels. Providing pre-service teachers with opportunities for ongoing feedback and evaluation related to their competencies and for designing technology-enhanced lessons in pre-service teacher education programs was indicated to foster the pre-service teachers' effective use of technology. Examining TPACK research in the Turkish context, Baran and Canbazoğlu Bilici (2015) indicated that the quantitative surveys and scales were the main source of data collection, and the pre-service teachers were the most common participant group. In addition, science and maths were the two academic fields where TPACK research is conducted. The researchers also pointed out the limited number of TPACK studies focusing on the design and application of TPACK. They emphasized the need for more studies on how TPACK knowledge is reflected in practice in teacher education programs.

3. The current study

3.1. The research design

The current study adopted an exploratory qualitative case research design aiming at an in-depth investigation of a phenomenon in its local context (Yin, 2009). Exploratory case study design is employed to investigate the situations where the outcomes of the intervention embedded in the study design are not clearly foreseen and where the cause-effect relationship among variables is not clear (Yin, 2003). As the current study is concerned with the exploration of the TPACK development of senior Turkish pre-service EFL teachers and how this development is reflected in the digital materials that they created, the case study was considered an appropriate research design.

3.2. Participants

Twenty-four Turkish pre-service EFL teachers of English (14 female and 10 male pre-service teachers) who took *FLE 470 Designing and Using Digital Materials for English Language Teaching* (ELT) course at an English-medium urban state university and 8 English teachers in the spring semester of the 2020 and 2021 academic year participated in the study. The purposeful sampling strategy was utilized for the selection of the participants. It is a common sampling strategy employed in qualitative research to identify and select information-rich cases to utilize the existing resources effectively (Patton, 2002). The senior pre-service teachers who were simultaneously involved in teaching English in real classroom settings as part of their practicum were included in accordance with the aims of the study. They were doing their practicum at different urban state K-12 schools in central Anatolia. Due to the administrative constraints, it was not possible for them to perform their internship at the private urban K-12 school where the study was conducted. The participants, aged between 22 and 38, were motivated prospective teachers who were committed to ongoing professional development. The pre-service teachers passed an institutional English language proficiency exam with grades that correspond to IELTS 7.0/TOEFL IBT 110/CEFR C1. They were estimated to have an advanced level of proficiency in English. Prior to their involvement in the study, they completed all the ELT methodology courses offered in their undergraduate studies and a basic digital literacy course. None of them had any prior teaching experience in a real classroom setting nor were they involved in designing digital teaching materials.

Moreover, nine English teachers voluntarily participated in the study who acted as mentors in the study. Each teacher was responsible for a specific grade level from kindergarten to Grade 8. They had a range of teaching experience from 3 to 10 years and were chosen via an online technology integration questionnaire (Ertmer et al., 2006) and an online interview. The

Cronbach Alpha coefficient of the survey was 0.76, a moderate level of reliability. The teachers with a relatively high level of computer proficiency and digital literacy who viewed intrinsic factors as being more influential than extrinsic factors in their decisions on technology integration (M=4.51) were invited for a semi-structured Zoom interview. Those who were found to be committed to integrating technology into their classroom practices actively and enthusiastically were included in the study.

3.3. The study context

The digital material preparation project was integrated into an elective course *Designing and Using Digital Materials for ELT* for senior pre-service EFL teachers at an urban state university in Turkey. The course aimed to highlight the theoretical frameworks for technology integration into language teaching, approaches to CALL, CALL tools, and TPACK in language education.

The project was launched in the fourth week of the 14-week course. 14 pre-service teachers were involved in the digital material preparation process for the primary school and 10 for the middle school.. The pre-service teachers worked in pairs. There were 12 pairs of pre-service teacher participants in the study. The pre-service teachers in the study were allowed to choose their pairs and the grade level (from kindergarten to Grade 8) where they would work. Each English teacher in the primary school division was matched with two pairs of pre-service teachers while there was a one-on-one match between the pairs and the English teachers in the middle school division. Each pair was responsible for creating digital teaching materials for different language skills in ELT under the supervision of their mentor teachers at the K-12 school. The pre-service teachers were provided with online guidance, detailed and constructive online feedback by their mentor teachers at the K-12 school throughout their digital materials development process. The course instructor, who was also the researcher, acted as a coordinator in the project. The timetable for the data collection can be seen in Table 1 in Appendix A.

3.4. Data collection instruments

The study data were collected via pre-service teachers' reflective journals, the online semi-structured interviews with the pre-service teachers and the English teachers as well as the technology integration observation instrument. The reflective journals contained open-ended questions exploring the main insights pre-service teachers gained via their digital material preparation experience and the challenges they encountered in the material preparation process as well as their TPACK development. The pre-service teachers wrote individual reflection

journals related to each digital material they produced in the study. The total number of reflections for each pre-service teacher was three.

As for the semi-structured interviews with the participants, they were composed of open-ended items concerned with their perceptions regarding the benefits and challenges of the project experience and the TPACK development of the pre-service teachers. The semi-structured interviews with the pre-service teachers were concerned with the insights they gained into their TPACK development, the benefits of the project for their professional development, and their challenges in the project. The interview templates for both parties can be seen in Appendix B.

The Technology Integration Observation Instrument developed by Harris et al. (2010) aimed to evaluate "the quality technology integration in an observed lesson" (p. 3840). The Cronbach's alpha reliability of the scale was calculated to be .911 (Harris et al., 2010). It was composed of six categories using a four-point Likert scale. The following categories were incorporated into the instrument: "(1) Curriculum goals and technologies; (2) instructional strategies and technologies; (3) technology selection(s); (4) fit; (5) instructional use; and (6) technology logistics" (p. 3840). The categories are assigned a score from 1 to 4, with explanations. The first four categories are concerned with the instructional plans while the last two categories are related to the implementation of these plans (Harris et al., 2010). Hence, in the current study, only the first four categories were employed for the evaluation of the pre-service teachers' digital materials. The first category of the instrument was related to the alignment between technology and curriculum in the digital materials. The second category was related to the interrelation between instructional strategies and technologies. The third one addressed the teachers' technology preferences. The fourth category was pertinent to the alignment among content, pedagogy, and technology (Harris et al., 2010).

3.5. Data collection and analysis procedures

The data in the study were collected via the following procedures. The pre-service teachers uploaded their reflections to the Google Drive folders that were formed for them by the course instructor, along with the digital materials they produced in the study.

In relation to the technology integration observation instrument forms, the English teachers at the K-12 school (mentor teachers) filled in a digital evaluation form regarding the technology integration for each digital teaching material produced by each pair in the project, and they uploaded these evaluation forms to the Google Drive folders of the pre-service teachers that they were mentoring.

As regards the semi-structured interviews, at the end of the study, both the English teachers and pre-service teachers were interviewed online regarding their project experience. Each interview lasted 45 minutes and was recorded online via Zoom. The semi-structured interview templates can be found in Appendix B. The online interviews with the mentor teachers and the pre-service teachers were transcribed by the course instructor later on. The written consent forms were obtained from the pre-service teachers and the mentor teachers regarding the use of their data for research purposes.

Qualitative content analysis was used to analyze the data in the study. It is one of the methods utilized in qualitative research for data analysis and interpretation (Schreier, 2012). In content analysis, the aim is to derive concepts describing the phenomenon of interest by forming categories, a conceptual map, or systems via the reduction of the data (Elo & Kyngäs, 2008). To ensure the trustworthiness of the data analysis, the researcher collaborated with a colleague from her department who is experienced in qualitative data analysis, to enhance "the comprehensivity and … the sound interpretation of the data" (Elo et al., 2014, p. 5). The researcher and her departmental colleague were initially engaged in reading the total data set iteratively through a constant comparative method and identified the relevant data parts for research purposes (Lincoln & Guba, 1985). Later on, they formed codes based on similar meanings in the data. Next, they created categories based on similar codes and combined similar ones to develop new categories. Finally, they created main themes and sub-themes that emerged from these categories. In case of a lack of consensus over the categories and themes in the data, both coders convened and negotiated any divergent ideas on the categorization issues until they came to an agreement. The interrater reliability was calculated at .95, which signifies a substantial agreement (Landis & Koch, 1977).

The online semi-structured interview data from the pre-service teachers and the mentors were transcribed by the course instructor and the departmental colleague. Subsequently, the transcribed data were sent to both parties for member checking. The pre-service teachers' data from the online interviews were triangulated with their written online reflections. Moreover, the data from the online interviews with the mentor teachers were triangulated with the data from technology observation instrument forms. The triangulation of the data from different sources and member checking was employed to further enhance the trustworthiness of the study (Elo et al., 2014). Figure 2 illustrates the phases of the data analysis in the study.
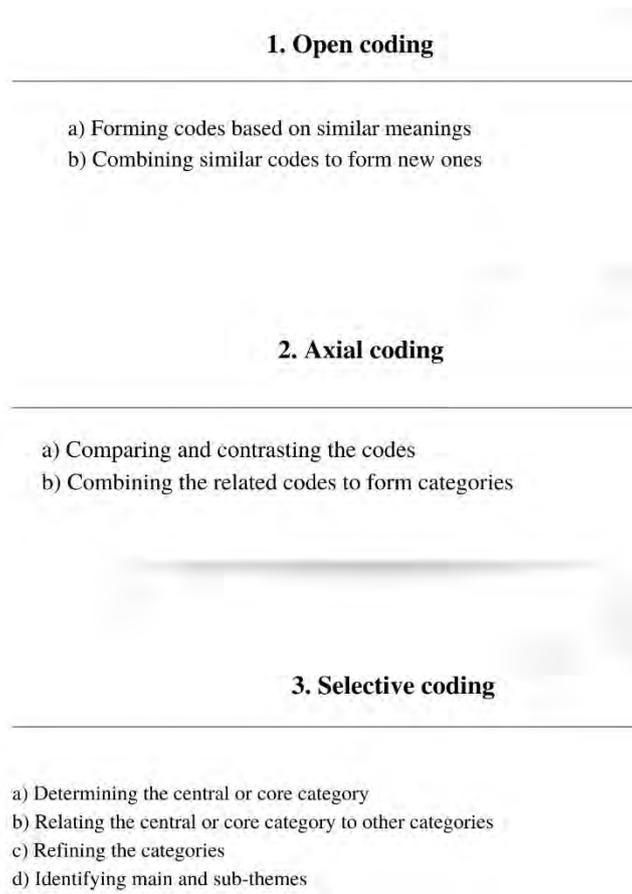
1. Open coding

a) Forming codes based on similar meanings
b) Combining similar codes to form new ones

2. Axial coding

a) Comparing and contrasting the codes
b) Combining the related codes to form categories

3. Selective coding

a) Determining the central or core category
b) Relating the central or core category to other categories
c) Refining the categories
d) Identifying main and sub-themes

Figure 2. Qualitative data analysis phases in the study (Strauss & Corbin, 1990)

4. Findings

The findings are presented in line with the research questions in the study.

4.1. Contribution of the digital material project to the TPACK development of the Turkish pre-service EFL teachers

Regarding the pre-service teachers' perceptions of their TPACK development journey, they indicated their consensus on the multiple benefits of their project involvement for their professional development in the reflective journals. The pre-service teachers mentioned that the flexibility built into the project as well as their mentors' ongoing support and constructive detailed feedback contributed to their teacher-agency development. The liberty pre-service teachers in the study were granted to become designers of their own digital materials promoted their autonomy and self-efficacy as prospective teachers and their TPACK development. The project enabled their engagement in a "bottom-up process" of "technology integration in language education" where they "should be in charge of conducting their professional development" (Tafazoli, 2021b, p. 12). The pre-service teachers acknowledged certain

challenges during their TPACK journey in their digital material development process. However, they managed to overcome them by collaborating with their partners. They also remarked that their mentors' affective support acted as a booster for their emerging teacher self.

The pre-service teachers in the project concurred that the emphasis on the integration of content, pedagogy, and technology in the project with a holistic perspective toward effective technology integration into education (Tafazoli, 2021b). In addition, the inclusion of the context into the picture, which appears to be the neglected element in TPACK (Kelly, 2010), required the pre-service teachers to consider the grade level, the student characteristics, and the types of available technologies (see Mishra & Koehler, 2006). The project emphasized that learners and the context should be "integral to teachers' TPACK" (Rosenberg & Koehler, 2015, p. 188).

Technological Knowledge (TK)

The pre-service teachers in the study reported an increase in their confidence to integrate technology into the digital material preparation process. In their journals, they indicated that they added new e-tools and websites into their professional repertoire thanks to their participation in the project. The pre-service teachers not only enhanced their familiarity with the new e-tools but also gained hands-on experience with these tools, raising their awareness towards the ease of use, challenges, and the sphere of applicability of these tools to teach different language skills. In his reflective journal, Participant 6 (Grade 2) voiced the development in his technological skills in the following way:

> Ed-puzzle helped us attain our objectives. Thanks to this material preparation process, we
> learned about this site better and discovered many of its features.

Pedagogical Knowledge (PK)

The pre-service teachers referred to pedagogical knowledge in their reflective journals or in the online semi-structured interviews very rarely. This might be attributed to their familiarity with the methodologies for teaching English to young learners through the course they took prior to their involvement in the study. However, one participant (P1- Grade 2) indicated her PK development in the study in the following way:

> I learned a lot in this study. One of them is the characteristics and needs of the age group we
> work with. I learned that we can attract them to the lesson with colorful visual materials and
> provide an effective revision activity.

Technological Content Knowledge (TCK)

The pre-service teachers in the study pointed out that becoming a digital material designer enhanced their creativity and problem-solving skills, which echoes Hughes' (2005) transformation function of technology-supported pedagogy. The project engagement provided the teacher candidates with an opportunity to bring creative solutions to their challenges through problem-solving activities (Hughes, 2005). Participant 5 (Grade 3) illustrated her project engagement in this regard as follows:

> When we found that the crossword puzzle feature of Wordwall is not free, we looked for some other digital platforms, like puzzle maker., discoveryeducation.com, rif.org. We thought that puzzle.org is the most appropriate one since it has a basic interface and allows interactive crossword puzzles.

The participants underlined that their project engagement shifted their role from passive consumers of technology to active technology users seeking proactive solutions to their challenges. They turned into autonomous teachers with a high level of agency.

Technological Pedagogical Knowledge (TPK)

The pre-service teachers in the study indicated in their reflective journals and during the semi-structured interviews how content they were to have improved their TPK. Participant 10 (Grade 7) stated that the project engagement helped her internalize the pedagogical concept of differentiated instruction and provided her with an opportunity to prepare differentiated activities to achieve the learning objectives she was given. She voiced her sentiments as follows:

> The most important insight that I have acquired thanks to this project is that we should follow the same objective(s) while preparing different versions of the same task.

Some pre-service teachers reported that their project engagement served as an eye-opening pedagogical experience for them as it helped them be informed of how to prepare engaging and informative digital instructional materials for young learners. As they had no prior teaching experience with this group of learners, they were not familiar with the teaching materials geared towards these learners. Participant 9 and Participant 10 (Grade 3) respectively illustrate their views in this respect:

> I think this process helped me understand the young learners' needs better. To make our material appeal to our 3rd grade students, we used cartoons in our questions as well as crossword puzzles (P9).

> We have learned how important it is to integrate visuals to our digital materials for young
> learners. We tried to find a web tool that has the feature of uploading pictures (P10).

The prospective teachers appreciated their course instructors' and their mentors' guidance and scaffolding throughout the project regarding the purposeful integration of technology into pedagogy. They emphasized their appreciation for collaborating with mentors who are equipped with techno-pedagogical competence (Tafazoli, 2021b). This finding is inconsistent with that of Aşık et al. (2020), who showed that language teacher education programs had no or very little institutional support and few teacher educators competent in technology integration into their classroom practices.

Pedagogical Content Knowledge (PCK)

Relatively few teachers highlighted the project gains concerning PCK, which might be attributed to their completion of all the ELT methodology courses prior to their involvement in the project. In these courses, they were exposed to different language teaching approaches, methods, strategies, and techniques, prepared and implemented lesson plans, in micro-teaching conditions (see also Tafazoli, 2021b). The following comments by Participant 1 and Participant 2 (Grade 2) respectively indicated the benefits of the project in terms of PCK:

> I learned new strategies as to how to promote students' higher-order thinking and creative
> thinking skills in online learning environments (P1).
> During this material preparation process, I learned how important it is to write the instructions
> as simple and understandable as possible, especially for young learners (P2).

Although P1 and P2 expressed their familiarity with the basic principles of teaching young learners through their methodology courses, they did not have any prior hands-on digital material preparation experience. Despite being aware of the importance of activating their students' creative thinking skills and of giving clear instructions, they admitted that they did not know how to create activities and materials to achieve these goals, particularly in a technology-enhanced lesson.

Content Knowledge (CK)

In terms of content knowledge, the pre-service teachers reported the digital material design project helped develop their content knowledge related to teaching young learners. They indicated that while the course *Teaching English to Young Learners*, which they took prior to their engagement in the project, enriched mostly their conceptual knowledge, they were not

engaged in preparing any digital learning materials for young learners in that course. Their practical experience was limited to one microteaching only. The pre-service teachers emphasized that their mentors' guidance helped them expand their content knowledge in terms of preparing digital instructional materials for young learners. The following quote by Participant 4 (Grade 3) is represented in this respect: "This digital material preparation journey helped me learn how to prepare appropriate materials for children."

Contextual Knowledge (XK)

Due to their lack of familiarity with the learner profile and the learning environment at the private school in the study, the pre-service teachers found it hard to align the difficulty level of their teaching materials with the level-specific learner profile, which is shown in the following quote by Participant 2 (Grade 2): "… we realized that we were working with a profile that was very different from the student profile we thought at the beginning of the project."

The lack of contextual knowledge of the pre-service EFL teachers in the study was due to the fact that they were not doing their practicum at the private K-12 school where the study was conducted. This goes opposite to the findings of Phelps et al.'s study (2021), where the pre-service teachers were provided with an opportunity to improve their contextual knowledge through their engagement in field experiences.

4.2. The reflection of Turkish pre-service EFL teachers' TPACK knowledge in their digital materials

Regarding the second research question in the study, two overarching themes emerged in relation to how pre-service teachers' TPACK knowledge was reflected in their digital materials. These included the relatively successfully integrated TPACK components into the digital materials (PK, CK, and TK) and relatively poorly integrated TPACK components into the digital materials (PCK, TPK, TCK, and XK).

The pre-service teachers were found to integrate their PK, CK, and PCK into their digital materials relatively successfully. From a PK perspective, the mentors' evaluations of the pre-service teachers' level of technology integration revealed that the pre-service teachers tended to align the pedagogical goals with the instructional strategies in their materials successfully. This might be attributed to their already existing pedagogical knowledge. In fact, M1, who was an English teacher in the third grade, made the following comment regarding how pre-service teachers reflected their pedagogical knowledge in the technology integration evaluation form:

> With this instrument, students can easily practice the topic. While multiple-choice questions are helpful for eliciting/ revising the topic, open-ended questions are beneficial for punctuation and spelling as well as grammar.

Mentor 1 indicated the successful integration of the pre-service teachers' PK in the form of instructional strategies:

> With the help of the instrument, students can focus on the form (the superlative). Also, students practice not only grammatical rules but also the spelling and punctuation.

During the semi-structured interviews, the mentor teachers remarked that the majority of the pre-service teachers gained new insights into the instructional strategies and the types of activities that were likely to appeal to young learners in the project.

As regards the CK, although the mentors had a consensus on the pre-service teachers' general understanding of the types of content (i.e., classroom activities and tasks) for young learners, they pointed out the need for the latter to refine their content knowledge so that they could integrate technology into their digital material design process effectively.

From the PCK standpoint, during the semi-structured interviews, the mentor teachers mentioned the pre-service teachers' challenge to prepare differentiated teaching materials for young learners. The mentors reported their need for continuous guidance and scaffolding concerning the differentiation of digital materials for young learners. This might be due to the insufficient emphasis on differentiated instruction in the pre-service EFL teacher education curriculum in the Turkish context. However, the mentors' engagement in an ongoing constructive feedback provision process, their clear guidance, and continuous support for the pre-service teachers helped the latter overcome their challenges in this respect. Even though the pre-service teachers did not feel competent in how to differentiate their digital materials at the beginning of the project, the mentor teachers highlighted their gains in this respect, which might contribute to their PCK during the project.

As regards the TK perspective, the mentor teachers also pointed out that the pre-service teachers had a moderate level of TK during the interviews. The former reported observing the latter's familiarity with quite a few e- tools and websites for teaching different language skills in English. The e-tool and website presentations by the course instructor and their peers as well as the hands-on practice with the tools and websites during the technology course appeared to raise the technological self-efficacy level of the pre-service teachers. As the mentors pointed out, although the prospective teachers were initially challenged to integrate some technological devices and resources with which they lacked familiarity, their experiential learning experience in the project helped them develop their TK.

Even though the pre-service teachers appeared to be able to integrate the pedagogical and content knowledge, on the whole, mentors suggested that the pre-service teachers had certain challenges while integrating their PCK, TPK, TCK, and XK, in addition to TK (see Kurt et al., 2014). As regards the pre-service teachers' TCK integration, the mentor teachers reported that, along with their challenge related to the integration of their CK into the digital material preparation process, the pre-service teachers expressed difficulty aligning technological tools and resources with a specific content they would create. However, the ongoing feedback cycle embedded in the digital material preparation process and their regular online interaction with their mentor teachers throughout the digital material preparation process enabled the pre-service teachers to choose the appropriate tools for their activities after their initial confusion.

In fact, one of the mentor teachers (Mentor 1- the kindergarten level) expressed her satisfaction with the pre-service teachers' tool choice:

> Bamboozle is a very good choice for very young learners with its differentiated tasks, the student-friendly interface and the formative assessment feature.

As for the pre-service teachers' integration of their TPK into the digital instructional materials, the mentor teachers indicated the pre-service teachers' challenges regarding the skillful integration of the technological tools into the pedagogical activity design in line with the characteristics of the learner profile in focus. The former reported that the final products were sometimes not conducive to the learning process of the young learners fully as the pre-service teachers were not always able to align technology and pedagogy in ways appropriate to the learner profile.

From an XK standpoint, the mentor teachers emphasized the pre-service teachers' lack of knowledge of the students' educational background and the learning environment at the K-12 school posed a challenge for them. They were not thoroughly familiar with the organizational and contextual constraints in the learning environment at the private school. The lack of such contextual knowledge seemed to affect their digital material design process unfavorably initially. Thus, they found it hard to tailor the difficulty level of their digital materials to the students' proficiency levels. However, through their mentors' guidance and the ongoing feedback, they managed to accommodate the digital materials they prepared to the pedagogical characteristics and proficiency levels of the intended target audience in the final version of their materials.

5. Discussion

This study is significant as it highlighted an under-researched topic in the Turkish context, which is the pre-service teachers' experiences regarding digital materials design for a real audience in collaboration with English teachers in the Turkish K-12 context. It enhances our understanding of the TPACK development of pre-service EFL teachers and the pre-service teachers' digital content creation experiences in a real learning environment (see Baran & Canbazoğlu Bilici, 2015; Baran et al., 2017; Çetin-Berber & Erdem, 2015; Koçoğlu, 2009; Kurt et al., 2014).

The study findings demonstrated that the digital materials design project helped pre-service teachers develop their TPK, TCK and XK mostly as well as their TK and CK to a certain extent (See Kurt et al., 2014). This may be attributed to the design of the project and the technology course where the project was integrated. The pre-service teachers in the study worked in close online collaboration with the English teachers at the private K-12 school. The mentors' provision of regular, detailed, and constructive feedback for the prospective teachers helped them promote the latter's contextual knowledge about the target K-12 student profiles in different grades at the private school. The mentors' provision of sample digital materials they were using in the institution and their guidance and modeling for the pre-service teachers' technology integration process seemed to enhance their understanding of how to align their activity types with the pedagogical aims of the activity (PK), the characteristics of the target learner profile (young learners) (CK) as well as with the technology selection (TCK). The pre-service teachers also benefitted from the project engagement in terms of TPK as well when their mentor teachers provided them with feedback about the strong and weak points of the digital materials and some suggestions for further improvement.

The pre-service teachers also appreciated their mentors' showing them what is/is not likely to work in the real classroom context. The course design where the pre-service teachers were engaged was also conducive to their TPACK knowledge gains as well, which is consistent with the previous research (Angeli & Valanides, 2009). Adopting a technology course design which includes TPACK instruction was found beneficial for the pre-service teachers' TPACK development. However, when pre-service teachers are actively engaged in different ways of technology integration as well as implementing their techno-pedagogical knowledge via hands-on experiential activities in class, they are likely to obtain full benefit in terms of TPACK knowledge enhancement (Krause et al., 2017). It is also argued that the pre-service teachers should be engaged in the technology implementation systematically (Ottenbreit-Leftwich, 2010). The study results concerning the development of XK and TK as the integral elements of

meaningful technology integration (Mishra, 2019) corroborate the findings of Phelps et al. (2021). The rise in the TPACK levels of pre-service teachers might also be attributed to their engagement in an experiential learning experience (see Seels et al., 2003). The structured guided and monitored nature of the digital materials creation experience enhanced the benefits for the pre-service teachers (Lim & Hang, 2015).

The current study findings are not in line with the previous research that pointed out the lack of institutional support and teacher educators who exhibit competency in technology integration in the pre-service teacher education context (Aşık et al., 2020). However, the findings are aligned with Ekmekçi (2021), indicating the benefits of a structured CALL course for the TPACK development of pre-service teachers. The autonomy-inducing nature of the project involvement highlighted by the pre-service teachers was also revealing, which echoes Tafazoli's (2021b) emphasis on "the bottom-up" nature of the technology integration process. Acting as the designers of their own materials is likely to play an important role in enhancing the pre-service teachers' agency which, in turn, promotes their teacher self-efficacy.

6. Conclusion

The study revealed that involvement in a structured and guided TPACK development experience is likely to play an important role in pre-service teachers' internalization of the mutual relationship between different parts of the TPACK framework (Phelps et al., 2021). In fact, it highlighted "the transformative perspective" of the TPACK, with an emphasis on the integral nature of learners and context (Rosenberg & Koehler, 2015, p. 188). Just as it was the case in the current study, granting the pre-service teachers the autonomy to design their digital materials for real learners for specified learning outcomes under the supervision of English teachers competent in technology integration may help them become self-directed teachers with well-developed technological competencies. Such prospective teachers might feel more efficacious and more competent to integrate technology into their classes in the future.

Although this study indicated the pre-service teachers' TPACK development, the lack of a teaching component in the study may have constrained the degree of development. As indicated in Mishra and Koehler (2006), "merely knowing how to use technology is not the same as knowing how to teach with it" (p. 1033). In fact, the degree of pre-service teachers' exposure to technology integration and instruction determines the level of TPACK development for prospective teachers (Lee & Tsai, 2010). Hence, integrating this TPACK development experience into the practicum course where the prospective teachers can implement their digital materials in a real learning environment might enable them to build a bridge between theory

and practice (see Gawrisch et al., 2020). The integration of the TPACK development into course work is likely to be beneficial for the development of CK, XK and TCK, and TPK, which are relatively hard to develop out of context (see also Phelps et al., 2021). Despite the limited number of participants and the relatively limited duration of the study, findings of the study may provide insights for EFL teacher educators in similar contexts regarding how to promote the pre-service EFL teachers' TPACK development through authentic digital material design experiences.

Regarding future research, the technology integration practices of teacher candidates who have digital content creation experience prior to their practicum might be compared to the practices of those in the practicum period with no prior experience in digital content creation. Furthermore, the pre-service and in-service teachers' perspectives towards the integration of technology into ELT might be worth investigating in the future. Last but not least, the relationship between in-service teachers' beliefs about technology integration and their technology integration practices might be considered as an area of further investigation.

References

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education, 52*, 154-168. https://doi.org/10.1016/j.compedu.2008.07.006

Aşık,A., Köse, S., Ekşi, G.Y., Seferoğlu, G., Pereira, R., & Ekiert, M. (2020). ICT integration in English language teacher education: Insights from Turkey, Portugal and Poland. *Computer Assisted Language Learning, 33*(7), 708-731. https://doi.org/10.1080/09588221.2019.1588744

Baran, E., & Canbazoğlu Bilici, S. (2015). A review of the research on technological pedagogical content knowledge: The case of Turkey. *Hacettepe University Journal of Education, 30*(1), 15-32.

Baran, E., Canbazoğlu Bilici, S., Albayrak Sari, A., & Tondeur, J. (2017). Investigating the impact of teacher education strategies on preservice teachers' TPACK. *British Journal of Educational Technology*, *50*(1), 357-370. https://10.111/bjet.12565

Baskerville, D. (2012). Integrating on-line technology into teaching activities to enhance student and teacher learning in a New Zealand primary school. *Technology, Pedagogy and Education, 21*(1), 119-135. https://doi.org/10.1080/1475939X.2012.65988

Brittingham, B., Sands, M., Erbas, S., Kavak, Y., Tarhan, L., Ayas, A., Vancı Osam, Ü., Özsoy, V., Topbaş, S., Ardac. D., Badavan. Y., Cephe, P. T., Ok, A., Paker, T., & Tercanlıoglu, L. (1999). *Türkiye'de öğretmen eğitiminde standartlar ve akreditasyon [The standards and accreditation in the Turkish teacher education]*.YÖK/ DÜNYA BANKASI Milli Eğitimi Geliştirme Projesi Hizmet Öncesi Öğretmen Eğitimi.

Çetin-Berber, D., & Erdem, A. R. (2015). An investigation of Turkish pre-service teachers' technological, pedagogical and content knowledge. *Computers, 4*, 234-250. https://doi.org/10.1080/1359866X.2014.932332

Directorate General for Teacher Training and Development (2017). General competencies for teaching profession 2017 report. https://oygm.meb.gov.tr/meb_iys_dosyalar/2018_06/29111119_TeachersGeneralCompetencies.pdf

Egbert, J., Akasha, O., Huff, L., & Lee, H. G. (2011). Moving forward: Anecdotes and evidence guiding the next generation of CALL. *International Journal of Computer-Assisted Language Learning and Teaching, 1*(1), 1-15. https://doi.org/10.4018/ijcallt.2011010101

Ekmekçi, E. (2021). Pursuing a standardized content of a CALL course for pre-service EFL teachers: The procedure, impacts, and reflections. *Computer Assisted Language Learning,* 1-35. https://doi.org/10.1080/09588221.2021.1968913

Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., & Kyngäs, H. (2014). Qualitative content analysis: A focus on trustworthiness. *Sage Open*, *4*, 1-10. https://10.1177/2158244014522633

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*, 107-115. http://dx.doi.org/10.1111/j.1365-2648.2007.04569.x

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia, 13*(1), 93-106.

Ertmer, P. A., Ottenbreit-Leftwich, A., & York, C. S. (2006). Exemplary technology-using teachers: Perceptions of factors influencing success. *Journal of Computing in Teacher Education, 23*(2), 55-61.

Gawrisch, D., Richards, K., & Killian, C. (2020) Integrating technology in physical education teacher education: A socialization perspective. *Quest, 72* (3), 260-277. https://doi.org/10.1080/00336297.2019.1685554

Harris, J., Grandgenett, N., & Hofer, M. (2010). Testing a TPACK-based technology integration assessment rubric. In C. D. Maddux, D. Gibson, & B. Dodge (Eds.), *Research highlights in technology and teacher education* (pp. 323-331). Society for Information Technology & Teacher Education (SITE).

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393-416. https://doi.org/10.1080/15391523.2009.10782536

Hughes, J. E. (2005). The role of teacher knowledge and learning experiences in forming technology-integrated pedagogy. *Journal of Technology and Teacher Education, 13*, 277-302.

Kelly, M. (2010). Technological pedagogical content knowledge (TPACK): A content analysis of 2006-2009 print journal articles. In D. Gibson & B. Dodge (Eds.), *Proceedings of SITE 2010--Society for Information Technology & Teacher Education International Conference* (pp. 3880-3888). Association for the Advancement of Computing in Education (AACE).

Kımav, A. U., & Kürüm-Yapıcıoğlu, D. (2021). A blended INSET program design for technopedagogical development in teaching English. *The Turkish Online Journal of Educational Technology, 20* (3), 1-23.

Koçoğlu, Z. (2009). Exploring the technological pedagogical content knowledge of pre-service teachers in language education. *Procedia - Social and Behavioral Sciences, 1,* 2734-2737.

Krause, J.M., Franks, J., & Lynch, B. (2017). Current technology trends and issues among health and physical education professionals. *The Physical Educator, 74*(1), 164-180.

Kurt, G., Mishra, P., & Koçoğlu, Z. (2013, March). *Technological pedagogical content knowledge development of Turkish pre-service teachers of English*. [Paper presentation]. 24th Society for Information and Teacher Education (SITE) International Conference, New Orleans, LA., U.S.A.

Kurt, G. , Akyel, A , Koçoğlu, Z , & Mishra, P . (2014). TPACK in practice: A qualitative study on technology integrated lesson planning and implementation of Turkish pre-service teachers of English. *ELT Research Journal, 3* (3), 153-166.

Labbas, R., & El Shaban, A. (2013). Teacher development in the digital age. *Teaching English with Technology, 13*(3), 53-64.

Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159-174.

Lee, M. H., & Tsai, CC. (2010). Exploring teachers' perceived self-efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web. *Instructional Science, 38*, 1-21. https://doi.org/10.1007/s11251-008-9075-4.

Lim, C. P., & Hang, D. (2003). An activity theory approach to research of ICT integration in Singapore schools. *Computers & Education, 41*(1)*,* 49-63. https://doi.org/10.1016/S0360-1315(03)00015-0

Lincoln, Y., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage.

Mishra, P. (2019) Considering contextual knowledge: The TPACK diagram gets an upgrade. *Journal of Digital Learning in Teacher Education, 35*(2), 76-78. https://doi.org/10.1080/21532974.2019.1588611

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*, 1017-1054. https://doi.org/10.1111/tcre.2006.108.issue-6

Mishra, P., Koehler, M. J., & Henriksen, D. (2011). The seven trans-disciplinary habits of mind: Extending the TPACK framework towards 21st century learning. *Educational Technology, 51*, 22-28.

Mouza, C. (2011). Promoting urban teachers' understanding of technology, content, and pedagogy in the context of case development. *Journal of Research on Technology in Education, 44*(1), 1-29.

Nami, F. (2021). How computer-assisted language learning literacy is conceptualized in research: A general review. *Aula Abierta, 50*(2), 577-584. https://doi.org/10.17811/rifie.50.2.2021.577-584

Nazari, M., & Xodabande, I. (2020). L2 teachers' mobile-related beliefs and practices: Contributions of a professional development initiative. *Computer Assisted Language Learning*, *35*(7), 1354-1383. https://doi.org/10.1080/09588221.2020.1799825

Ottenbreit-Leftwich, A. T. (2010, February). *Teacher technology professional development and policy in the United States*. [Working paper No.20]. Giovanni Agnelli Foundation. https://www.fondazioneagnelli.it/wp-content/uploads/2017/08/A._T._Ottenbreit-Leftwich__Teacher_Technology_Professional_Development_-_FGA_WP20_01.pdf

Patton, M.Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work, 1*(3), 261-283.

Phelps, A., Colburn, J., Hodges, M., Knipe, R., Doherty, B., & Keating, D. X. (2021). A qualitative exploration of technology use among pre-service physical education teachers in a secondary methods course. *Teaching and Teacher Education*, *5*, 1-11. https://doi.org/10.1080/1359866X.2010.541601

Rosenberg, J., & Koehler, M. (2015). Context and technological pedagogical content knowledge (TPACK): A systematic review. *Journal of Research on Technology in Education, 47*(3), 186–210. https://doi.org/10.1080/15391523.2015.1052663

Schreier, M. (2012). *Qualitative content analysis in practice*. Sage.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(4), 4-14. https://doi.org/10.3102/0013189x015002004

Seels B., Campbell S., & Talsma V. (2003). Supporting excellence in technology through communities of learners. *Educational Technology Research and Development, 51*(1), 91-104.

Solak. E., & Çakır, R. (2014). Examining preservice EFL teachers' TPACK competencies in Turkey. *Journal of Educators Online, 11*(2), 1-22. http://dx.doi.org/10.9743/JEO.2014.2.2

Strauss, A., & Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Sage.

Tafazoli, D. (2021a). Language teachers' professional development and new literacies: An integrative review. *Aula Abierta, 50*(2), 603-614. https://doi.org/10.17811/rifie.50.2.2021.603-614

Tafazoli, D. (2021b). CALL teachers' professional development amid the COVID-19 outbreak: A qualitative study. *CALL-EJ, 22*(2), 4-13.

Tafazoli, D., Gómez Parra, M. E., & Huertas Abril, C. A. (2017). Computer literacy: Sine qua non for digital age of language learning & teaching. *Theory and Practice in Language Studies, 7*(9), 716-722. http://dx.doi.org/10.17507/tpls.0709.02

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Sage.

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Sage.

Appendix A. Timetable for the Data Collection

Weeks (Duration: 10 weeks)	Procedures
Week 1	Online Zoom meeting with pre-service teachers to discuss the project procedures
Week 2	Pre-service teachers' work on their first digital materials
Week 3	Pre-service teachers' first online draft material submissions to their mentors Mentors' online feedback provision (via e-mail, Zoom, or WhatsApp)
Week 4	Pre-service teachers' revisions on their first draft materials and their final online material submissions to their mentors
Week 5	Pre-service teachers' work on their second digital materials
Week 6	Pre-service teachers' second online draft material submissions to their mentors Mentors' online feedback provision
Week 7	Pre-service teachers' revisions on their second draft materials and their final online material submissions to their mentors
Week 8	Pre-service teachers' work on their third digital materials
Week 9	Pre-service teachers' online submissions of their third draft materials to their mentors Mentors' online feedback provision
Week 10	Pre-service teachers' revisions on their third draft materials and their final online material submissions to their mentors

Appendix B.

a) **The Semi-structured Interview Template for the Pre-service Teachers**

  1. What are the main insights you gained into the digital material preparation process?

  2. What are the challenges that you encountered during the digital material preparation process?

  3. What do you think of the feedback you received from your mentor? How did your mentor's feedback affect your digital material preparation process?

  4. How did your project involvement affect your TPACK development as a prospective teacher?

b) **The Semi-structured Interview Template for the English Teachers**

  1. What are the benefits of the digital material preparation project experience for the pre-service teachers?

  2. What are the challenges of the digital material preparation project experience for the pre-service teachers?

  3. What are your perceptions of the TPACK development of the pre-service teachers in the project?