The Development of Preservice English Teachers' TPACK in a Course Based on TPACK

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This thesis results entirely from my own work and has not been offered previously for any other degree or diploma. The word length of this thesis is 53,686 and does not exceed the permitted maximum.

Abstract

This qualitative case study investigates how a Technological Pedagogical Content Knowledge (TPACK) course impacts the development of preservice English teachers' TPACK, as well as their perceptions and attitudes towards technology integration in English Language Teaching (ELT). While much of the existing research on TPACK development in preservice teacher education focuses on generic technology courses, this study addresses the gap by exploring how content-specific courses can enhance TPACK in preservice teachers. To achieve this, the course was designed using TPACK Design-Based Learning (TPACK-DBL) principles (Baran & Uygun, 2016), aimed specifically at exploring the TPACK development and experiences of preservice English teachers.

Despite numerous studies examining TPACK in preservice education, concrete evidence of TPACK development within content-specific contexts remains scarce. Therefore, this study collected and analysed self-report data (semi-structured interviews, peer feedback, reflective journals, and macroteaching application reports), observations (microteaching), and performance assessments (design activities) to explore the development of TPACK and perceptions of technology in a course offered at a higher education institution in Israel.

The data analysis resulted in five key themes: *Design Activities, Experiences in Technology-Enhanced Teaching*, *Integrating Technology to Support Pedagogical Practices in English Language Instruction*, *Perceptions and Attitudes Towards Integration of Technology into Teaching*, and *Perceived Value of the Course*. The findings demonstrate that the preservice teachers developed TPACK by making connections between technology, content, and pedagogy. In addition, the study provides insights into preservice teachers' perceptions and attitudes towards technology integration in ELT and the TPACK-based course. This study contributes to enhancing teaching practices and informs the design of technology courses in preservice teacher education, recommending that such courses be

tailored to subject-specific content using TPACK-DBL principles to develop preservice teachers' skills in the design and implementation of technology.

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Nahla Nassar

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Abbreviations

CALL	Computer-Assisted Language Learning
CK	Content Knowledge
DBL	Design-Based Learning
EFL	English as a Foreign Language
ELT	English Language Teaching
ICT	Information and Communication Technology
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
TCK	Technological Content Knowledge
TK	Technological Knowledge
TPACK	Technological Pedagogical Content Knowledge
TPACK-DBL	TPACK Design-Based Learning
TPK	Technological Pedagogical Knowledge

Chapter One: Introduction

Introduction

This chapter provides an overview of the study on the development of preservice teachers' Technological, Pedagogical, and Content Knowledge (TPACK). It includes the research background and context, a statement of the problem, my personal statement and motivation for the study, the purpose of the study, and the research questions. The chapter concludes with an outline of the study's organisation.

Research Background

Creating a 21st-century education system brought with it a recognition of the role of Information and Communication Technologies (ICT) in enhancing learning (Boling & Beatty, 2012; Gizaw & Tessema, 2020; Niess, 2012) and preparing students for the challenges and expectations of a digitally connected world (Tondeur et al., 2018). The way in which teachers use technology in the education system has the potential to support these learning opportunities for students (Gizaw & Tessema, 2020). Beyond possessing ICT knowledge and skills, teachers must be able to integrate these tools within the context of teaching specific subjects and curriculum goals (Koehler & Mishra, 2005b).

The advancement of technology in education has also brought with it the acknowledgement of the important role that teacher preparation institutes have in preparing future teachers to acquire the knowledge and skills for integrating technology into their teaching practices (Baran et al., 2019; Mouza, 2016; W. Wang et al., 2018). There is an increasing focus on developing preservice teachers' knowledge of technology integration (Koehler & Mishra, 2005) for classroom application using instructional and cognitive tools to foster students' learning (Tondeur et al., 2018). Tondeur et al. (2012) emphasise the need for preservice education institutions to prepare teachers for technology integration by aligning

theory and practice, using teacher educators as role models reflecting on technology's role in education, Learning Technology by Design (an approach in which teachers engage collaboratively in the design of technology-enhanced instructional solutions to address authentic pedagogical challenges (Koehler & Mishra, 2005a) , as explored in detail in Chapter Two), collaborating with peers, scaffolding authentic technology experiences, and transitioning from traditional assessment to continuous feedback. Mishra and Koehler (2006) argue that knowledge of using technology differs from knowledge of teaching it. Therefore, teachers should be provided with opportunities to learn how to integrate technology, pedagogy, and content, as their knowledge influences their classroom practices and actions (Shin et al., 2009; Tseng et al., 2022).

Extending Shulman's (1986) Pedagogical Content Knowledge framework, Mishra and Koehler (2006) introduced TPACK, a conceptual framework for developing teacher knowledge for technology integration. The framework includes content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK), and the intersection of the three types of knowledge are represented as pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). Mishra and Koehler (2006) assert that developing TPACK is critical in teacher education as knowledge about content, pedagogy and technology and the interplay between them is essential for transforming teaching and learning in the 21st century (Kushner Benson et al., 2015).

The study investigates the development of English preservice teachers' TPACK and explores their perceptions and attitudes towards technology integration during a course designed based on the TPACK framework. It aims to provide insights into how English preservice teachers develop their TPACK, and how their attitudes and perceptions towards teaching English with technology evolve through their experiences in the course.

Research Context

In 2011, Israel's Ministry of Education (2011a) launched the national programme for Adapting Education to the 21st Century, aiming to implement innovative pedagogy, equip students with 21st-century skills, and integrate Information Communication Technology (ICT) in schools. The change in the policies of the educational system resulted in changes in the English curriculum, but it was not until 2013 that the English Inspectorate in Israel revised the English Curriculum (Ministry of Education, 2013) to include the integration of ICT in schools. This change included principles that underlie the integration of ICT in language teaching and learning to encourage learners to interact with digital media, assess the reliability of internet information, use various modes of digital communication (e.g., email, voice, video chat, and Web 2.0 tools), create and share digital content, and adhere to netiquette and online safety standards. Students should be provided with activities that align with their language proficiency to access online information and opportunities to connect and cooperate with local and global communities (Ministry of Education, 2013, p. 13).

These changes in the Israeli English Curriculum were to be applied in all four domains of the curriculum, which include Access to Information, Written Presentation, Appreciation of Language, Literature, and Culture, and Presentation. First, the domain of Social Interaction, meaning the ability to interact in English both orally and in writing, requires learners to use ICT in a way in which they create, collaborate, and respond to digital media such as discussion forums and web 2.0 tools (Ministry of Education, 2018b). Second, the domain of Access to Information, meaning accessing written and oral texts for a variety of purposes, requires learners to use ICT to access digital media and apply knowledge of the English language (Ministry of Education, 2018b). Third, the domain of Presentation, in which learners present ideas orally and in writing, includes the use of digital media tools to present, design, review, and edit information (Ministry of Education, 2018b). However, the domain of

Appreciation of Language, Literature, and Culture, which focuses on the appreciation of the English language and literature, did not specify ICT integration requirements.

Despite the comprehensive revisions to all the domains and benchmarks of the English curriculum, no plan of action was provided for inservice teachers. They were left with the policy of adapting education to the 21st century without a plan of action (Eisenberg & Eden Selivansky, 2019). The Revised English Curriculum, published in January 2018, and later the 2020 English Curriculum, maintained the same generic guidelines for technology use as the 2013 version (Ministry of Education, 2013, 2018b, 2020). These revisions included identical "links to Word documents providing criteria and checklists for approving technology-based English-teaching activities" (Ministry of Education, 2018b, p. 16), but the 2020 curriculum omitted these, leaving only a set of principles for ICT integration (Ministry of Education, 2020). In addition, a review of inservice courses in English (Personal Communications, September, 2019; September, 2018; August, 2017; September, 2016) and the Inspectorate's website (Ministry of Education, 2019, 2022) revealed that no content-specific technology integration training courses were provided. The Ministry of Education (Ministry of Education, 2018a) offers generic courses in ICT integration in education. Studies investigating the implementation of the national programme for Adapting Education to the 21st Century found that while the programme positively affected teachers' technological literacy, their skills were still considered very basic by international standards (Eisenberg & Eden Selivansky, 2019).

The lack of inservice training for technology integration in English stresses the role of education colleges and English departments in preparing preservice English teachers to meet the ministry's policies and curriculum requirements. The changes in the education system necessitated adapting these colleges to the new demands, leading to the creation of the national programme for Adapting Teacher Education Colleges to the 21st Century (Ministry

of Education, 2011b). As part of this initiative, teacher education colleges received funding to prepare and implement the programme's vision for preservice education (Albion et al., 2015). This national programme emerged from discussions about the state of ICT training in teacher education colleges in Israel (Goldstein & Tesler, 2017), guided by a study on ICT integration in teacher education (Goldstein et al., 2011). The study found that preservice teacher programmes in Israel were insufficient in preparing teachers for ICT implementation. Thus, the primary goal of the national plan was to develop 21st-century skills among preservice teachers for effective technology integration in their teaching practices. The focus was on implementing innovative pedagogy suitable for the digital age, preparing students to be productive citizens in the digital age. The committee of the Education Ministry (2011b) stated that preservice teachers must develop digital literacy and TPACK skills to reach their role as effective teachers in 21st-century classrooms. Studies conducted by colleges measured the programme's impact on faculty development and student ICT skills. For instance, a quantitative study in seven teacher education colleges examined the effect on preservice teachers' ICT integration skills. Although Goldstein and Tesler (2017, 2020) reported a positive impact of the programme on students' ICT integration, their studies highlighted several areas needing improvement, such as more practice in ICT-based teaching, developing student-centred teaching approaches using ICT, matching preservice teachers with mentors proficient in ICT, and providing necessary equipment.

The current study focuses on preservice English teachers enrolled in the English Language and Literature B.Ed. degree programme at a teacher education college in Israel, specifically those taking a technology integration course. Established by the government, the teacher education college trains teachers and provides complementary education, preparing students to teach in all schools within the Israeli education system. The teacher preparation college is accredited as a four-year institute of higher education and is authorised to grant

undergraduate and graduate degrees (Personal Communications, 2020). The English department is a single-major track that trains preservice teachers to teach in junior high schools. One of the department's goals (Personal Communications, 2020) is to expose students to contemporary educational and pedagogical issues and train them for 21st-century teaching, including ICT integration.

To train preservice English teachers for 21st-century teaching with technology integration, the college offers three technology-related courses during the B.Ed. programme. In their first year, students take a generic introductory technology course covering basic computer technology and software, such as Microsoft Office, Windows operating system functions, internet searching, and email use. During their second year, they take a course in computer literacy, focusing on advanced digital technology tools like advanced email techniques, Google Documents, audiovisual tools, and collaborative tools. In their third year, preservice teachers take a course on integrating technology through the lens of pedagogy with a focus on content, which is the focus of this study. This course is offered in their third year after completing three courses in English methodology and English language instruction, and while they are completing their second round of practicum in the Israeli education system.

Statement of the Problem and Contribution to the Literature

Teacher education programmes are essential for preparing preservice teachers to effectively integrate technology into their future lessons (Baran et al., 2019). The way in which technology should be covered and the way it is implemented in preservice teacher education has received much attention (Koehler & Mishra, 2005a; Willermark, 2018). To teach effectively using technology, teacher education institutions need to assist preservice teachers in linking technology, pedagogy, and content knowledge (Tondeur et al., 2017). Key strategies in these programmes include offering courses, field practice, workshops, and engagement with mentors and faculty (Kay, 2006; Mouza, 2016; W. Wang et al., 2018). The

most fruitful learning strategy is based on a subject-specific learning experience (Hughes, 2004; Koehler & Mishra, 2005a; Mouza et al., 2014; Tseng et al., 2022), highlighting the need to understand how technology courses in teacher education programmes develop preservice teachers' knowledge regarding technology integration (Hofer & Grandgenett, 2012), especially in subject-specific learning experiences (Fabian et al., 2024; Voogt et al., 2013).

For preservice teachers to teach effectively using technology, they need Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006). One way to address this need is by acknowledging the value of courses that focus on educational technology (Mouza et al., 2014; W. Wang et al., 2018) and develop preservice teachers' TPACK (Mishra & Koehler, 2006). Since technology is a major concern for the development of English language teachers (S. Liu et al., 2014; Öz, 2015; A. Wang, 2016), developing TPACK in English preservice teacher education is necessary and invites research on the development of TPACK and the way in which this development may assist preservice teachers in gaining technology integration skills. Therefore, this study aims to investigate English preservice teachers' TPACK development and their experiences in a TPACK-based course.

This study aims to contribute to theory, practice, and policy. Firstly, this research aims to contribute to the literature on the theoretical framework TPACK and its development in the field of preservice education and English Language Teaching (ELT), as there are very few studies conducted in this specific subject area to develop preservice teachers' TPACK (Bich Dieu et al., 2019; Charbonneau-Gowdy, 2015; Ersanlı, 2016; Kayaduman & Delialioğlu, 2017; Koçoğlu, 2009; Kurt et al., 2013, 2014; Kwangsawad, 2016; Limbong, 2017; Muniandy & Veloo, 2011; Turgut, 2017b). This is especially true in Israel, where, based on my search for studies that investigate the development of TPACK, there are very

few studies and those only focus on the sciences and/or mathematics (Assadi & Hibi, 2020; Baya'a et al., 2017; Kramarski & Michalsky, 2009, 2010), education (Goldstein & Ropo, 2021), and multidisciplinary courses (Oster-Levinz & Klieger, 2009). To the best of my knowledge, no studies exist on the development of TPACK of preservice English teachers in the Israeli context. Therefore, this study aims to contribute to the burgeoning body of literature studying TPACK development among preservice English teachers. Since there is a lack of studies exploring the development and implementation of TPACK in content-specific areas such as ESL preservice teachers, especially in Israel, this stresses the need for such studies that have the potential to contribute to and extend the growing body of literature about subject-specific TPACK development (Mouza, 2016; Tseng et al., 2022).

Secondly, this study on developing preservice English teachers' TPACK aims to contribute to policy. The study aims to contribute to the national policy of the education ministry, which requires colleges to transform their practices to meet the demands of 21st-century skills through the use of ICT (Ministry of Education, 2011b). Thus, this study investigates the implementation of this policy in a teacher education college in Israel through a TPACK-based educational technology course for English preservice teachers. It aims to inform policymakers and teacher education colleges about the impact of technology courses on preservice teachers' TPACK development and their perceptions of technology in education. As teacher education programmes must actively prepare preservice teachers for technology integration (Mouza, 2016; W. Wang et al., 2018), this study aims to contribute to the practice and policy of teacher education programmes not only in the field of ELT (Bich Dieu et al., 2019; Ersanlı, 2016; Kharade & Peese, 2014; Kurt et al., 2014; Kwangsawad, 2016; Le & Song, 2018) but also in Israel as the study will offer insights on the development of TPACK in English Language Teaching (ELT) through a TPACK driven course. Succeeding in developing preservice teachers' skills and bringing about conceptual and

practical change could encourage institutions to adopt the practices in this study to develop technology integration courses through the lens of pedagogy in content-specific areas of instruction.

Thirdly, the study aims to contribute to practice. It examines the implementation of the Ministry of Education's demands within English teaching and the Israeli English Curriculum (Ministry of Education, 2020), as participants must implement these policies in their practicum. Thus, the study aims to investigate the contribution of the course to the implementation of the education ministry's requirements in the practice of teaching English. In addition, the study aims to contribute to the practice of English teachers' technology integration into their teaching practices and the design of curriculum-based technology lessons (Adipat, 2021; Bich Dieu et al., 2019; Ersanlı, 2016; Kharade & Peese, 2014; Kurt et al., 2014; Kwangsawad, 2016; Le & Song, 2018). Furthermore, since TPACK does not suggest learning experiences for the development of TPACK in preservice education (Mouza, 2016; W. Wang et al., 2018), the study also aims to contribute to the practice of designing and implementing technology courses to develop TPACK by instructors in preservice education (Adipat, 2021; Bich Dieu et al., 2019; Ersanlı, 2016; Kayaduman & Delialioğlu, 2017; Kurt et al., 2014).

Therefore, the aim of this research is to contribute to the body of literature on the TPACK framework, address the gaps in the literature, inform policy implementation in higher education, and contribute to the practice of technology instruction and integration in practice.

Motivation and Positionality

My transition from high school English teacher to PhD student and lecturer was driven by a passion for integrating technology into education through the TPACK

framework. In Israel's Arabic-speaking sector, I faced challenges with technology integration but recognised its potential. Later, as a professional development instructor, I incorporated technology into teacher training. My pursuit of a PhD in E-Research and Technology-Enhanced Learning aimed to deepen my understanding and share this knowledge with preservice teachers, leading to the development of a TPACK-based course. This study investigates their TPACK development and perceptions in the course.

A major challenge was avoiding bias, as I am an insider researcher deeply involved in the research setting and influenced by my experiences as a teacher and instructor. Following Merriam (2014), I acknowledge my bias and understand how it could shape the research process. I aimed to ensure the research's trustworthiness by viewing the data from the participants' perspectives while recognising that my knowledge of the English curriculum and teaching context adds a unique contribution to the field.

Purpose of the Study

The purpose of this qualitative case study was to investigate the development of Technological Pedagogical Content Knowledge (TPACK) in preservice English teachers through a course designed using the TPACK framework. By analysing self-report data, performance assessments, and observations, the study explores the development of TPACK and examines preservice teachers' perceptions of technology integration resulting from their participation in this TPACK-based course.

Research questions

This qualitative case study will focus on answering the following research questions:

1. How does preservice English teachers' Technological Pedagogical Content Knowledge (TPACK) change through a course based on TPACK?

I. What is the relationship between design activities based on TPACK and TPACK development in preservice English teachers?

II. What is the relationship between microteaching, macroteaching lessons and the development in TPACK of preservice English teachers?

III. How is TPACK development reflected in the microteaching lessons, macroteaching lessons, and design activities of preservice English teachers?

2. To what extent are the perceptions and attitudes of preservice teachers towards the integration of technology into English Language Teaching influenced by the TPACK-based course?
3. How does the course impact the conceptions of preservice teachers of learning and teaching with technology?

Summary and Organisation of the Study

This qualitative case study aims to investigate how a TPACK-based course affects preservice teachers' TPACK development and their perceptions regarding technology integration.

This introductory chapter provides the study's background and context, outlines the research problem, and presents my motivations as a researcher. It concludes with the study's purpose, research questions, key definitions, and an overview of the organisation of the study.

Chapter two provides a theoretical framework and reviews literature related to TPACK, focusing on its development within preservice English education. It highlights challenges, identifies gaps, and emphasises the need for further research.

Chapter three details the research methodology, including the study's design, data collection, and analysis methods, as well as ethical considerations.

Chapter four presents the findings related to TPACK development, using a vignette and thematic analysis to explore research question one.

Chapter five addresses research questions two and three, examining participants' perceptions and attitudes towards technology integration, illustrated through a vignette and thematic analysis.

Chapter six discusses the study's findings, relating them to the research questions: RQ1 explores TPACK development, RQ2 examines perceptions and attitudes towards technology integration, and RQ3 assesses the course's impact on conceptions of teaching and learning with technology.

Chapter seven concludes the study by summarising its contributions, implications, and suggestions for future research.

Chapter Two: Literature Review

Introduction

The purpose of this chapter is to identify key topics from the literature which are connected to this thesis. The review begins with TPACK which was used as a theoretical framework in this study to explore the development of preservice teachers' TPACK. The next part focuses on the challenges related to preparing preservice teachers to teach with technology. The chapter then turns to Learning Technology by Design and the TPACK-DBL instructional design model, which inform the design of this study. The final section reviews studies on TPACK in English preservice teacher education, examining how TPACK is developed, what outcomes are reported, and how this development is assessed. These sections together provide the foundation for understanding the design and analytical lens of this study.

The literature review for this study was conducted through systematic searches of peer-reviewed journal articles, books, and doctoral dissertations using Lancaster University's library databases and search engines such as Google Scholar. The databases I accessed included ERIC, EThOS, Wiley Online Library, SpringerLink, and ScienceDirect, among others. The search included keywords such as TPACK, TPCK, Technological Pedagogical Content Knowledge, ELT, ESL, EFL, preservice, pre-service, English, education, course, teacher development, challenges, and technology. I applied Boolean operators (AND, OR) to refine and expand the search results (e.g., TPACK AND preservice AND EFL). I included studies if they focused on the development of TPACK in preservice teacher education, particularly in the context of English language instruction. In addition, I included studies published from 2006 to 2025 to reflect advancements since the introduction of the TPACK framework. This includes research that evaluated the development or enhancement of TPACK among preservice teachers through various interventions, instructional strategies, or

program evaluations. Furthermore, I focused on studies relevant to my research questions, such as the factors influencing TPACK development, the effectiveness of different instructional approaches, and assessment methods. I excluded studies that focused only on in-service teachers or were not directly relevant to the development or assessment of TPACK in preservice teacher education.

TPACK as a Theoretical Framework

This section presents Technological Pedagogical Content Knowledge (TPACK) as the framework for this study, including a description of its components and the rationale for employing TPACK in this study.

Created as an extension to Shulman's (1986) concept of pedagogical content knowledge (PCK), the TPACK framework, introduced by Mishra and Koehler (2006), emerged from the discipline of teacher education and teacher professional development (Herring et al., 2016) to define the knowledge needed to effectively integrate technology into teaching (Koehler & Mishra, 2009). Their model, represented in Figure 1, illustrates that content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK) are the main components of teachers' knowledge (Koehler & Mishra, 2009). The intersection between these main components forms pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK). The intersection of all three circles is technological pedagogical content knowledge (TPACK) which stands for understanding how to represent concepts with technology, using pedagogical techniques that effectively integrate technology to teach content, knowing what makes concepts difficult or easy to learn and how technology can address these challenges, being aware of students' prior knowledge and epistemology, and using technology to build on existing knowledge or develop new understanding (Koehler & Mishra, 2009). To effectively integrate technology

into education, all three key sources of knowledge: technology, pedagogy, and content must be intertwined, and combining the key sources creates seven components.

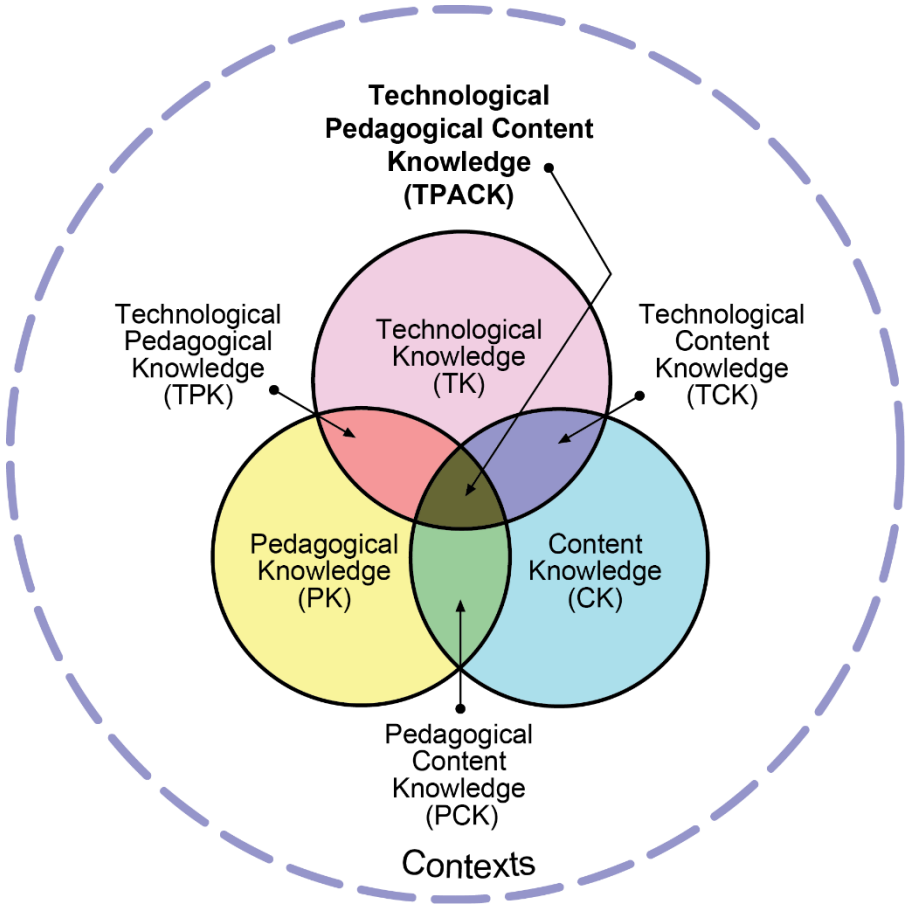
The basic knowledge domains in the TPACK framework include content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK). CK refers to the knowledge teachers have about the subject matter, including concepts, practices, and approaches for developing that knowledge (Koehler et al., 2013; Koehler & Mishra, 2009; Mishra & Koehler, 2006). An English teacher, for example, needs to develop knowledge in English language-specific linguistics, language proficiency, and cross-cultural awareness (Van Olphen, 2008). PK refers to the knowledge about the processes and methods for teaching and learning, such as classroom management, an understanding of how students learn, and student assessment (Koehler et al., 2013; Koehler & Mishra, 2009; Mishra & Koehler, 2006). TK refers to the knowledge about standard and advanced technologies, how to operate them (Mishra & Koehler, 2006), and adapt to the evolving state of TK (Koehler et al., 2013; Koehler & Mishra, 2009; Mishra & Koehler, 2006).

The intersection of the basic knowledge domains creates the integrated knowledge domains, which include pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK). The intersection of the integrated knowledge domains creates technological pedagogical content knowledge (TPACK). PCK refers to a combination of content and pedagogy, including the knowledge of teaching approaches, how they fit the content, and the arrangement of content for better teaching (Mishra & Koehler, 2006). For English teachers, for example, PCK refers to what teachers know about teaching English and using the language to "empower students to communicate across linguistic and cultural borders" (Van Olphen, 2008, p. 112). TCK refers to the knowledge of how technology and content influence one another and the understanding of how the application of technology can change the subject matter (Koehler & Mishra, 2009)

and be used to teach it. For language teachers, it is the knowledge that they have about the English language and its culture, and the way in which technology can be used to represent this knowledge and enhance learning (Van Olphen, 2008). TPK refers to an understanding of how particular technologies can change teaching and learning when used in particular ways. An English teacher, for example, should understand how blogs, which were designed for entertainment purposes, can be used for pedagogical purposes to enhance students' learning and understanding (Koehler & Mishra, 2009). Finally, TPACK refers to the combination of knowledge of technology, content, and pedagogy, leading to effective teaching with technology (Koehler & Mishra, 2009; Mishra & Koehler, 2006). For language teachers, effective teaching with technology includes understanding how technology can be used to represent linguistic and cultural concepts, developing language and cultural competence through socio-constructivist approaches to education, recognising how technology can improve problems faced by students in the acquisition and development of language competence, being aware of students' previous knowledge (including second language acquisition and cognitive development theories), and understanding how technologies can be used to develop current knowledge, new epistemologies, and maintain previous ones (Van Olphen, 2008).

Figure 1

Technological Pedagogical Content Knowledge (TPACK)



Note. From "What is technological pedagogical content knowledge?" by M. J. Koehler and P. Mishra, 2009, *Contemporary Issues in Technology and Teacher Education*, *9*(1), p. 63.

Since the framework is useful for defining the knowledge needed to successfully integrate technology into teaching (Koehler & Mishra, 2009), the study of the TPACK framework and its practical application has been the focus of scholars from around the world (Herring et al., 2016; Koehler & Mishra, 2009; Schmid et al., 2024). Teacher preparation programmes play an essential part in training and preparing teachers to develop knowledge of TPACK (Mouza, 2016; Ning et al., 2022; W. Wang et al., 2018). Therefore, there is a need to inform the development and assessment of TPACK within teacher preparation programmes. The TPACK framework has been used in teacher preparation programmes to develop,

measure, apply and assess preservice teachers' TPACK (Mouza, 2016; Schmid et al., 2024; Tseng et al., 2022). Studies that have aimed to measure and assess preservice teachers' TPACK have employed self-report measures, open-ended questionnaires, performance assessments, interviews, and observations (Koehler et al., 2012; W. Wang et al., 2018). Studies that have aimed to develop preservice teachers' TPACK have utilised a stand-alone educational technology course (e.g., Chai et al., 2010), integrated methods courses (e.g., Zipke, 2018), or a TPACK-infused approach in an entire educational institution programme (e.g., Foulger et al., 2012). Despite the increasing body of literature regarding TPACK in teacher preparation programmes, very few studies examine the pedagogical practices employed to prepare preservice teachers to use technology, the development of TPACK in content-specific subjects, and concrete evidence of that development (Fabian et al., 2024; Mouza, 2016; Voogt et al., 2013). This highlights the need for research that explores how teacher education programmes can foster the development of TPACK while considering the interplay of technological, pedagogical, and content knowledge. Specifically, there is a need for more research on how to effectively integrate TPACK development into different programme structures and pedagogical approaches within higher education (Ning et al., 2022; Papanikolaou et al., 2017).

Despite its influence, the TPACK framework has faced criticism regarding its complexity (Schmid et al., 2024; Sickel, 2019), which can hinder practical classroom application (Saubern et al., 2020; Schmid et al., 2024). A key critique of the TPACK framework-based interventions is their tendency to prioritise developing teachers' technological skills without providing adequate support in connecting those skills to specific pedagogical practices and content knowledge (Fabian et al., 2024). The framework also requires further development to address the context of technology integration, including factors such as student demographics, curriculum needs, and available resources (Brianza et

al., 2022; Greene & Jones, 2020; Schmid et al., 2024). In addition, measuring TPACK remains a complex task (Bower, 2017c), and existing instruments have limitations in accurately capturing the multifaceted nature of this knowledge (Schmid et al., 2024). Many of these instruments rely on participants' self-reported abilities, which may not always provide an accurate measure of their actual competence (Bower, 2017c). These challenges highlight the need for ongoing investigation of the TPACK framework, particularly in specific areas like English language teaching, where technology integration must align with specific pedagogical approaches and language learning goals (Tseng et al., 2022).

The theoretical framework in this study is based on the TPACK framework to explore the preparation of preservice teachers and the development of their TPACK in a content-specific context. The TPACK framework has been used as a tool for technology integration in teacher education contexts (Bakir, 2016; Baran & Uygun, 2016; Ning et al., 2022; Voogt et al., 2013), for developing preservice teachers' TPACK (Mouza, 2016; Tseng et al., 2022), and to inform the design of teacher education programmes (Fabian et al., 2024; Mouza, 2016), therefore, it is employed as the theoretical framework in this study. This framework is used in this study for two reasons: first, it is employed as an analytic lens for studying the development of preservice teacher's TPACK (Bower, 2017c) in the context of English preservice education, because the framework describes the types of knowledge needed (technology, content and pedagogy) to "assist the development of better techniques for discovering and describing how technology-related professional knowledge is implemented and instantiated in practice" (Koehler & Mishra, 2009). Second, it informs the course design, which is based on the TPACK model, as described in the following sections of the review, and aims to provide support and structure for the development of preservice teachers' TPACK. Therefore, the aim of this study is to develop English preservice teachers' TPACK

through a course that uses and applies the TPACK framework both for the design of the course and TPACK development.

Challenges in Preparing Preservice Teachers to Integrate Technology

Preparing preservice teachers to teach with technology is described in reports and policies as one of the most important aspects that leads to the technology integration in teaching (Lei, 2009). The purpose of this part of the review is to explores the key barriers that hinder the effective integration of technology by preservice teachers. It focuses on three main challenges identified in the literature: the limited skills preservice teachers demonstrate when attempting to integrate technology into instruction, their lack of confidence in using technology for teaching purposes, and the tendency to focus on learning about technology rather than learning how to teach with it. The review also highlights the importance of aligning technology with pedagogy and content, drawing on the TPACK framework to support the development of the specific knowledge preservice teachers need to plan and deliver technology-integrated instruction.

Lack of Skills for Technology Integration into Education

A review of relevant research on the use of technology by preservice teachers reveals that they underuse technology for teaching purposes. The research suggests that, while preservice teachers are often referred to as digital natives; they are not necessarily digital native preservice teachers (Lei, 2009; Siregar et al., 2024; Stockless et al., 2022), as they are well equipped to use technology for expression and communication but underuse it when teaching or use structured teaching and learning approaches (Jeong, 2017; Mouza et al., 2014; Sointu et al., 2016; Tondeur et al., 2017; W. Wang et al., 2018). It cannot be assumed that preservice teachers are comfortable with technology simply because they are familiar with it; therefore, they will not necessarily know how to integrate technology into their teaching

practices (Lei, 2009; Niess, 2015). On the contrary, preservice teachers may demonstrate limited knowledge of pedagogical technology, which does not always align with innovative teaching methods that effectively integrate technology (Abedi et al., 2024; Instefjord & Munthe, 2016; Kontkanen et al., 2016).

Studies have shown that preservice teachers need training to develop their knowledge of ICT and its application to teaching (Abedi et al., 2024; Agyei & Voogt, 2015; Jeong, 2017; Le & Song, 2018). Preservice teachers may have technology skills, but merely knowing how to use technology does not result in effective technology use when teaching (Jamila & Basya, 2024; Tondeur et al., 2017; Turgut, 2017a). Agyei and Voogt (2015), for example, found that participants in their study showed improvement in their competence in integrating technology; however, the results showed some difficulties in transferring the theoretical background to create authentic activities. This resulted in the replication of the instructor's examples with slight changes when trying to create their own activities, indicating their lack of experience in using technology for instructional purposes. Despite overall positive results, a study aiming to develop digital literacy by Jeong (2017) showed elevated confidence in integrating technology into participants' future teaching as a result of their experience in the offered course. This shows that the more experience preservice teachers get in integrating technology into their teaching practices, the more confidence they gain in doing so.

Research shows that preservice teachers' limited technology integration skills are partly shaped by their teacher training learning experience, which often emphasises traditional teaching methods while positioning technology as a secondary instructional tool (Tondeur et al., 2012). Although preservice teachers receive technology training, they use technology in a traditional way as an aid rather than a medium to transform learning (Abedi et al., 2024; Stockless et al., 2022; Turgut, 2017a). The use of ICT seems to focus on the passive role of students, while the teacher is the main conveyor of information (Kontkanen et

al., 2016). This is partly connected to the way they receive instruction during their teacher training, as preservice teachers are not always exposed to teaching with technologies (Abedi et al., 2024; Borthwick & Hansen, 2017; Chigona, 2015; Jin & Harp, 2020). In addition, when preservice teachers are passive learners, they have no opportunity to put theory into application (Zhou et al., 2011). Therefore, preservice teachers would rather teach using a traditional mode of instruction rather than use ICT in their teaching, as they are comfortable with teaching methods they are accustomed to (Chigona, 2015; Zipke, 2018). Studies stress the need for modelling by education institutions to encourage preservice teachers to adopt technologies into their teaching practices (Abedi et al., 2024; Alnasib, 2023; Andreasen et al., 2022; Chigona, 2015; Jeong, 2017; Lindfors et al., 2021). Chigona (2015), for example, stated that preservice teachers are not equipped to teach with technology and suggested that teacher educators at preservice preparation institutions should "embrace the new pedagogies and model them to their preservice teachers" (2015, p. 486). This is also the case in the study by Admiraal et al. (2017), in which preservice teachers were inspired to use technology in their own teaching as a direct result of the technology-infused approach they experienced in class.

This stresses the role of teacher preparation programmes in helping preservice teachers to understand how to integrate technology into their teaching practices (Abedi et al., 2024; Andreasen et al., 2022; Chai et al., 2013; Le & Song, 2018). Emphasis should be given to gaining experience using technology meaningfully by learning to make a connection between technology and teaching (Abedi et al., 2024; Lei, 2009). This cannot be done in isolation, as preservice teachers "require support in applying these technologies as tools for learning, especially for collaborative learning and student-centred activities" (Sointu et al., 2016, p. 3072), particularly in subject-specific contexts (Andreasen et al., 2022; Fabian et al., 2024).

Lack of Confidence in Integrating Technologies into Practice

Research suggests that preservice teachers and newly qualified teachers feel they are not well-prepared to use technology in their classrooms. Preservice teachers feel that they have limited proficiency in teaching and using technology for subject-specific teaching (Alnasib, 2023; Lei, 2009; S.-H. Liu, 2012) and do not feel prepared to effectively integrate technology into their teaching (Siregar et al., 2024; Stockless et al., 2022; Tondeur et al., 2017) even after taking computer literacy courses (Alnasib, 2023; Chigona, 2015). This is often a result of the focus on generic computer skills or technology in contrast to the focus on "subject content knowledge with appropriated technology and pedagogy" (Mei, 2019, p. 21). This aligns with the research by Zhou et al. (2011), who explored participants' experiences and perspectives after taking an educational technology course. The findings suggest that since the course focused on technical skills rather than teaching subject-specific pedagogy with technology, participants were not well-prepared to use technology in their teaching practices, although they showed positive responses towards using technology in education.

Research suggests that preservice teachers should be provided with experiences in which they make connections between practice and theory suitable to the pedagogy of the subject they will be teaching (Adipat, 2021; Chigona, 2015; Kontkanen et al., 2016; Mei, 2019; Zhou et al., 2011). Simply focusing on theory is not sufficient for developing preservice teachers' confidence in practical application. Studies have shown that engaging preservice teachers in student-centred and hands-on activities helps them develop their practical application skills. This is illustrated in the study by Lock and Redmond (2010), who explore how ICT can be integrated to enhance learning outcomes. The participants in the study, who are all preservice teachers, engaged in learner-centred activities to develop these skills, which resulted in transforming theory into practice. Similarly, Nzai et al. (2014) studied the effect of participation in a laboratory practice project designed to train preservice

teachers to integrate technology into their teaching. The findings showed that the mode of study was student-centred as preservice teachers engaged in design and application activities. The researchers conclude that although preservice teachers showed concern regarding technology tools and skills, the hands-on experience enhanced their teaching skills with technology. Buss et al. (2018) stated that the growth of their participants' TPACK and technology integration was a result of the effort invested in preparing preservice teachers for technology integration, mainly through modelling by mentors, designing technology-infused lessons, and practical application during student teaching. In conclusion, studies have shown that engaging participants in practice increases their confidence in integrating technology into their practice.

Too Much Focus on Technology and Not Enough on Teaching

Research suggests that teacher education programmes should help students gain knowledge and experience with a wide range of technologies and even more advanced technologies (Lei, 2009; Lindfors et al., 2021). However, teaching technology cannot be taught separately, as preservice teachers need to focus on how these technologies support their roles as teachers (Forkosh-Baruch, 2018; Lei, 2009; Mei, 2019; Ottenbreit-Leftwich et al., 2012; Sadaf et al., 2012; Sointu et al., 2016; Tondeur et al., 2017) and enhance learning and teaching outcomes (Lock & Redmond, 2010). Focusing on the technology rather than how preservice teachers can teach the subject using the technologies has failed to transform education (Abedi et al., 2024; Tondeur et al., 2017; Turgut, 2017a; Zhou et al., 2011). According to research, preservice teachers believe that technology tools are easy to use, but they struggle when integrating technology tools into their lessons to support learning (Lindfors et al., 2021; Mei, 2019; Mouza et al., 2014; Sadaf et al., 2012). This claim is supported by a study by Tondeur et al. (2017), who explored the connections between beginning teachers' technology uses and their preservice education programmes. They

concluded that, while exposure to technology tools and their application is useful for teachers, preservice teachers needed more instruction on how to use such technologies in their teaching practice.

Research indicates that too much focus on ICT tools in isolation from content does not support technology integration. “In fact, preservice teachers often learn about teaching and learning with technology in a more generic manner unconnected with the development of their knowledge of the subject matter” (Niess, 2005, p. 510), and therefore only gain technology use skills. This assertion is illustrated in a study of the integration of digital competence in teacher education institutions by Instefjord and Munthe (2016), who found that educational technology courses increased technology competence by focusing on digital tools. However, these courses did not enhance students’ ability to integrate technology to improve learning outcomes due to a lack of subject-specific content application. Similarly, Mei (2019) explored English as a Foreign Language (EFL) teacher education programme in China, focusing on preparing preservice teachers for Computer-Assisted Language Learning (CALL) normalisation. Participants reported that technology tools were easy to use, but even after ICT courses, they were not sufficiently trained to use CALL for innovative language learning experiences. This indicates that generic ICT learning does not support technology integration with pedagogy in subject-specific content.

Research has shown that in order for preservice training in the use of technology to be effective, it needs to be combined with teaching practice (Alnasib, 2023; Stockless et al., 2022). Therefore, rather than focusing on ICT tools in isolation, preservice teachers should be provided with opportunities to apply ICT within their teaching context (Abedi et al., 2024).When technology is integrated with teaching, preservice teachers can practise combining knowledge of technology with pedagogy and content. For instance, Zipke (2018) found that although the course was designed to enhance technology skills by focusing on

technology tools, participants were able to create lesson plans that demonstrated some level of TPACK. This success was because ICT tools were integrated with an instruction strategy that combined learning technology skills and digital literacy into field-based lessons. In addition, the study by Agyei and Voogt (2015) demonstrated the impact of focusing on a specific ICT tool, spreadsheets, while integrating it with instructional strategies and, most importantly, providing opportunities for practical application, which led to increased competence in using technology effectively among mathematics preservice teachers. The participants in the study experienced multiple technology-enhancing strategies, such as design activities, collaboration, and practical application. The results showed that the participants succeeded in increasing their skills in integrating technology, but those who had the opportunity to apply their skills using the tools showed more improvement than those who did not. Therefore, preservice teacher education programmes should not only expose students to a wide range of technologies but also emphasise how these tools can be effectively integrated to support teaching and learning.

Aligning Technology with Pedagogy and Content

Research shows that there is a need to align instruction of technology with pedagogy and content in preservice education (Abedi et al., 2024; e.g., Bell et al., 2013; Chigona, 2015; Mei, 2019; Mouza et al., 2014). Technology should not be taught separately from content and pedagogy. Teacher education institutions should help preservice teachers "understand how technology intersects with content and with pedagogy and make connections between technology, content, and pedagogy" (Lei, 2009). Studies show that, regardless of their technological proficiency, preservice teachers need to learn to integrate ICT through curriculum delivery (Chigona, 2015; Koehler et al., 2012). When preservice teachers become active learners and make connections between pedagogy and technology, they develop their knowledge of technology and pedagogy simultaneously (Kontkanen et al., 2016). Kopcha et

al. (2014) found a gap between what is taught and how it is put into practice, as the participants in the study could clearly articulate an understanding of technology based on their reflections but found great difficulties in planning technology-infused lessons that align with specific content standards. Similarly, Mouza and Karchmer-Klein (2013) examined preservice teachers' lesson plans as part of a technology integration course. The findings suggest that there is a gap between the theoretical aspect of their lesson plans and the application in real-class settings, which indicates the need for more experience with technology to effectively put theory into practice. Jeong's (2017) study, further stresses the need for curriculum development focused on technology integration, as participants recommended more structured opportunities to design technology-rich lessons that would better prepare them to use technology effectively as future inservice teachers.

The aim of this section was to identify common challenges in the preparation of preservice teachers to use technology in education. Research shows that these challenges are often related to the limited focus on pedagogical use of technology, the lack of authentic opportunities to practise technology integration, and the insufficient alignment between technology, content, and pedagogy. Effective technology integration requires providing preservice teachers with experiences that align technology use with pedagogy and content. Using the TPACK framework to design learning experiences has the potential to impact preservice teachers' professional development (Öz, 2015; Schmidt et al., 2009). Therefore, more studies are needed to investigate the development of technology use combined with pedagogy in content-specific subjects within preservice education. The course in this study, designed based on the TPACK framework, aims to prepare preservice teachers to integrate technology with content and pedagogy in their teaching practice, addressing the challenges identified in this section of the review.

Learning Technology by Design and TPACK-DBL

Teacher education programmes play a crucial role in preparing preservice teachers to effectively integrate technology into education (Baran et al., 2019; Ozden et al., 2024). Effective technology integration into teaching and learning requires the development of the knowledge and skills to integrate technology with content and pedagogy, as conceptualised through the TPACK framework (Mouza, 2016; Ozden et al., 2024). One effective method used by teacher preparation programmes to prepare teachers for using technology is through courses based on the TPACK framework (Tseng et al., 2022). However, since TPACK does not provide specific recommendations for TPACK development experiences (Bower, 2017c; Mouza, 2016; Schmid et al., 2024), teacher preparation programmes must consider the types of experiences that can effectively develop TPACK. Therefore, understanding how preservice teachers' technology integration knowledge develops through their course experiences and identifying effective strategies to develop TPACK is essential (Baran et al., 2019; Hofer & Grandgenett, 2012). This chapter examines empirical findings on how preservice teachers develop TPACK through learning experiences designed based on Learning Technology by Design. It focuses on how combining theoretical instruction with design activities, practical implementation, collaboration, and reflection supports the development of TPACK. In addition, it reviews key strategies and outcomes reported in the literature, analyses the TPACK-DBL instructional model, and identifies gaps that inform the design and analytical framing of this study.

Learning Technology by Design

Much of the literature has focused on the Learning Technology by Design (Koehler & Mishra, 2005a), examining the outcomes of design-based approaches that align with the TPACK framework. Based on a constructivist approach to teacher education (Herring et al., 2016), Learning Technology by Design emphasises learning by doing, in which teachers

construct and design instructional artefacts. Engagement in design tasks is done in collaborative groups and is "experienced in activity, depends on recognition of design quality, entails a creative process, is understood in dialogue and action, and involves reflection in action" (Mishra & Koehler, 2006, p. 1035). A growing body of research demonstrates that preservice teachers who engage in Learning Technology by Design activities develop stronger TPACK competencies (Bich Dieu et al., 2019; Hofer & Grandgenett, 2012; Kurt et al., 2014).

Studies show that preservice teachers who engage in design activities, such as creating their own lessons or artefacts, experience increased TPACK domains (Aktaş & Özmen, 2020; Bich Dieu et al., 2019; Hofer & Grandgenett, 2012; Koh & Divaharan, 2011; Kurt et al., 2013). While developing TPACK is time-consuming and effort-intensive, the Learning Technology by Design approach is highly effective in preparing preservice teachers and fostering a TPACK mindset (Mishra & Henriksen, 2015). For instance, Kurt et al. (2013, 2014) engaged English as a Foreign Language (EFL) preservice teachers in designing and implementing technology-integrated lesson plans, resulting in significant TPACK improvements and increased confidence in using technology to support learning. The key advantage of these studies lies in their combination of design activities with practical application, which helps preservice teachers connect the theoretical and practical aspects of teaching with technology.

Subject-Specific Applications of Design-Based Learning. Research indicates that Learning Technology by Design is most effective when applied to specific subject areas, allowing preservice teachers to integrate technology into their teaching practices by combining content knowledge with pedagogical knowledge (Andreasen et al., 2022; Bich Dieu et al., 2019; Voogt et al., 2016). For example, Koh and Divaharan (2011) examined a three-phase intervention designed for preservice teachers from different content subjects.

Although the design activity developed technological knowledge (TK) and pedagogical knowledge (PK), it had a limited impact on technological content knowledge (TCK) and overall TPACK development, suggesting that generic applications may restrict the depth of integration. Similarly, Mouza and Karchmer-Klein (2013) engaged preservice teachers from various subjects in designing web-based lessons and integrating Web 2.0 tools, which helped participants recognise the relationship between technology, content, and pedagogy, although practical application gaps in their lesson plans remained. In contrast, Assadi and Hibi (2020) found that preservice mathematics teachers who participated in an integrated pedagogical course demonstrated improvements in their TPACK, mainly in designing lesson plans that combined mathematical content with technological and pedagogical strategies. These studies suggest that preservice teachers benefit most from Learning Technology by Design when the design tasks are directly linked to the subject they are preparing to teach and implemented within authentic instructional contexts.

Integrating ICT Tools in Design Activities. The literature has shown that integrating technology and ICT tools in design activities requires more than technical proficiency; it stresses the need for preservice teachers to understand the pedagogical affordances of these tools and their alignment with specific content and learning objectives (Angeli & Valanides, 2009). Studies that examine the outcomes of the use of ICT tools in design-based TPACK courses indicate that preservice teachers' ability to select and apply appropriate digital tools directly affects the quality of their instructional design and implementation (Drajati et al., 2021). However, preservice teachers face difficulties in finding appropriate ICT tools for their design activities (Abedi et al., 2024; Nguyen & Bower, 2018; So & Kim, 2009) and need time to be familiarised with, utilise, and integrate unfamiliar ICT tools (Koh & Divaharan, 2011). As ICT usage influences TPACK competencies (Kabakci & Coklar, 2014), effective technology integration and the design of activities depend on teachers' ability to

choose and utilise appropriate ICT tools (Bower et al., 2010; Nguyen & Bower, 2018; Stockless et al., 2022). This stresses the need for enhancing preservice teachers' skills in selecting the right ICT tools to support teaching and learning (Abedi et al., 2024; Angeli & Valanides, 2015), and providing them with ample experience and exposure to ICT tools that are appropriate for their specific subject content (Koh & Divaharan, 2011; So & Kim, 2009).

In addition, recent findings indicate that preservice teachers develop two main types of ICT competencies: using ICT to facilitate student learning and using ICT as a delivery tool (Drajati et al., 2021; Tondeur et al., 2017). These competencies suggest that while preservice teachers can effectively use ICT to aid their teaching, there is a need for greater emphasis on designing ICT-based learning activities that engage students actively to transform education and promote students' cognitive skills (Krauskopf et al., 2015). This leads to the conclusion that preservice teachers, especially in the early stages of TPACK development (Koh & Divaharan, 2011; Kontkanen et al., 2016), should engage in learning experiences in which they explore technological capacities and pedagogical benefits of ICT tools before creating technology-rich learning experiences (Baran & Uygun, 2016; Kontkanen et al., 2016; Nguyen et al., 2022). Such experiences can help them transform their view of technology from a reinforcement tool into a tool to support students' development (Drajati et al., 2021; Özgün-koca et al., 2009), select the appropriate tools for effective pedagogical practices (Abedi et al., 2024; Aktaş & Özmen, 2020; Angeli & Valanides, 2009; Drajati et al., 2021), and integrate TPK, TCK, and TPACK to develop expert thinking (Nguyen et al., 2022).

Aligning Theory and Practice in Design Activities. Studies have shown that aligning theoretical instruction with practical application in Learning Technology by Design contexts contributes to improvements in preservice teachers' TPACK (Agyei & Voogt, 2015; Aktaş & Özmen, 2020; Durdu & Dag, 2017). Understanding technology integration and theories is crucial for preservice teachers because it provides insights into the reasons for

using technology in education (Agyei & Voogt, 2015). Strategies used to introduce theoretical knowledge include introducing theoretical concepts (Agyei & Voogt, 2015; Aktaş & Özmen, 2020; Durdu & Dag, 2017; Jeong, 2017), presenting information about technologies (Sadaf et al., 2012), holding class discussions about technology integration (Kurt et al., 2014), providing introductory lectures (Sointu et al., 2016), learning to critique technology-integrated lessons (Mouza et al., 2014), using exemplary curriculum material (Agyei & Voogt, 2015), and inviting guests lecturers (Harte, 2017; Zipke, 2018). These methods contributed to understanding and developing TPACK constructs such as TK, TPK, TCK (Aktaş & Özmen, 2020; Kurt et al., 2013), increasing preservice teachers' confidence with educational technology (Zipke, 2018), and improving the ability to critique technology-integrated lessons (Mouza et al., 2014). Kurt et al. (2013) found that coursework introducing the TPACK framework, combined with designing and teaching subject-specific lessons, led to improved alignment of tools with content and pedagogy. Thus, when coursework integrates theoretical instruction with practical design tasks, preservice teachers show clearer reasoning about their technology choices and better alignment of tools with subject-specific content and pedagogy.

Research indicates the need to align theory with practice to develop preservice teachers' TPACK. While theoretical knowledge enhances preservice teachers' knowledge and provides a basic understanding of TPACK (Voogt et al., 2016), it is insufficient for effective classroom practices. The literature has shown that incorporating Learning Technology by Design- based activities in courses can shift instructional practices from teacher-centred to student-centred (Aktaş & Özmen, 2020; C.-J. Lee & ChanMin, 2017). However, integrating technology into teaching practices can be challenging for teachers (Abedi et al., 2024; Siregar et al., 2024; Voogt & McKenney, 2017), often resulting in teacher-centred lessons (Kontkanen et al., 2016; Voogt et al., 2016). In contrast, a student-

centred learning environment encourages students to use technology for advanced cognitive tasks. Engaging teachers in design activities shifts their practices from traditional instruction to advanced knowledge creation, offering a new perspective on teaching and learning (Chai et al., 2013). When preservice teachers engage in design activities, they become equipped to engage students in learning using technology (Chai et al., 2013), as their TPACK is reflected in the type of activities they design for their students (Özgün-koca et al., 2009). Thus, it is essential for teachers to practice designing lessons that foster a new learning culture (Chai et al., 2019), and thus should be provided with opportunities to develop TPACK in-depth through experience in practice (Stockless et al., 2022). The Learning by Design approach, which involves designing and implementing instructional artefacts, bridges theory and practice (Koehler & Mishra, 2005a). For example, the participants in Agyei and Voogt's (2015) study attended lectures to learn theoretical foundations and lab sessions, where they applied this theory in practice. The results showed that participants gained theoretical insights when provided with exemplary material and theoretical knowledge, but these were not taught in isolation. Instead, they were combined with Learning by Design activities and practical application sessions, including peer teaching, which resulted in improved competencies and higher TPACK scores in comparison to those who did not take part in the practical application. Similarly, Akkoç (2011) investigated technology integration in mathematics lessons to address student difficulties with learning the subject matter. The study included two pre- and post-workshop microteaching experiences in which participants taught their peers. An analysis of lesson plans, teaching notes, lesson videos, and interview transcripts showed that participants' TPACK improved, particularly in addressing student difficulties. Similarly, Durdu and Dag (2017) aimed to develop TPACK in preservice mathematics teachers by having participants teach microteaching sessions based on the lesson plans they created. This resulted in increased TPACK, especially in the TK, TCK, and TPK sub-

domains. These findings suggest that the more preservice teachers are engaged in practical application, the more their TPACK develops. Voogt et al. (2013) also found that although preservice teachers gain lesson design experience, they lack experience in practical application. Therefore, enacting designed lessons is crucial to the development of TPACK. Learning Technology by Design thus serves as a bridge between conceptual understanding and classroom practice.

Providing preservice teachers with authentic teaching experiences is vital for transforming their teaching practices (Stockless et al., 2022). Studies have utilised authentic learning experiences aiming to bridge the gap between theoretical knowledge and practical knowledge by employing microteaching (Agyei & Voogt, 2015; Bich Dieu et al., 2019; Cavin, 2007; Durdu & Dag, 2017; Harte, 2017), macroteaching (Aktaş & Özmen, 2020; Kurt et al., 2014; Mouza et al., 2014; Mouza & Karchmer-Klein, 2013), or a combination of microteaching during the course and macroteaching during practicum (Kurt et al., 2014, 2013; Kwangsawad, 2016; M.L. Niess, 2005). The literature on providing authentic learning experiences has reported increases in participants' TPACK levels, as well as in confidence levels (Aktaş & Özmen, 2020; Foulger et al., 2012; Kurt et al., 2013, 2014; Martin et al., 2020), awareness of students' learning (Akkoç, 2011; Aktaş & Özmen, 2020) and a deeper understanding of the relationship between technology, content, and pedagogy (Durdu & Dag, 2017; Kurt et al., 2013, 2014; Kwangsawad, 2016; Mouza & Karchmer-Klein, 2013; Özgün-koca et al., 2009). However, to make connections between theory and practice and demonstrate a deep understanding of TPACK, preservice teachers need more opportunities to gain more experience with technology integration by practising technology application (Abedi et al., 2024; Alnasib, 2023; Mouza et al., 2014; Özgün-koca et al., 2009; So & Kim, 2009), practising teaching to their peers (Aktaş & Özmen, 2020; Foulger et al., 2012; Martin et al., 2020), and engaging in reflection (Drajati et al., 2021; Martin et al., 2020; Saralar-Aras

& Türker-Biber, 2024; Syamdianita & Cahyono, 2021). In addition, the literature shows that preservice teachers should be placed with mentor teachers who can model and support preservice teachers to integrate technology into their teaching practices (Foulger et al., 2012; S.-H. Liu, 2012; Mouza et al., 2014; Stockless et al., 2022; Zipke, 2018). Placement with cooperating teachers who do not model successful technology integration negatively impacts preservice teachers' TPACK development (Meagher et al., 2011; Mouza et al., 2014).

In conclusion, while theoretical aspects of technology integration are necessary to introduce teachers to technology integration and form an understanding of TPACK, without putting theory into practice, the use of technology in education remains superficial (Agyei & Voogt, 2015; Harte, 2017; Kurt et al., 2014; Mouza et al., 2014; Sointu et al., 2016; Zipke, 2018), as TPACK develops during teaching in practice (Voogt et al., 2016). Creating authentic learning experiences (Kay, 2006; Stockless et al., 2022) is necessary for preservice teachers to develop TPACK through practice. Limited experience in applying technology while teaching may hinder preservice teachers' ability to integrate technology into their teaching (Harte, 2017; Koh et al., 2010; Mouza et al., 2014; Mouza & Karchmer-Klein, 2013; So & Kim, 2009; Turgut, 2017a).

Collaboration and Reflective Practices in Learning by Design. A growing body of research demonstrates that integrating collaborative and reflective practices in design activities results in preservice teachers' TPACK development. Collaborative design activities reflect the social nature of learning (Koehler & Mishra, 2005a), stimulating and supporting preservice teachers' training (Agyei & Voogt, 2015; Nguyen et al., 2022). As group members work on design tasks to solve authentic problems, their TPACK and its constructs develop (Baran & Uygun, 2016; Kharade & Peese, 2014). In addition, the literature highlights that Learning Technology by Design is often integrated with reflection because "reflective learning is that which enables the learner to engage in deep and transformatory learning.

Without the interaction brought about by dialogue reflective learning may not happen" (Brockbank & McGill, 2007, p. 94). According to Baran and Uygun (2016), reflection encourages learners to engage in self-assessment, expand on their experiences, and identify difficulties in TPACK development.

Studies have shown that collaboration and peer learning are key methods in preparing preservice teachers to develop TPACK (Cengiz & Kaçar, 2024; Tondeur et al., 2012). Collaboration and group work in designing activities allow preservice teachers to practise and apply technology in a supportive environment (Agyei & Voogt, 2015; Angeli & Valanides, 2009; Aşık et al., 2018; Nguyen & Bower, 2018). This results in "developing the concrete artefacts that constitute an environment for technology-enhanced learning" (Voogt et al., 2016, p. 43). For instance, Agyei and Voogt (2015) reported an increase in all TPACK constructs among participants who took part in collaborative design and peer teaching in comparison to those who did not. The increase in knowledge and skills among preservice mathematics teachers was attributed to the additional work and planning required for peer teaching, which provided a supportive environment for enhancing TPACK. Additional studies have shown that when preservice teachers collaborate in groups to design, discuss, give feedback, and reflect on activities, their self-efficacy and confidence levels are raised (Bich Dieu et al., 2019; Chai et al., 2019; Kayaduman & Delialioğlu, 2017), their performance in design tasks improves (Angeli & Valanides, 2009), their TPACK level increases (Agyei & Voogt, 2015; Bich Dieu et al., 2019; Cavin, 2007; Jin & Harp, 2020; Koh & Divaharan, 2011), and they learn about teaching with technology and curriculum implementation (Bich Dieu et al., 2019; Kayaduman & Delialioğlu, 2017). For example, Koçoğlu (2009) showed that collaborative lesson discussions helped preservice English teachers transform their technological knowledge into technological content knowledge. Similarly, Cavin (2007) showed the development of preservice teachers' TPACK through

microteaching lessons created in groups, where participants received peer feedback and engaged in reflection after practical application. The reflection focused on analysing student comprehension, the success of technology integration, and the overall effectiveness of teaching the lesson with technology, leading to noticeable development in their TPACK. Jeong (2017) further reinforces the benefits of collaborative learning by showing how group work in developing technology-integrated lessons and engaging in peer assessment helped preservice teachers build confidence in using technology. These studies stress the positive results of cooperation and teamwork in design activities, which are instrumental in enhancing preservice teachers' TPACK.

Reflective practices such as peer and self-reflection have also been shown to lead to significant outcomes in TPACK development (Baran et al., 2019; Bugueño, 2013; Cavin, 2007; Chai et al., 2010; Harrington, 2008; Harris & Hofer, 2011; Hofer & Grandgenett, 2012; Koh & Divaharan, 2011; Kurt et al., 2014, 2013; Martin et al., 2020; Mouza & Karchmer-Klein, 2013; Niess, 2005). Preservice teachers should be given an opportunity to reflect on the use of technology with a focus on teaching subject-specific content (Turgut, 2017a). However, reflection cannot be used as the sole form of TPACK development assessment, as there may be disparities between preservice teachers' reflections and actual implementation (Kopcha et al., 2014). Turgut (2017a), for example, suggests a combination of group and collaborative work, observations, and reflection to improve preservice teachers' teaching skills with technology integration. Similarly, the participants in Mouza and Karchmer-Klein's (2013) study went through a process of design, enactment, and reflection on their classroom experience with using technology. The results showed that integrating reflection in the learning process contributed to helping participants identify the relationship between technology, content, and pedagogy.

Thus, the literature suggests that employing Learning Technology by Design supported by reflective practices and feedback results in gains for preservice teachers. The results of studies employing reflective practices, feedback and Learning Technology by Design show gains in self-efficacies for design thinking (Chai et al., 2019; Martin et al., 2020), evaluation of effective use of technology (Martin et al., 2020; Rehmat & Bailey, 2014), recognition and acceptance of technology use (Aşık et al., 2018; Mouza & Karchmer-Klein, 2013), improvement of technology integration competencies (Agyei & Voogt, 2015), identification of teaching difficulties and improvement in building teachers' abilities and motives to change their teaching practices (Jeong, 2017; Zipke, 2018), and development of TPACK constructs (Angeli & Valanides, 2009; Koh & Divaharan, 2011) in addition to making connections between technology, content, and pedagogy (Mouza & Karchmer-Klein, 2013).

Learning Technology by Design in the Israeli Teacher Preparation Context. Within the Israeli education system, limited studies have focused on TPACK development through design processes; however, several attempts have been made to explore strategies for preparing preservice teachers with the skills needed to integrate technology into teaching. Studies have focused on interventions or courses aiming to develop TPACK by integrating tasks that align with principles of Learning by Design, where teachers develop knowledge by creating instructional artifacts. While these studies (Assadi & Hibi, 2020; Baya'a et al., 2017; Kohen et al., 2025; Kohen & Kramarski, 2012) report some positive outcomes, an examination of their methodologies for both developing and assessing TPACK, specifically through design processes, reveals some limitations and gaps.

Efforts to develop TPACK in the Israeli preservice teacher education context have involved methods centred around design tasks, reflecting some aspects of Learning by Design. These include engaging preservice teachers in designing lesson plans that integrate

technology and pedagogy with considerations for self-regulated learning (SRL) (Kohen & Kramarski, 2012) and engaging participants in learning a variety of technological tools in teaching mathematics or science (Baya'a et al., 2017) or very specific tools like GeoGebra to explore teaching mathematics for TPACK development (Assadi & Hibi, 2020; Kohen et al., 2025). For example, in Kohen, Schwartz-Aviad, and Peleg's (2025) study, after learning GeoGebra, exploring dynamic geometry content, and experiencing inquiry-based learning as learners, pre-service teachers designed a geometry activity using GeoGebra. This design process involved choosing topics, creating the technological application, presenting it, and receiving feedback, serving as a key method for assessing their developed TPACK. Similarly, in Assadi and Hibi's (2020) study, participants were required to create and present lesson plans that integrated GeoGebra software twice over the semester. This process included preparing lesson plans, receiving peer evaluations and conducting self-evaluations after the first project, and then revising their lesson plans based on the feedback and reflection. In addition, Kohen and Kramarski (2012) involved nine pre-service teachers from different subjects in designing lesson plans, yet the study does not specify opportunities for collaborative design or practical implementation of these lesson designs. Furthermore, the study by Baya'a et al. (2017), described a preparation model focused on developing preservice teachers' technical proficiency in digital tools and aligning them with specific mathematics and science content, requiring them to design lessons, yet the process itself remained largely individual, with limited opportunities for collaborative design or peer feedback. While these studies aimed to develop TPACK through a design process, they reveal a limitation in that the design activities often remain theoretical, with insufficient opportunities for practical implementation (Assadi & Hibi, 2020; Kohen et al., 2025; Kohen & Kramarski, 2012), or did not integrate collaborative design processes (Baya'a et al., 2017). Thus, Efforts to develop TPACK through design tasks have focused on engaging preservice

teachers in creating lesson plans that integrate technology, pedagogy, and content, yet these activities often remain theoretical, lacking opportunities for practical implementation or collaborative design processes.

Assessment in studies in the Israeli context, particularly concerning the outcomes of design activities, have employed varied methods, but significant limitations exist in their ability to fully capture TPACK development in practice. In Kohen and Kramarski's (2012) study, assessment involved analysing pre- and post-intervention written lesson designs collected from pre-service teachers using a TPCK-SRL scheme. However, they focus only on these theoretical design products rather than their implementation in practice. Assadi and Hibi's (2020) assessment relied on analysing participants' lesson plans, video recordings of presentations, peer and self-evaluations, and interviews. This provided rich data on the design process, but not the assessment of the implementation of these design products in practice. Similarly, the study by Kohen et al. (2025) assessed perceived TPACK using pre- and post-intervention self-report questionnaires and evaluated participants' designed GeoGebra activities using a rubric, but did not assess the participants' actual classroom implementation of these designs. Finally, while Baya'a et al. (2017) integrated design and application in training schools, their main assessment of TPACK development used pre- and post-intervention questionnaires measuring perceived TPACK and ICT proficiency. Thus, TPACK assessment primarily relied on quantitative self-report measures rather than analysis of design artifacts or practical implementation. Thus, Israeli studies on TPACK assessment focus on design products and self-reports, with limited emphasis on practical implementation, leaving a gap in understanding how well preservice teachers apply their designed lessons and digital tools in practice.

In conclusion, while studies in the Israeli context have employed design-based approaches to develop TPACK among preservice teachers, the emphasis on creating

instructional artifacts and technology-integrated activities has not been matched by enough opportunities for practical implementation. The assessment methods focus on evaluating design products and perceived capabilities through self-reports, ignoring performance-based assessment that captures TPACK in action, such as micro- or macroteaching. Addressing these gaps requires integrating more practice-based activities that support preservice teachers in applying their designs in real teaching contexts, together with assessment methods that more accurately reflect TPACK development in practice.

TPACK-DBL

Using the TPACK framework in this study aims to both design the course and examine the development of preservice teachers' TPACK. The course design is informed by the Social-Constructivist theory of learning and the TPACK-DBL principles, aiming to develop preservice teachers' TPACK through engagement in design activities within a structured course.

Social-Constructivist Theory of Learning. Constructivism, a theory of learning rooted in philosophy and psychology, posits that learning is a result of experience (Ertmer & Newby, 2013) and is based on the construction of knowledge (Pritchard & Woollard, 2010). According to Vygotsky's (1978) theory on constructivism, knowledge construction is a product of social interaction, which results in cognitive development. Learning occurs in the Zone of Proximal Development, which is the "distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Thus, according to the socio-constructivist theory of learning, learning is a social process that takes place when learners are engaged in social activities, construct their own knowledge, and actively participate (Pritchard & Woollard, 2010) with their peers and teacher (Bower, 2017b). While Vygotsky's definition is often

studied in the context of facilitated collaboration among children in classroom settings (Kuusisaari, 2014; Polly & Byker, 2020), and is not extended to teacher education, this study focuses on peer-to-peer collaboration among adults with similar levels of expertise (Fani & Ghaemi, 2011; Kuusisaari, 2014).

In constructivist learning environments, the constructivist teacher's pedagogy integrates "critical thinking, motivation, learner independence, feedback, dialogue, language, explanation, questioning, learning through teaching, contextualisation, experiments and/or real-world problem solving" (Pritchard & Woollard, 2010, p. 45). These environments, as described by Honebein (1996), focus on students constructing their own knowledge, solving problems, and engaging in realistic contexts. They also promote student ownership, collaboration, diverse media use, and reflective activities for a holistic learning experience. Previous studies have shown that preservice teachers can benefit from learning and engaging in constructivist learning environments (Chai et al., 2013; Kuusisaari, 2014; S. M. Lee & Kim, 2024; Yan & Yuhong, 2012), especially for developing TPACK (Angeli & Valanides, 2015; Ansyari, 2012; Chai et al., 2013; S. M. Lee & Kim, 2024).

Studies have shown that effective TPACK development strategies rely on constructivist approaches (Ansyari, 2012; Chai et al., 2013; S. M. Lee & Kim, 2024; Niess, 2012), particularly social constructivism, in which learning is a process of social experience. The theory of social constructivism is used in this study as a learning theory, as "constructivism forms a strong theoretical foundation for the use of technology" (Chai et al., 2013) and the Learning Technology by Design (Mishra & Koehler, 2006) approach is used as an instructional approach because it has its foundations in the socio-constructivist theory of learning. This approach views knowledge development as a product of active and collaborative learning environments in which participants engage in solving authentic and ill-structured problems (Koehler & Mishra, 2005b). Thus, the course and learning environment

in this study were designed and developed based on the socio-constructivist theory of learning, engaging participants in social activities to construct their knowledge through Learning Technology by Design (Mishra & Koehler, 2006), a TPACK development model, to support and develop their technology integration practices.

TPACK-DBL. The Learning Technology by Design (Mishra & Koehler, 2006) approach is an effective way to develop TPACK (Voogt et al., 2016). It is based on constructivist learning, reflecting the social nature of learning as students engage in collaborative problem-solving activities (Koehler & Mishra, 2005a). This approach helps teachers develop their TPACK by engaging in the design and construction of artefacts through collaborative learning (Koehler & Mishra, 2005a). Informed by the problem-based learning theory, Learning Technology by Design is learner-centred and engages students in problem-solving through collaborative groups. It is ill-structured, meaning it is open to multiple correct answers, and it is inquiry-based, engaging learners to take control of their own learning process through challenging problems that reflect real-world complexity (Koehler & Mishra, 2005a; Mishra & Koehler, 2006). Learning Technology by Design requires instructors to adopt non-conventional teaching methods, as it involves students being active learners, undergoing a process of creativity and design through dialogue and action while reflecting on the process (Mishra & Koehler, 2006). The effectiveness of Learning Technology by Design in developing participants' skills in making connections between technology, pedagogy, and content (Mishra & Koehler, 2006) has led to its widespread use in the context of teacher education (Baran & Uygun, 2016; Bower, 2017c; Chai et al., 2013).

With the widespread adoption of the Learning Technology by Design approach in the field of teacher education (Brianza et al., 2022), Baran and Uygun (2016) developed a model including eight principles that help develop TPACK in preservice and inservice teacher education, known as TPACK Design-Based Learning (TPACK-DBL). These principles,

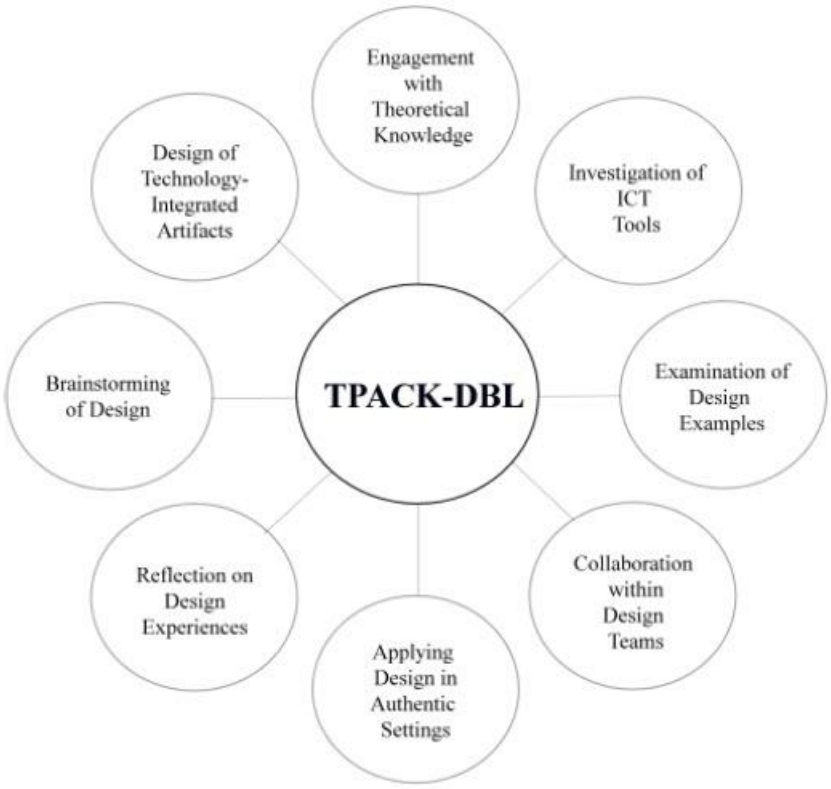
illustrated in Figure 2, include "brainstorming of design ideas, design of technology-integrated artefacts, examination of design examples, engagement with theoretical knowledge, investigation of information and communication technology (ICT) tools, reflection on design experiences, applying design in authentic settings, and collaboration within design teams" (Baran & Uygun, 2016, p. 48). These principles are not organised as a step-by-step procedure, but as elements that can be integrated into teacher education settings as a whole or in different combinations (Baran & Uygun, 2016) to develop TPACK. The principles and their description, according to Baran and Uygun (2016) appear in Table 1.

The course in this study is informed by the TPACK-DBL instructional design model to support the development of preservice teachers' TPACK development through design processes (Bower, 2017a) and expand the literature on TPACK-DBL, which is underexplored (Alemdag et al., 2019; Baran & Uygun, 2016; Bich Dieu et al., 2019; E. Lee et al., 2017; Wah, 2018). This gap is especially evident in the field of preservice teacher education, where there is a limited number of studies employing TPACK-DBL (e.g., Bich Dieu et al., 2019; E. Lee et al., 2017). Baran and Uygun (2016), who developed the TPACK-DBL model, applied all eight design principles in a graduate-level course with ten participants from varied disciplinary backgrounds including English, mathematics, science, and computer education. While the study showed strong development of TPACK through artefact analysis, reflections, and observations, its broad participant profile limits its relevance to subject-specific contexts. Studies focusing on preservice education have tended to implement only selected principles of the model. Lee et al. (2017), for example, investigated science preservice teachers' self-efficacy through a 15-week course using different training models, one of which was based on TPACK-DBL. However, the study relied on quantitative data and did not assess participants' subject-specific teaching practices or artefact development. Similarly, Bich Dieu et al. (2019) implemented all eight TPACK-DBL principles in a course for preservice English

teachers and reported gains in confidence and perceived TPACK growth, yet their findings were based only on reflections and focus group interviews, without triangulation through teaching observations or artefact analysis. These limitations highlight the gap in existing research on TPACK-DBL, especially the lack of studies in preservice English teacher education that apply all eight principles and provide evidence-based analysis supported by triangulated data. This study addresses this gap by implementing the full model within a subject-specific course and documenting participants' TPACK development through multiple data sources. The analysis draws on self-report data including interviews, peer feedback, reflective journals, and application reports, in addition to observations and performance assessment of participants' design activities. Together, these sources provide a comprehensive report of how preservice teachers develop TPACK.

Figure 2

TPACK-DBL Principles



Note. From "Putting technological, pedagogical, and content knowledge (TPACK) in action: An integrated TPACK-design-based learning (DBL) approach," by E. Baran and E. Uygun, 2016, *Australasian Journal of Educational Technology*, *32*(2), p. 49.

Table 1
TPACK-DBL Principles and Their Description

Principle	Description
Brainstorming of design ideas	Discussing problems about technology and their solutions and thinking of creative ideas for lessons.
Design of technology-integrated artefacts	Designing artefacts that integrate technology, such as lesson plans.
Examination of design examples	Exploring and critiquing existing materials created by the learners, their peers, or other materials. It includes a process of deep thought on how technology, pedagogy and content interact together, the limitations of technology and how it can be improved.
Engagement with theoretical knowledge	Engaging with theoretical knowledge for effective and meaningful technology integration.
Investigation of information and communication technology (ICT) tools	Exploring ICT tools before design activities to understand their benefits and constraints.

Principle	Description
Reflection on design experiences	Reflecting on the design process by sharing experiences, identifying difficulties, and assessing TPACK development.
Applying design in authentic settings	Applying designed materials in authentic teaching settings, such as microteaching or practicum field experiences.
Collaboration within design teams	Engaging in collaborative problem-solving activities to discover optimal solutions for technology integration.

In conclusion, the TPACK framework is important for integrating technology in education, and the best way to develop TPACK is through engaging in continuous design processes that are collaborative in nature (Bower, 2017a). Although there is an expanding body of literature on TPACK in teacher preparation programmes, a limited number of studies exist on the development of TPACK in content-specific subjects, and studies that examine concrete evidence of that development are scarce (Mouza, 2016; Tseng et al., 2022; Voogt et al., 2013). Research highlights the importance of combining theoretical knowledge with collaborative artefact design, practical implementation, and reflection. The Learning Technology by Design approach aligns with these strategies but is often applied in limited or theoretical ways, particularly in contexts like Israel, where practical teaching implementation and triangulated assessment are often missing. While the TPACK-DBL (Baran & Uygun, 2016) instructional model draws its main principles from the literature and translated TPACK into action, research integrating the model is underdeveloped. This study, therefore, aims to employ TPACK as an analytical lens for examining the development of preservice teachers in a content-specific subject and expand the literature on TPACK-DBL by using the model in the instructional design process and thus contribute to the literature through an evidence-based, practice-oriented application of the model.

TPACK in English Preservice Teachers' Education

With the development of the TPACK framework, researchers have set out to study the development of TPACK among preservice teachers (Kurt et al., 2013). A review of the literature on the development of TPACK shows that the research on TPACK has increased; however, most of the current literature on TPACK development focuses particularly on content areas such as mathematics and sciences (e.g., Akkoç, 2011; Aktaş & Özmen, 2022; Alblaihed, 2016; Durdu & Dag, 2017; Jang & Chen, 2010; Meagher et al., 2011). Although TPACK is important in English language teaching (S. Liu et al., 2014), a search of the literature has resulted in very few studies conducted to investigate the TPACK development of preservice English teachers (Chai et al., 2013; Tseng et al., 2022). This review examines how TPACK is developed in preservice English teachers, what outcomes are reported in terms of their professional growth, and how this development is assessed across existing studies.

Pedagogical Approaches to TPACK Development in English Preservice Teacher Education

There is an increasing body of literature examining TPACK in content-specific subjects (W. Wang et al., 2018). However, studies carried out exclusively in the field of language learning are limited in number (Çalik & Mirici, 2024; Chai et al., 2013; Tseng et al., 2022) and geographical regions, mainly focusing on Turkey and countries in Southeast Asia. Some studies concerning preservice English teachers have looked to develop and assess preservice teachers' TPACK. Out of thirty studies reviewed, twenty-one detailed the strategies employed to develop TPACK. The review identified several individual or combined development strategies for English preservice teachers' TPACK including ICT tools (e.g., Aşık et al., 2018; Charbonneau-Gowdy, 2015), design activities (e.g., Adipat, 2021; Bich Dieu et al., 2019; Syamdianita & Cahyono, 2021), practical application (e.g., Drajati et al., 2021), collaboration (e.g., Cengiz & Kaçar, 2024), reflection (e.g., Aşık et al.,

2018), and theoretical knowledge (e.g., S. M. Lee & Kim, 2024). The representation of these strategies in the literature varies. The most frequent strategies are the application in practice (microteaching and/or macroteaching) and learning ICT tools, each featured in sixteen studies. Design activities appear in fifteen studies, while reflection is employed in eleven studies. Collaboration and theoretical knowledge are less represented, with eight and nine studies, respectively.

The review of TPACK development strategies identified the integration of ICT tools as a prominent approach, with learning ICT tools featured in sixteen of the reviewed studies (e.g., Aşık et al., 2018; Charbonneau-Gowdy, 2015). However, studies on TPACK in language teaching highlight ICT tools but fail to integrate them into practical teaching (e.g., Ersanlı, 2016), resulting in a gap between theoretical knowledge and classroom practice. The review of the literature shows that such studies were limited to familiarising students with ICT tools (Ersanlı, 2016; Koçoğlu, 2009), while others emphasised the use of very specific technologies (Charbonneau-Gowdy, 2015; Fook et al., 2011; S. M. Lee & Kim, 2024; Limbong, 2017; Muniandy & Veloo, 2011). These limitations hinder the effective technology integration in teaching English to develop students' four language skills. Such studies are unsatisfactory because the technologies were employed to engage preservice teachers in designing activities for specific ELT fields such as grammar (Limbong, 2017), evaluating the applicability of technologies to ELT (Muniandy & Veloo, 2011), improving computer literacy skills (Fook et al., 2011), or modelling technology use by instructors (Charbonneau-Gowdy, 2015). For example, Muniandy and Veloo (2011) used TPACK as a theoretical framework to study the usefulness of video clips in teaching English. While preservice teachers showed readiness and acceptance of using video clips, the study did not assess the effectiveness of video clips in actual teaching practice. Similarly, in a qualitative study of TPACK development, Koçoğlu (2009) researched 27 preservice English teachers in a course

designed to familiarise them with various computer technology tools for English teaching. Although the course developed their TPACK skills, it focused on ICT tools in isolation from practical application. Studies suggest that preservice teachers can develop TPACK more effectively when provided with practical application and authentic learning experiences (Kay, 2006). Preservice teachers need to explore the possibilities of ICT tools (Baran & Uygun, 2016) while also designing materials for classroom use. Based on the review, however, very few studies employed ICT tools to engage preservice teachers in designing activities that demonstrate the application of technologies in ELT (Bich Dieu et al., 2019; Kayaduman & Delialioğlu, 2017; Kurt et al., 2013).

Based on the previous section on the development of TPACK, the Learning Technology by Design (Koehler & Mishra, 2005a) approach has been found effective in enhancing preservice teachers' TPACK (Mishra & Henriksen, 2015), especially when combined with cooperation, reflection, and practical application. In the review of TPACK in the field of ELT, very few studies (Bich Dieu et al., 2019; Cengiz & Kaçar, 2024; Kurt et al., 2013, 2014) examine the effectiveness of these strategies combined. As part of a large mixed-methods study, Kurt et al. (2013) found that English preservice teachers developed TPACK and the knowledge domains related to technology after taking a course during their language teaching programme. The course was structured based on the Learning Technology by Design principles and included design tasks that were collaborative, problem-centred, and reflective. To measure participants' TPACK development, one source of quantitative data was collected, with additional qualitative data from lesson observations and lesson plans implemented in the practicum and published in a later paper (Kurt et al., 2014). The results indicated that engaging preservice teachers in cooperation, design, reflection, and practical application helps them to consider the relationship between content, pedagogy, and technology in English language teaching. Other studies in the field of ELT have been mostly

restricted to employing only some of these strategies focused on design activities and collaboration (Limbong, 2017), design activities combined with reflection and collaboration (Kayaduman & Delialioğlu, 2017), and design activities combined with macro- or microteaching (Adipat, 2021; Kwangsawad, 2016; Muslimin et al., 2022; Syamdianita & Cahyono, 2021). However, the first two studies (Kayaduman & Delialioğlu, 2017; Limbong, 2017) have failed to provide evidence regarding the practical application of the design activities. Although preservice teachers gained lesson design experience in these studies, they lacked practical application experience, suggesting that the enactment of designed lessons is crucial for TPACK development. To stress the importance of implementation, Kayaduman and Delialioğlu (2017) shed light on the weakness of studies, such as their own, which do not employ practical application as technology integration might be different when designed lesson plans and activities are not practised. The latter approach (Adipat, 2021; Kwangsawad, 2016; Muslimin et al., 2022; Syamdianita & Cahyono, 2021), combining design activities with macro- or microteaching, did not address the social nature of learning in design activities (Koehler & Mishra, 2005a) and its significance in the process of TPACK development (Agyei & Voogt, 2015). This section highlights that although various approaches have been used to support TPACK development, their impact remains limited when practical application is absent or when elements like design, collaboration, and reflection are only partially combined.

Key Findings of TPACK Development in English Preservice Teacher Education

The varied approaches to developing TPACK in preservice English teachers, including ICT tool integration and Learning by Design, have resulted in a variety of documented impacts. An outcome consistently reported in the literature is the development of the core TPACK constructs. In addition, other significant themes include the instruction of English language skills with technology, growth in teacher confidence, and the effects of

practical application, modelling, and collaboration. These impacts are detailed in the following sections.

Growth in TPACK Knowledge Domains. The theme related to the growth in TPACK constructs is recurrent throughout the studies and refers to the integrated knowledge domains (TCK, PCK, TPK, and TPACK) and the basic knowledge domains (TK, CK, PK) of TPACK. The studies showed a positive impact on technological pedagogical knowledge (TPK) (Aşık et al., 2018; Bich Dieu et al., 2019; Koçoğlu, 2009; Kurt et al., 2013; Kwangsawad, 2016; Muslimin et al., 2022), technological content knowledge (TCK) (Aşık et al., 2018; Koçoğlu, 2009; Kurt et al., 2013), pedagogical content knowledge (PCK) (Ersanlı, 2016), technological knowledge (TK) (Aşık et al., 2018; Bich Dieu et al., 2019; Kurt et al., 2013), content knowledge (CK) (Ersanlı, 2016; Kwangsawad, 2016), and pedagogical knowledge (PK) (Ersanlı, 2016). The findings from studies on English preservice teachers also showed the development in TPACK (Aşık et al., 2018; Bich Dieu et al., 2019; Cengiz & Kaçar, 2024; Ersanlı, 2016; Koçoğlu, 2009; Kurt et al., 2013; Kwangsawad, 2016; Muslimin et al., 2022; Öz, 2015; Syamdianita & Cahyono, 2021) and an understanding of the interrelationship of the three components of technology, content, and pedagogy (Bich Dieu et al., 2019; Kurt et al., 2013, 2014; Kwangsawad, 2016; Mei et al., 2018). However, the development of TPACK components is not always the same and varies from one study to another.

Technology-Integrated Instruction of English Language Skills. The second theme relates to the development of English language skills through technology integration. Findings from studies on the development of TPACK in English preservice teachers indicate that they developed instructional strategies for teaching English with technology (Adipat, 2021; Bich Dieu et al., 2019; Fook et al., 2011; Koçoğlu, 2009; Kurt et al., 2013, 2014; Syamdianita & Cahyono, 2021), developed their skills in the use of technology tools for

educational purposes (Adipat, 2021; Aşık et al., 2018; Ersanlı, 2016; Koçoğlu, 2009; Limbong, 2017; Muniandy & Veloo, 2011), and developed an awareness of their English students' learning needs (Ersanlı, 2016; Fook et al., 2011; Koçoğlu, 2009; S. M. Lee & Kim, 2024; Öz, 2015). These findings provide insight into how preservice teachers plan for technology integration and recognise its educational potential. However, most studies describe general strategy development or ICT tool awareness, with little attention to how technology is used to teach specific English language skills. This section examines studies that explore the development of TPACK through the use of technology in English language instruction, focusing on how it has been applied to the teaching of specific skills such as reading, listening, speaking, writing, grammar, and vocabulary.

Findings of studies on preservice English teachers show that there is a lack of detailed application of technology to support the development of English language skills. While many studies show growth in TPACK domains, only a limited number address how preservice teachers use technology to support the teaching of receptive (reading and listening) and productive (speaking and writing) skills. For example, the participants in Limbong's (2017) study designed grammar materials using tools such as PowerPoint, Audacity, Camtasia, and web resources, followed by the development of exercises to assess understanding; however, the study focused on grammar only and was not implemented in classroom settings, thus limiting its contribution to wider English language skill development. Ersanli (2016) found that preservice teachers developed awareness of a wide range of digital tools for supporting English instruction. Their journal entries included descriptions of activities and materials such as podcasts for listening, text-to-speech websites for pronunciation, digital storytelling for speaking, and games and visual tools for vocabulary and reading. While these reflections showed attempts to apply technology across multiple language skills, they were self-reported and not supported by observation or analysis of how the tools were implemented or how they

developed specific skills in practice. Other studies, such as such as Koçoğlu (2009) and Bich Dieu et al. (2019) also noted that participants gained awareness of ICT tools and their instructional potential in English language teaching, but their findings were focused on perceptions rather than on analysed design or teaching activities. Exceptions to these approaches include Kurt et al. (2014), who examined how technology was used to support reading, speaking, and listening through three cases. One participant focused on reading comprehension using video texts, followed by students recording their own videos. Another designed a project around speaking, with students using Wikipedia to gather information and prepare oral presentations. The third integrated speaking and listening by having students record chants using MP3 tools. While these examples show attempts to link technology with specific language skills, the technology was often used as a presentation or recording tool rather than being embedded into the learning process, and the study was limited to three participants. Similarly, Syamdianita and Cahyono (2021) explored preservice teachers' creation of instructional videos to support listening and vocabulary development, but technology in their study was mainly used for delivering content, while speaking tasks were conducted without technological tools. The present study addresses these limitations by involving a larger sample, analysing two design activities per participant, and examining both micro and macro teaching implementations, including an analysis of teaching activities that addressed all four language skills including reading, listening, speaking, and writing as well as grammar and vocabulary. Therefore, it offers a more comprehensive understanding of how preservice teachers developed and applied technology supported strategies for English language instruction and responds directly to the gap in research between awareness of technology integration and its application in teaching specific English language skills.

Increased Teacher Confidence. The third major theme related to the findings of studies on preservice English teachers' TPACK development is confidence. The findings of

studies on preservice English teachers show that preservice teachers became more confident in choosing the technologies to be used in the English language classroom (Charbonneau-Gowdy, 2015; Kurt et al., 2013; Öz, 2015), became more confident in their actual technology use (Bich Dieu et al., 2019; Fook et al., 2011; Kayaduman & Delialioğlu, 2017), and more confident in constructing and designing artefacts for technology integration (Bich Dieu et al., 2019; Muslimin et al., 2022). However, findings of this kind carry limitations associated with the disparity between confidence levels and actual classroom application.

Impact of Practical Application, Modelling, and Collaboration. The three less frequent themes are the impact of practical application, modelling, and collaborative learning on preservice English teachers' TPACK. Findings related to practical application had mixed results. Some studies reported the positive impact of practical application in helping preservice teachers develop TPACK in the field of ELT (Bich Dieu et al., 2019; Kurt et al., 2013, 2014), while others report a disparity between self-reports and actual classroom practice (Kwangsawad, 2016), and superficial use of technology (Charbonneau-Gowdy, 2015). Despite the drawbacks, there is a need for practical application to bridge between theory and practice to develop TPACK in action (Adipat, 2021; Kayaduman & Delialioğlu, 2017; Öz, 2015). The second theme relates to the impact of modelling on TPACK development. The findings show that TPACK development can be affected by the type of modelling provided for preservice teachers by faculty members or cooperating teachers. Studies discussing the effect of modelling highlight the positive impact of modelling effective uses of technology for teaching English by the instructor or faculty members (Bich Dieu et al., 2019; Fook et al., 2011; Koçoğlu, 2009; Öz, 2015), the negative impact of the lack of or superficial technology modelling by faculty members (Charbonneau-Gowdy, 2015), and the impact of cooperating teachers in the field (Öz, 2015). Together, these findings provide important insights into the major role of modelling in the development and adoption of

technology by preservice teachers. The third and most underrepresented theme relates to the effect of collaboration on preservice English teachers. Although cooperative learning by design is a popular approach for TPACK development, very few studies report on the effect of these activities on preservice teachers' TPACK development, and those that do show an increase in self-efficacy for technology integration (Aşık et al., 2018; Cengiz & Kaçar, 2024; Kayaduman & Delialioğlu, 2017) and development of technological knowledge into technological content knowledge (Koçoğlu, 2009). These findings indicate the importance of further investigating the role of practical application, modelling, and collaborative learning in TPACK development.

TPACK Assessment Strategies in English Preservice Teacher Education

Although TPACK development has been widely explored, the ways it is assessed in studies focusing on English preservice teachers vary in scope and depth. This section reviews the assessment strategies employed in the literature, with attention to the types of data collected and the extent to which these methods capture the application of TPACK in English language instruction. Studies in the field of language education have employed a range of assessment strategies to evaluate preservice teachers' TPACK, including performance assessments (e.g., Drajati et al., 2021; Muslimin et al., 2022), self-report assessments (e.g., Syamdianita & Cahyono, 2021), and observations (e.g., Adipat, 2021). While these forms reflect common approaches across language teacher education more broadly, the majority of studies focusing specifically on preservice English teachers rely primarily on self-report data (Aşık et al., 2018; Ciptaningrum, 2017; Fook et al., 2011; Kurt et al., 2013; Mariette, 2022; Mei et al., 2018; Muslimin et al., 2022; Öz, 2015; Sahin, 2011; Turgut, 2017a; Yet & Noordin, 2017) alone to assess preservice English teachers' TPACK. Other studies employ one or more less frequent assessment measures, such as performance assessments (Adipat, 2021; Drajati et al., 2021; Kurt et al., 2014; Kwangsawad, 2016; Syamdianita & Cahyono,

2021), interviews (Bich Dieu et al., 2019; Charbonneau-Gowdy, 2015; Kayaduman & Delialioğlu, 2017; Koçoğlu, 2009; Limbong, 2017; Syamdianita & Cahyono, 2021), observations (Charbonneau-Gowdy, 2015; Kurt et al., 2014; Kwangsawad, 2016), and journals (Bich Dieu et al., 2019; Charbonneau-Gowdy, 2015; Ersanlı, 2016).

Studies that have employed self-report data aimed to assess preservice English teachers' technology integration skills and TPACK levels (Adipat, 2021; Ciptaningrum, 2017; S. M. Lee & Kim, 2024; Öz, 2015; Yet & Noordin, 2017), attitudes towards technology integration (Mei et al., 2018; Muniandy & Veloo, 2011), perceptions of TPACK development (Kurt et al., 2013, 2014; Turgut, 2017b), and develop and validate a survey (Ciptaningrum, 2017; Sahin, 2011). Some studies employ two self-report measures, such as surveys or questionnaires and interviews (Kayaduman & Delialioğlu, 2017; Koçoğlu, 2009; Muslimin et al., 2022) to explore preservice teachers' beliefs about TPACK; surveys and journals (Ersanlı, 2016) or interviews and reflections (Bich Dieu et al., 2019; Cengiz & Kaçar, 2024) to measure the development of TPACK. Ersanli (2016), for example, aimed to improve the TPACK of preservice English teachers through a five-week course and workshops. This mixed-methods study included 59 preservice English teachers who completed a survey and reflective journals before and after the course. A list of software and their purposes were extracted from the journals. Although the results show an increase in TPACK and its subcategories, the study would have been more interesting had it included an assessment of the participants' performance using the software listed in the results. Similarly, Kayaduman and Delialioğlu's (2017) participants designed lesson plans to investigate their technology integration self-efficacy beliefs but only collected data through self-report measures, such as interviews and surveys. This study would have been more useful in providing a complete analysis of the development of TPACK if it had included an analysis of the design activities in this course rather than focusing only on surveys and interviews, as the

essence of the course is based upon Learning Technology by Design (Koehler & Mishra, 2005a) framework.

Studies in the field of TPACK development have shown that measuring preservice teachers' TPACK knowledge and understanding of TPACK alone does not ensure the successful use of technology in practice, as there are inconsistencies between theory and the application of technology in practice (Mouza et al., 2014). Therefore, a deeper form of evidence-based investigation, such as performance-based assessment, is necessary to provide evidence of preservice teachers' implementation of TPACK. This can be combined with self-report measures, such as surveys or interviews, to understand preservice teachers' thought processes (Archambault, 2016). Very few studies in the field of ELT TPACK development among preservice English teachers employ performance assessment (Adipat, 2021; Drajati et al., 2021; Kurt et al., 2014; Kwangsawad, 2016; Syamdianita & Cahyono, 2021). For example, Kwangsawad (2016) examined EFL preservice teachers' TPACK through a self-report survey, lesson plans, and observations of microteaching in a school setting. While the results showed high scores in TPACK domains and an alignment between self-report measures and lesson plans, there were differences between the lesson plan and the assessment of practical application, highlighting the need for performance-based assessment.

In conclusion, the review of studies in the field of preservice English teachers' TPACK development reveals a range of approaches aimed at supporting the development of technological, pedagogical, and content knowledge. While many studies emphasise the use of ICT tools and reflect growing awareness of technology integration, there remains a clear gap between theoretical understanding and classroom application. The most effective studies were those that combined practical teaching experiences with design-based tasks, collaboration, and reflection, particularly when informed by the Learning Technology by Design framework. However, assessment practices in the reviewed literature were often

limited to self-report measures, offering only a partial view of participants' actual capabilities. The review highlights the importance of incorporating performance-based assessments, such as lesson enactment and design analysis, in addition to self-reported data. This combination provides a deeper understanding of how preservice English teachers develop and apply TPACK in ways that reflect both conceptual knowledge and classroom practice.

Summary

This review of the literature focuses on TPACK-based courses within preservice education programmes, examining how TPACK is developed and assessed through various strategies and frameworks, including the TPACK-DBL model used in this study. The study makes several significant contributions to the field. Firstly, it addresses the underrepresentation of TPACK-DBL in the literature, as few studies have applied this model to develop TPACK. Secondly, it adds to the sparse body of research on TPACK development in English language education (Chai et al., 2013). Thirdly, it explores TPACK development within the Israeli context, in which, to the best of my knowledge, no studies exist on the development of preservice English TPACK development and those that explore TPACK development in preservice education are very scarce in numbers. Finally, in addition to self-report measures, it develops TPACK through a deeper form of evidence-based investigation employing performance-based assessment to provide evidence of preservice teachers' implementation of TPACK, as very few studies in the field of ELT TPACK development employ performance assessment. Thus, this study provides a valuable addition to the literature on TPACK and its application in preservice teacher education.

Chapter Three: Research Design

Introduction

This section outlines the methods and methodology employed in this study, including the researcher's epistemological and ontological perspectives, the study design, course procedure, participant selection, data collection and analysis methods, as well as the ethical considerations addressed throughout the research process.

Epistemological and Ontological Position

My ontological and epistemological positions form the philosophical basis for this research. I adopted an interpretive/constructivist theoretical perspective in building the course and interpreting the data. I acknowledge that knowledge is constructed through social interaction as individuals develop subjective meanings of their experience in the world. As a constructivist researcher, I focus on understanding the historical and cultural contexts in which people live and work. I also recognise that my background shapes my interpretation, and I position myself within the research to acknowledge how my interpretations flow from my personal, cultural, and historical experiences (Creswell & Creswell, 2018).

Qualitative research is most often interpretive as it views reality as being socially constructed, "that is, there is no single, observable reality. Rather, there are multiple realities, or interpretations, of a single event" (Merriam, 2014, p. 8). The goal of qualitative research is to describe, understand, and interpret the meanings that people assign to their world and how they construct it (Merriam, 2014).

Therefore, I follow a constructivist/interpretive approach to explore, understand, describe, and interpret participants' TPACK development, focusing on their experiences in the course and the meanings they derive from it. In addition, I focus on a specific context which is English preservice teachers' education and the theoretical framework TPACK is

used in this research to focus on a specific context. Furthermore, I acknowledge my role in the process and how my interpretations are influenced by my personal experience in teacher education. I acknowledge that my beliefs about the knowledge a preservice teacher should have to function as a good teacher are based on my experience in training both preservice and inservice teachers.

Research Design

This study employs a qualitative case study approach to explore the experiences and perceptions of preservice teachers in a technology course. A qualitative approach is chosen to uncover the meaning of the phenomenon for those involved by understanding how they "interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences (Merriam, 2014, p. 5). Merriam (2014) highlights four key characteristics of qualitative research in which "the focus is on process, understanding, and meaning; the researcher is the primary instrument of data collection and analysis; the process is inductive, and the product is richly descriptive" (p. 14). This study aligns with these characteristics as it is concerned with understanding preservice teachers' experience in the technology course; the researcher collects and analyses the data; the process of this research is inductive as the researcher understands and analyses the data to produce findings gathered through themes and categories while being informed by TPACK as a theoretical framework, which enables the researcher to focus on the inquiry and analyse the data (Merriam, 2014); and the research is richly descriptive, using words and quotes to convey and support the findings.

I employed a qualitative case study because it offers an "intensive, holistic description and analysis of a bounded phenomenon such as a programme, an institution, a person, a process, or a social unit (Merriam, 2014, p. x). This study sets out to describe and analyse how preservice English teachers experience a technology course and what meaning they give to this experience. Therefore, it fits the definition of a case study, as it provides an intensive,

holistic description and analysis of a process of TPACK development within the bounded system of the technology course. Merriam (2014) describes the distinctive features of case studies as particularistic, descriptive, and heuristic. This study is particularistic, focusing on a specific course within a teacher education college. It is descriptive, yielding rich, thick descriptions through data analysis. It is also heuristic, enhancing readers' understanding of the phenomenon by illuminating the participants' development and understanding of TPACK, potentially revealing new insights, extending the reader's experience, or confirming existing knowledge (Merriam, 2014).

Participants

The participants (Appendix A) were enrolled in the course entitled Models of Pedagogical Implementation of ICT into Teaching English as an International Language. This face-to-face course is a core component of a higher education Bachelor of Education (B.Ed.) degree programme and is taken in the third year of study. It was designed to prepare preservice teachers to integrate ICT into their teaching, in alignment with the Israeli Education Ministry's national plan to update the Colleges of Education for the demands of 21st-century education (Ministry of Education, 2011b).

The course was conducted in a large computer lab, where each student had access to an individual computer. The instructor facilitated the sessions using a central computer connected to a projector. Sessions were held once a week over a twelve-week academic semester, with each session lasting 1.5 hours. Attendance was mandatory in accordance with college regulations. The sessions combined lecture and practical application (equivalent to a workshop format), enabling students to engage with theoretical content while applying digital tools through collaborative tasks and design-based activities.

The course was delivered through two parallel course sections to accommodate the full third-year cohort of 38 students, allowing for smaller class sizes and enhanced instructional support. Each group, consisting of 19 students, followed the same instructional design, content, and delivery, and was facilitated by the same instructor. The two courses were scheduled on different days to allow the instructor adequate time for preparation and follow-up, and to ensure access to the computer lab. Both courses ran concurrently during the first semester of the academic year; no similar courses were offered in the second semester.

The participants in this study were recruited based on a purposive sampling strategy. I sampled participants in a strategic way to ensure relevance to the research questions (Bryman, 2012). The criteria for recruitment included being third-year preservice teachers enrolled in the English Language and Literature B.Ed. degree programme at a teacher education college in Israel and registered for a course entitled Models of Pedagogical Implementation of ICT into Teaching English as an International Language focused on integrating ICT into English teaching. An invitation email was sent to prospective participants in both courses, including an information sheet and consent form. A total of 24 participants agreed to take part in the study, with 11 participants from one course and 13 from the other.

Procedure

For the purpose of the study, a course entitled Models of Pedagogical Implementation of ICT into Teaching English as an International Language was redesigned based on the TPACK-DBL (Baran & Uygun, 2016) instructional design model, which includes eight principles aimed at TPACK development. The TPACK-DBL model has been chosen as it supplies practical application on how TPACK translates into action and how TPACK can be developed based on DBL contexts (Baran & Uygun, 2016). Table 2 illustrates how the TPACK-DBL principles were applied to the course components.

Table 2
TPACK-DBL Principles Application in the Course

Course Component	TPACK-DBL principles
Discussion of technology, ICT, and lesson planning	d
ICT tool activity - Investigating the tool - Designing an activity - Presenting the tool - Applying the tool - Feedback by peers and instructor - Reflection on the blog	b, c, e, f, g, h
Learning about approaches for technology integration	d
Two collaborative Design-Based activities - Brainstorming - Investigating suitable ICT tools - Designing activities and lesson plans - Presenting activities and lesson plans - Receiving feedback by peers and instructor - Revising lesson plans and activities - Reflection on the blog	a, b, c, e, f, h
Applying a designed activity during the practicum	g
Reflecting on the blog	f

a) Brainstorming of design ideas
b) Design of technology-integrated artefacts
c) Examination of design examples
d) Engagement with theoretical knowledge
e) Investigation of ICT tools
f) Reflection on design experiences
g) Applying design in authentic settings
h) Collaboration within design teams

The course was divided into sections that integrated all TPACK-DBL principles. It began with an introductory session discussing the integration of ICT into teaching, including an overview of the Israeli English curriculum and how ICT can be integrated into English instruction. This session also covered the design of technology-enhanced lesson plans, aligning with the Revised English curriculum's domains and benchmarks.

The following sessions focused on investigating ICT tools and approaches for technology integration. Participants were tasked with exploring ICT tools applicable to the domains of the English curriculum. The participants collaborated in pairs to explore and learn

the tools, presenting them to their classmates by demonstrating the potential applications for English language teaching. They then designed activities tailored for English language learners, which they taught to their peers, allowing them to test the activities and practice using the tools. After teaching, students guided their peers in creating activities for English language learners, which were shared on personal blogs along with reflections on the sessions and tools. The ICT tools investigated were categorised to align with curriculum requirements and include concept mapping tools, infographics, reading and writing facilitative e-tools, listening and speaking facilitative e-tools, social learning tools, and e-assessment and survey tools. The theoretical component of the course focused on different approaches to technology integration in English teaching, including problem-based learning, task-based language learning, cooperative learning, computer-based assessment, digital storytelling, and social learning networks. Participants also studied TPACK in order to understand the competencies needed to teach effectively with technology.

The next part of the course included two Learning Technology by Design activities. The participants were divided into groups of four. The first activity involved analysing a unit from a junior-high course book used during their practicum. The unit covers the four domains of the curriculum, which include Access to Information, Presentation, Social Interaction and Appreciation of Language, Literature and Culture. The participants were presented with problems related to each domain that required technology integration for solutions. Through discussion and brainstorming, each participant took responsibility for one domain, and the group collaborated to find solutions for all problems. They designed lesson plans and activities that demonstrated how ICT tools could solve the presented problems. These were then presented to the class, with feedback from both the instructor and peers, leading to adjustments in their activities and lesson plans.

The second Learning Technology by Design activity followed a similar structure, but this time participants selected a unit of their choice from a junior-high book. Again, they addressed problems related to the four domains: brainstorming, planning, and designing technology-based activities and lesson plans, presenting their work, and revising it based on feedback from their peers and the instructor. The rationale for this process is that "by participating in design, teachers are confronted with building a technological artefact while being sensitive to the particular requirements of the subject matter to be taught, the instructional goals to be achieved, and what is possible with the technology" (Koehler & Mishra, 2005b, p. 148).

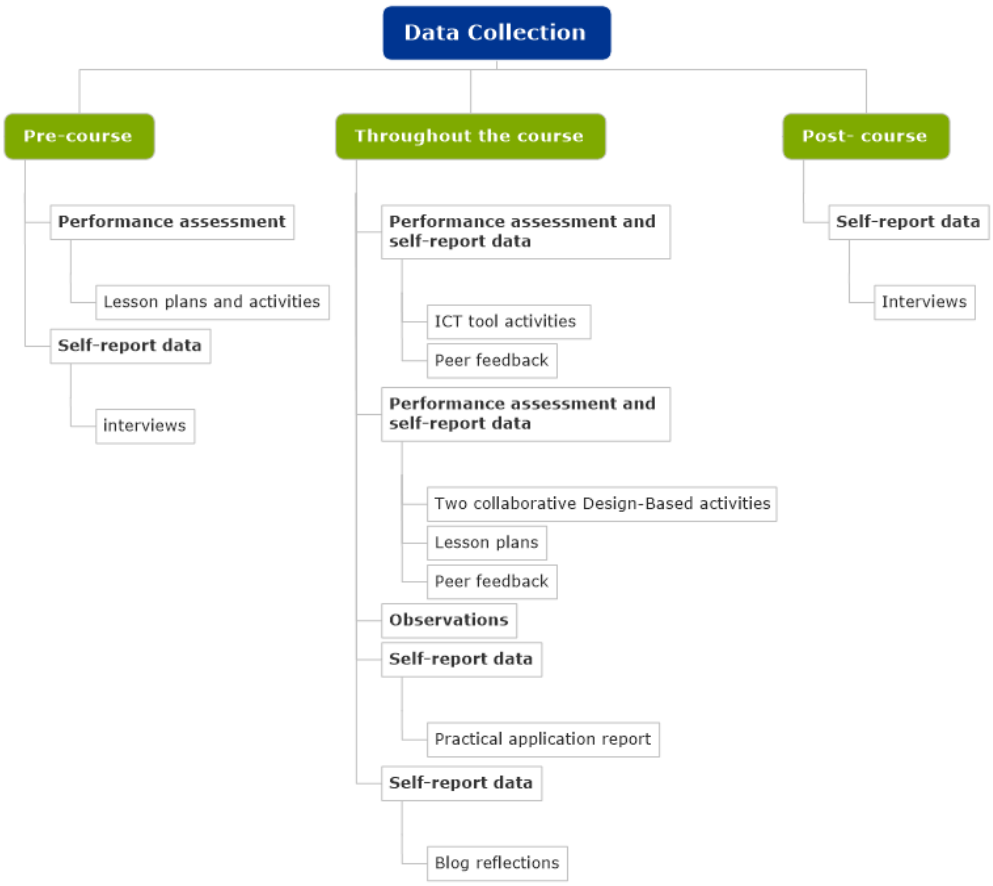
Toward the end of the course, participants were required to implement a designed activity during their practicum, integrating technology into their classroom practice. They submitted a report detailing this implementation. In addition, throughout the course, the participants kept a blog to reflect on their learning process, post their observations of their classmates, and share the activities they created throughout the course.

Data Collection Instruments

Qualitative research is richly descriptive (Merriam, 2014), therefore, multiple sources of data were collected to make this research richly descriptive and to triangulate findings. Data collection began one week prior to the course. The data collection methods I used in this study are grouped into three main categories including self-report data, observations, and performance assessment. This approach aligns with the recommendation that multiple measures and data sources are essential for a comprehensive understanding of TPACK in qualitative research (Archambault, 2016, p. 82). A summary of the data collection methods and times of collection are presented in Figure 3.

Figure 3

Data Collection Instruments and Timetable



Self-report Data

The self-reported data consisted of interviews, peer feedback, reflective journals, and application reports.

Semi-Structured Interviews. I conducted two rounds of semi-structured interviews (Appendix B), one before the course began and one after it concluded. I chose semi-structured interviews in this research to enable me to have a guiding list of questions to explore the topic while allowing flexibility as the word and order of questions are not fixed, which allows me to probe for new ideas and perspectives about the topic (Merriam, 2014).

The precourse interviews aimed to collect qualitative data on the participants' views, experiences, and current knowledge regarding technology integration in education. The postcourse interviews focused on capturing their experiences in the course, their perceptions of technology integration, and their current knowledge of technology integration. I chose interviews because they are a primary data collection instrument in qualitative research (Merriam, 2014), offering "access to the context of people's behaviour and thereby provides a way for researchers to understand the meaning of that behaviour" (Seidman, 2006, p. 10).

Peer Feedback. I collected peer feedback (Appendix C) after microteaching lessons and presentations of design activities and lesson plans. The participants provided structured feedback, including the learning goal of the observed lesson, the impact of technology on the lesson, and the integration of content, pedagogy, and technology. This peer feedback served as a form of assessment of participants' understanding of sound technology integration into teaching because when students engage in peer feedback and review their peers' work, it improves and facilitates their own learning, as feedback is derived from an understanding of the content area (Li et al., 2010). Peer feedback also helped me evaluate the development of TPACK by focusing on the appropriateness of the designed lessons and activities and whether they combine content and pedagogy with the use of technology from the participants' point of view.

Reflective Journals. I used blogs to collect reflective journals. These blogs included reflections on the course, the design activities that the participants and their peers created, presentations and activity links created after teaching and learning ICT tools, and ideas for application in their teaching practice. I chose blogs to provide participants in the course with a digital tool for reflective practices, since reflection is a key concept in the development and training of teachers (Wopereis et al., 2010). When teachers reflect, they develop a deeper understanding of their experiences as they construct these experiences in their own words

(Lu, 2014). In addition, using blogs for reflection has a positive effect on the quality of the reflection as it enables participants to reflect *on* action, while the learning is taking place, (Wopereis et al., 2010) using a readily available ICT tool. When using reflection specifically in an LBD environment, it "can be a potential effective strategy to enhance preservice teachers' TPACK development" (Lu, 2014, p. 31).

Practicum Reports. Towards the end of the course, after completing microteaching, participants were required to apply their planned activities in a real classroom setting during their practicum and submit a report (Appendix D) detailing their experience. I used these reports to gather data because a teacher's TPACK is developed through both formal knowledge and practical experience, which is further refined through interaction with sub-social systems such as students and teachers (Voogt et al., 2016).

Observations

I conducted microteaching observations as a participant observer (Merriam, 2014), engaging in the central activities of the course while maintaining my role as an instructor (Hawkins, 1990 as cited in Mercer, 2009), providing feedback and posing questions during microteaching activities. Observing lessons involving TPACK application was a logical step toward evaluating the planning and execution of the lessons (Schmidt-Crawford et al., 2016). I documented observations related to the use of technology tools, alignment with curriculum goals, teaching methods, instructional strategies, and the coherence of technology, content, and pedagogy (TPACK) within the lessons. I employed a structured observation protocol (Appendix E) that included predefined categories and guiding questions directly aligned with the TPACK framework. These observations helped me triangulate self-report data with an external assessment of participants' TPACK (Hofer et al., 2011).

Performance Assessment

I collected artefacts created by participants during the course to assess the development of TPACK through their performance. Performance assessment was crucial because these artefacts provided evidence of the participants' instructional design and planning processes, offering insight into their knowledge across TPACK domains (Abbitt, 2011; Koehler et al., 2012). In this study, I gathered artefacts that were produced as part of the course requirements. Despite potential challenges in analysing artefacts, such as inconvenient formats, I valued them because they were produced in real-life contexts and were unaffected by research procedures (Merriam, 2014). To assess the participants' artefacts, I employed codes based on the TPACK framework and looked for evidence of TPACK constructs.

Design Activities. I collected three lesson plans and three designed activities (Appendix F) from each participant as part of the course requirements. The first lesson plan was submitted before the course began, reflecting participants' prior use of technology in their practicum. The second and third lesson plans were part of the collaborative group work design activities. While each participant was responsible for the submission of one lesson plan corresponding with the domains of the Israeli English curriculum, they all worked together in a group to submit lesson plans that make a unit that combines all domains of the curriculum, which they then performed as a microteaching activity. The participants also designed three activities as part of the course. The first activity relates to the use of technology tools in the field of English language teaching, while the second and third activities were part of the design activities and lesson plans. As part of the group work activity, each participant was responsible for designing, creating, and teaching the activities submitted with the lesson plans.

Data Collection

After receiving ethical approval and participant consent, I initiated the data collection process. The first two data sources I collected were interviews and lesson plans. The lesson plans were a mandatory requirement for all participants, while the interviews were scheduled at convenient times on campus. Each interview lasted no longer than an hour and was audio-recorded and transcribed. Participants were encouraged to speak in whichever language they felt most comfortable, and most interviews were conducted in English. However, some segments were spoken in Arabic or Hebrew, which I translated into English. As a native Arabic speaker with a B.A. in Hebrew, I translated these segments, which were then back-translated (Edwards, 1998) into the original languages by a colleague who is a PhD candidate in linguistics and fluent in both Arabic and Hebrew, ensuring the accuracy of the translations.

During the course, I collected reflections, observations, application reports, and lesson plans and activities, all of which were part of the course requirements. Postcourse data collection included follow-up interviews, conducted after the course ended, where I applied the same translation and back-translation procedures for any non-English responses.

After each pre- and postcourse interview, I used follow-up questions to clarify and deepen understanding. In addition, I sent the interview transcripts to participants for member checking, allowing them to revise or add information. This process of using follow-up questions and member checking was employed to enhance the credibility and internal validity of the study (Kornbluh, 2015; Thomas, 2017).

The final dataset, collected from 24 preservice teachers, comprised 48 interviews, 72 lesson plans and activities, 24 application reports, 24 blogs, 48 instructor observations, and 300 peer reflections.

Alignment of Data sources with research questions

Table 3 presents the alignment of the different data sources with the research questions.

Table 3
Alignment of Data Sources with Research Questions

Research Question	Data Source
1. How does preservice English teachers' Technological Pedagogical Content Knowledge (TPACK) change through a course based on TPACK? I. What is the relationship between design activities based on TPACK and TPACK development in preservice English teachers? II. What is the relationship between microteaching[1], macroteaching lessons and the development in TPACK of preservice English teachers? III. How is TPACK development reflected in the microteaching lessons, macroteaching lessons and the design activities of preservice English teachers?	• Lesson plans • Observations • Design activities • Practicum reports • Peer feedback • Interviews • Reflective journals
2. To what extent are the perceptions and attitudes of preservice teachers towards the integration of technology into English Language Teaching influenced by the TPACK-based course?	• Interviews • Reflective journals
3. How do the conceptions of preservice teachers of learning and teaching with technology change as a result of participation in the course?	• Interviews • Reflective journals

Data Analysis

Data analysis is a dynamic process used to answer research questions and involves continuously moving between specific data points and broader conceptual ideas, blending inductive and deductive reasoning, and balancing description with interpretation (Merriam, 2014). In case study research, this process begins with a comprehensive description of the setting or participants, followed by an analysis of the data to identify themes or issues

[1] A technique used in teacher training to practice teaching skills practiced with a small lesson, a concept or a small number of students (Remesh, 2014).

(Creswell, 2014). I followed the six phases of reflexive thematic analysis as outlined by Braun and Clarke (2022): familiarisation with the data, coding, generating initial themes, developing and reviewing themes, refining, defining and naming themes, and writing up. This process was not linear but recursive, with continuous movement back and forth between phases (Braun & Clarke, 2022). This recursive approach was crucial because the data collected were segmented into precourse, during course, and postcourse phases, each analysed separately. This method allowed me to identify relationships between taking the course and the development of TPACK by comparing findings across different data sets. This approach was applied to all data sources, including interviews, reflective journals, lesson plans, observations, and design activities.

Phase 1: Familiarising Oneself with the Data

The familiarization phase involved transcribing, reading, and rereading the data, and noting down initial ideas (Braun & Clarke, 2022). The interviews, which were recorded, transcribed, translated, and back-translated, served as the starting point. The transcription process enabled me to become familiarised with the data, develop a deeper reflexive understanding, and facilitate a close reading and interpretation skills needed for the analysis (Braun & Clarke, 2022). Merriam (2014) emphasises the value of the researcher performing the transcription to generate insights from the data.

I used NVivo (version 12), a qualitative data analysis software, for sorting and categorising the data sources. I used NVivo because of familiarity with its features. The categories of the data sources were uploaded as file classifications, which included precourse interviews, precourse lesson plans and activities, observations, blog reflection, application reports, peer feedback, activities and lesson plans and postcourse interviews. Once the data were uploaded, I thoroughly read and reread the entire dataset to identify potential ideas and

patterns. Throughout this process, I kept written memos to capture my evolving ideas and observations.

Phase 2: Coding

After completing the data reading, I transitioned to the process of coding. The analysis of the data was both inductive and deductive while enabling most of the codes to arise from the thematic data analysis procedure. Thematic analysis is a method used to search across data to develop, analyse and interpret patterns of meaning (Braun & Clarke, 2022).

According to Braun and Clarke (2022), inductive analysis is a data-driven process of coding and theme development, while a deductive analysis approach is driven by the researcher's theoretical framework. In my deductive approach, I used a precoding strategy based on the TPACK framework to identify evidence of TPACK development. The seven domains of TPACK made up seven codes for the precoding procedure. Table 4 shows the TPACK codes, their descriptions, examples, and coding rules, adapted from the codebooks by Chai et al. (2013) and Valtonen et al. (2019). The data coded with TPACK codes were grouped to reflect themes and to provide evidence of TPACK constructs within the collected data.

In addition to the deductive approach, I employed inductive analysis to identify codes from the data itself. As I read and coded the data, I constructed new codes and added them to the NVivo codebook, while existing codes were applied to relevant data segments. NVivo facilitated this process, allowing for easy retrieval and assignment of codes. Some data segments were coded multiple times with different codes reflecting their content, following Braun and Clarke (2022) explanation that a single data extract may be coded in several ways depending on its relevance to the developing analysis.

Table 4
Coding Scheme Based on TPACK Constructs

Code	Description	Example	Coding Rule
CK	Relating to English and the development of the language	Knowing how to use tenses	Understanding the English language in terms of structure and content and how to develop the language.
PK	Relating to methods for teaching and learning (pedagogy)	Knowing how to use problem-based learning	Ability to use different teaching and learning methods (e.g., how students learn, lesson planning, assessment).
TK	Relating to knowledge and understanding of technology	Knowing how to use blogs	Ability to use technology tools, create artefacts, and demonstrate knowledge of how technology can help or hinder teaching goals.
PCK	Relating to teaching methods and how they fit with teaching English	Knowing how to use problem-based learning to teach literature	Ability to teach English using methods that fit the content and promote learning.
TCK	Relating to how technology is used to represent knowledge of the English language and teach it. It also includes an appropriate selection of technology to teach English and understanding how technology and content affect one another.	Using Merriam Webster's Online Dictionary by students	Ability to select the appropriate technology that fits the English classroom content and understanding how the use of the tool can change the way English is taught and learned.
TPK	Relating to using technology to teach using different instructional methods and understanding of how the choice of technology can affect teaching	Using Google Drive for collaborative learning	Ability to select technologies that enhance the lesson, students' learning, and the teaching approaches
TPACK	Relating to using technology for developing English language competence using effective pedagogical methods	Using Google Docs to enhance communication and collaboration skills in English projects.	Ability to select appropriate technologies to teach English using varied pedagogical approaches.

Phase 3: Generating Initial Themes

After coding the data, I began identifying potential themes by analysing the codes and combining them to create broader themes. In reflexive thematic analysis, theme development is not a process of discovery, but one of construction, shaped by the researcher's

interpretative engagement with the data (Braun & Clarke, 2022). Using NVivo, I grouped similar codes under potential themes and sub-theme by creating nodes and dragging and dropping relevant codes under the theme. Once the codes were collated under each potential theme, I added a definition using the Node Properties feature on NVivo.

Since the precourse data were analysed separately from the in-course and postcourse data, I created two main nodes in NVivo, titled *precourse* and *in-course and postcourse*, to separately analyse data based on each phase. This structure allowed me to identify and organise themes within each phase. I continuously compared the themes from the precourse data with those from the in-course and postcourse data, keeping in mind similarities and differences across these phases.

Phase 4: Developing and Reviewing Themes

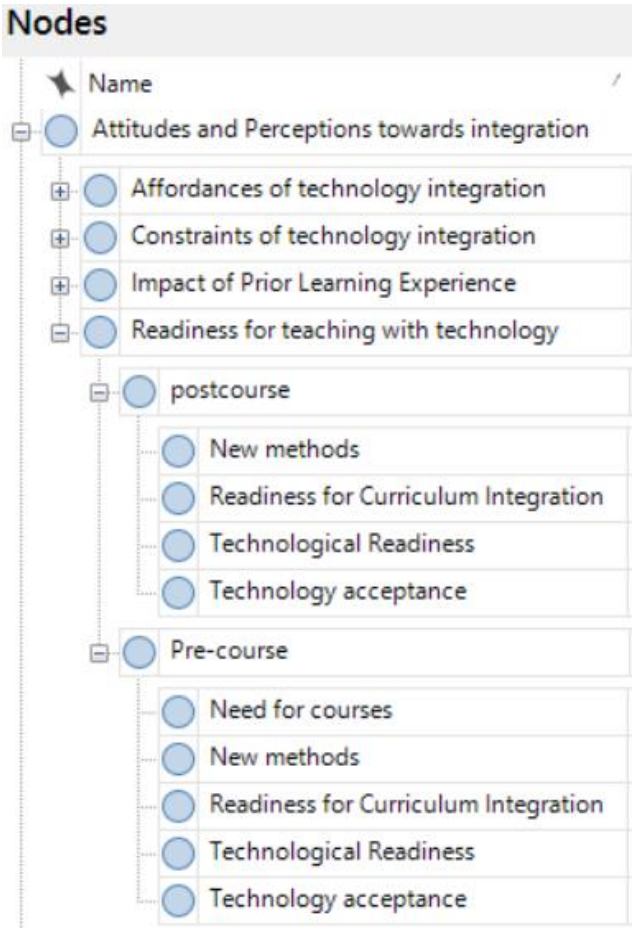
Once the initial themes were constructed, I reviewed and refined them to ensure their coherence and relevance. This involved re-engaging with both the coded data extracts and the entire dataset to assess the quality and scope of the candidate themes (Braun & Clarke, 2022). During this phase, I assessed whether some themes overlapped or lacked sufficient data support and adjusted accordingly by splitting, collapsing, or discarding as needed (Braun & Clarke, 2022). For example, I initially found the theme *Technical Constraints*, but upon review, I realised it could be combined with the theme *Experiences in Technology-Enhanced Teaching* under the sub-theme *Macroteaching Experiences*, because the codes under the initial theme *Technical Constraints*, referred to challenges faced by participants during technology application in macroteaching.

In addition, I reviewed the themes for both the precourse data and the in-course and postcourse data, combining them where appropriate. This process began with combining similar themes from the precourse, in-course, and postcourse data together on NVivo. It was

done by inserting a node with the title of the theme, followed by the sub-theme, and then inserting sub-nodes for the precourse data, in-course, and postcourse data each with their codes. This is illustrated in Figure 4, which shows the theme *Attitudes and Perceptions Towards Technology Integration* and Sub-theme *Readiness for Teaching with Technology,* which was divided into precourse and postcourse (including in-course) codes. This process included recursive movements between the codes and themes and comparisons between themes for the precourse data and in- and postcourse data.

Figure 4

Example of One Theme, Sub-Themes and Codes Using NVivo



Phase 5: Refining, Defining, and Naming Themes

This phase involved a process of defining and refining the structure and clarity of each theme and developing the overall flow of the analysis. I reviewed the candidate themes

to ensure each one was centred around a clear organising concept and contributed to the broader story of the dataset (Braun & Clarke, 2022). I examined sub-themes and codes to identify the narrative each theme conveyed, ensuring it fits within the broader story of TPACK development in preservice teachers. In addition, I refined the themes further by examining sub-themes and checking whether they fit within the larger theme and tell a story connected to the main theme. For example, under the theme *Design Activities,* I created sub-themes for different types of artefacts designed by participants, such as lesson plans and activities, to capture the various aspects of this theme.

Phase 6: Writing Up

The final phase of the analysis involved bringing together the analytic narrative in written form, aiming to tell a coherent and persuasive story about the dataset that directly addressed the research questions (Braun & Clarke, 2022). I selected data extracts that illustrated each theme and sub-theme, using these quotes to capture their essence. Quotations from the participants were preserved in their original form, including any grammatical, spelling, or punctuation inconsistencies, as recommended in section 8.29 of the APA 7th Edition Publication Manual (American Psychological Association, 2020). The intention was to maintain the authenticity and integrity of the participants' language and written expression. Where an error might interfere with comprehension, the notation [*sic*] was added immediately after the word to clarify that the error is part of the original source. The report presented each main theme, followed by a definition, sub-themes, and codes, all supported by illustrative excerpts. This structure allowed for a clear and compelling narrative of the data, reflecting the development of TPACK among preservice teachers.

Trustworthiness of the Research

In qualitative research, it is crucial to understand the perspectives of those involved in the phenomenon of interest, to uncover the complexity of human behaviour within a contextual framework, and to present a holistic interpretation of the events (Merriam, 2014). It is important to capture these perspectives and interpret them while maintaining the quality of the research by its trustworthiness. Lincoln and Guba (1985) outline key components to establish the trustworthiness of the research: credibility, transferability, dependability, and confirmability, which will be presented in the following sections.

Credibility

Credibility, the equivalent of internal validity, addresses the alignment between research findings and reality (Merriam, 2014). Lincoln and Guba (1985) recommend techniques such as prolonged engagement, persistent observation, triangulation, peer debriefing, negative case analysis, referential adequacy, and member checks to establish credibility. In this study, prolonged engagement, persistent observation, triangulation, and member checks were used to establish credibility. Firstly, I was engaged for a prolonged period of twelve weeks in the setting of the course providing scope and depth to the research. Secondly, my role as an instructor helped to make the context appreciated and understood (Lincoln & Guba, 1985) and allowed for building trust, in addition to focusing on the characteristics of the topic of study in detail. Thirdly, multiple data collection methods, such as self-report data, observations, and performance assessments, were employed to triangulate findings. Finally, member checks were conducted by inviting participants to review their transcripts, allowing them to add or delete information, and follow-up questions provided opportunities for participants to contribute additional insights.

Transferability

Transferability, the equivalent of external validity, refers to the generalizability of the research findings (Merriam, 2014). Thick descriptions are used as a technique to strengthen transferability and "to enable someone interested in making a transfer to reach a conclusion about whether transfer can be contemplated as a possibility" (Lincoln & Guba, 1985, p. 316). In this study, I provided thick descriptions of the participants, setting, data collection methods, analysis procedures, and findings supported with sufficient evidence in the form of quotes. I believe that the results may be transferred to similar preservice education programmes, particularly those involving English preservice teachers participating in educational technology courses designed to develop TPACK, based on the TPACK-DBL model.

Dependability

Dependability, the equivalent of reliability, refers to the extent to which the results of a study can be replicated (Merriam, 2014). Lincoln and Guba (1989; 1985) suggest an audit trail, a record of the inquiry that allows others to verify the study's findings. To address the issue of dependability, I documented the research process, providing a detailed account of the context, design, and procedures followed. This transparency enables readers to "authenticate the findings of a study by following the trail of the researcher" (Merriam, 2014, p. 222).

Confirmability

Confirmability, or objectivity, is "the extent to which the data and interpretations of the study are grounded in events rather than the inquirer's personal constructions" (Lincoln & Guba, 1985, p. 324). To ensure confirmability in this study, I employed triangulation of data collection methods, ensuring that interpretations were grounded in the data itself. In addition, I practised reflexivity and examined my role throughout the process. As Merriam (2014) suggests, researchers must disclose their biases, dispositions, and assumptions to provide a

transparent interpretation of the data. In this study, my position as an insider researcher, including my interest in the topic, background, and preconceived ideas, was addressed in chapter one. In addition, the duality of the role of the researcher from an ethical perspective is discussed in the next section.

Role of the Researcher

As both the researcher and the course instructor, I acknowledge the ethical challenges posed by my dual roles, particularly regarding power dynamics. Ferguson et al. (2004) note that these dynamics are moderated by trust and the moral commitment of teachers to act in their students' best interests. The main ethical concerns relating to role duality in the research process include the recruitment of participants, the informed consent process, data collection, withdrawal from research, anonymity, and confidentiality (Ferguson et al., 2004). I have made efforts to identify issues related to these ethical concerns and tried to manage and reduce them by the best possible means available at the time of the research.

To minimise the potential of coercion to participate in the research, participants were not recruited individually; instead, an invitation was sent to all course participants. Those interested contacted me directly, ensuring voluntary participation. The information sheet and consent form clarified that participation was voluntary and would not affect academic assessments, with participants free to withdraw at any time. The course data, apart from the precourse interviews, were not collected, stored, or analysed until after the courses ended and the final grades were posted, ensuring that academic performance was not influenced by research participation. Pseudonyms were assigned to participants immediately after transcription to protect anonymity, and the name and location of the teacher education institution were withheld to minimise any risk to participants' confidentiality. In addition, apart from the interviews which were conducted before and after the course, all collected data were part of the course requirements. Thus, participants were not required to perform

additional tasks for the purpose of the research and no class time was used for research procedures.

Ethics

Ethical approval was obtained from both Lancaster University and the education college in Israel. The process of ethical approval from the college was prolonged, therefore, I obtained approval from the college administration to begin data collection until the official ethical approval document was released. This was necessary as the data collection instruments included precourse interviews, which could not be postponed until receiving the official document.

Participants were fully informed of the research aims, data collection methods, and their rights through information sheets (Appendix G) and consent forms (Appendix H). The information sheets and consent forms included the aims of the study, the reason for the invitation, data collection methods, the voluntary nature of participation, the storing and use of data, and an explanation of their rights as participants, including anonymity and confidentiality. All collected data were stored securely in encrypted files, accessible only to me. The files were stored on my personal computer, which is password protected. The only hard copies of data included my observations, and these were stored securely in a locked cabinet at my home.

Summary

This chapter provided an overview of the methods and methodology employed in this study, which aimed to investigate the development of preservice teachers' TPACK. It detailed the epistemological and ontological positions of the researcher, the research design and procedures, a description of the participants, an overview of the data collection instruments, the analysis process, and the steps taken to ensure the study's trustworthiness.

The chapter concluded with a discussion of the researcher's role and the ethical procedures followed throughout the study.

Chapter Four: Findings on TPACK Development of Preservice English Teachers

Introduction

The purpose of this study was to investigate how a TPACK-based course impacts preservice teachers' TPACK development and their perceptions and attitudes towards technology. This chapter aims to respond to research question one (RQ1), focusing on how a TPACK-based course impacts preservice teachers' TPACK development. This chapter presents the findings from the data analysis of the precourse, in-course and postcourse data after they were analysed separately to check for differences. The findings of research question one about the development of TPACK are presented through a vignette and three themes related to the three sub-research questions. The vignette is drawn from the data to capture the development of TPACK throughout the study and represents both the breadth and depth of the data collected, offering an example of how the intervention influenced pedagogical practices. It provides the reader with a description and overview of the participants' TPACK development in the natural sequence of its occurrence (Merriam, 2014) throughout the study. This vignette forms only a part of the whole data but is representative of the data as a whole (Merriam, 2014). The vignette is followed by themes generated from the data analysis, with a description of how each theme is constructed from sub-themes and codes. Table 5 presents the themes related to research question one and its sub-research questions with a list of sub-themes.

Table 5
Themes and Sub-Themes Arrangement According to Research Question One and the Three Sub-Research Questions

Research Questions	Themes	Sub-themes
RQ1: How does preservice English teachers' technological pedagogical content knowledge change through a course based on TPACK?		
• SRQ1: What is the relationship between design activities based on TPACK and TPACK development in preservice English teachers?	Theme 1: Design Activities	1) Representation of TPACK in Design Activities 2) Lesson Plans

Research Questions	Themes	Sub-themes
		3) Activities
• SRQ2: What is the relationship between microteaching, macro teaching lessons and the development in TPACK of preservice English teachers?	Theme 2: Experiences in Technology-Enhanced Teaching	1) Microteaching Experience 2) Macroteaching Experience
• SRQ3: How is TPACK development reflected in the microteaching lessons, macroteaching lessons and the design activities of preservice English teachers?	Theme 3: Integrating Technology to Support Pedagogical Practices in English Language Instruction	1) Teaching Methods 2) Developing Students' English Language Skills

Vignette

This vignette presents the case of P13's TPACK development throughout the study, illustrating how the course enhanced their pedagogical practices and technology integration in teaching English. Initially limited to basic presentation tools like PowerPoint, P13 demonstrated significant development in TPACK by incorporating technology into lesson design activities, microteaching, and macroteaching.

P13's development in TPACK began with design activities integrating technology into lesson plans. In the first design activity, P13 created a technology lesson aligned with the Access to Information domain of the Israeli English Curriculum, which aimed to help students "understand the general meaning, main ideas and supporting details in a text, and use this knowledge as needed" (P13, Lesson Plan). P13 used a timeline ICT tool (Figure 5) to help students categorise events from a text and encouraged collaboration by having pairs create their own representation of the text using a timeline ICT tool as a multimedia presentation.

Figure 5

P13 Timeline Sample During Design Activities Stage of the Course

Feedback on P13's microteaching of this lesson highlighted the integration of TPACK elements. Peer feedback stated that the technology used was "appropriate to the goal of the lesson. The pedagogy was clear; the teacher explained and showed the students how to use the website" (P11, Feedback). Observations emphasised that the activity "enabled students to work in groups and analyse the content of a reading comprehension text… showing their understanding and creativity by designing timelines with videos, images, and information" (Observation 6). P13 demonstrated evidence of TPACK development in this design activity by aligning the lesson with the curriculum, adapting the coursebook, and employing a relevant ICT tool to foster collaboration, multimedia presentations, and curriculum-based pedagogical practices in English language teaching.

In the second design activity, P13 incorporated the Presentation domain of the curriculum, which required students to "independently find and integrate information from multiple sources" (P13, Lesson Plan). P13 designed a post-reading activity where students, in groups, used Piktochart to create and present infographics about places in the country. Peer feedback noted that the "application Piktochart is used in a good way, students have to create

a page about different places in groups, which will make the students more interactive with the lesson" (P5, Feedback). Reflecting on the experience, P13 stated, "My role was to teach the lessons in a more engaging, simplified, and interesting way… these activities provide a more appealing and engaging learning process… [and] improved my skills in teaching" (P13, Blog). P13's microteaching influenced participants like P19, who integrated Piktochart into their own macroteaching and noted that "students were able to create their own infographic using Piktochart, then present it in front of the class" (P19, Application Report), highlighting the value of peer learning.

P13's macroteaching report detailed the use of various ICT tools, such as "timeline, PlayPosit, Quizlet, and Padlet, for different purposes like teaching vocabulary, answering LOTS questions, and communication and sharing ideas" (P13, Application Report). For instance, Padlet was used in a brainstorming activity where students elicited information about images related to the poem and commented on each other's posts, practising the higher-order thinking skill of predicting. Quizlet (Figures 6 and 7) supported vocabulary practice, while PlayPosit (Figure 8) enabled interactive video-based listening and comprehension exercises. P13 reported positive collaboration with mentor teachers, stating their "feedback was very encouraging" (P13, Application Report). Students also enjoyed the lesson, describing it as "a source of enjoyment and for learning too" (P13, Application Report).

In summary, P13's development in TPACK through the course showed progress in integrating technology into lesson design, microteaching, and macroteaching. This progress was supported by curriculum-based activities, the use of ICT tools, and positive feedback from peers and mentors, ultimately enhancing P13's pedagogical practices and student engagement in English language instruction.

Figure 6

P13 Quizlet Activity-Matching for Macroteaching

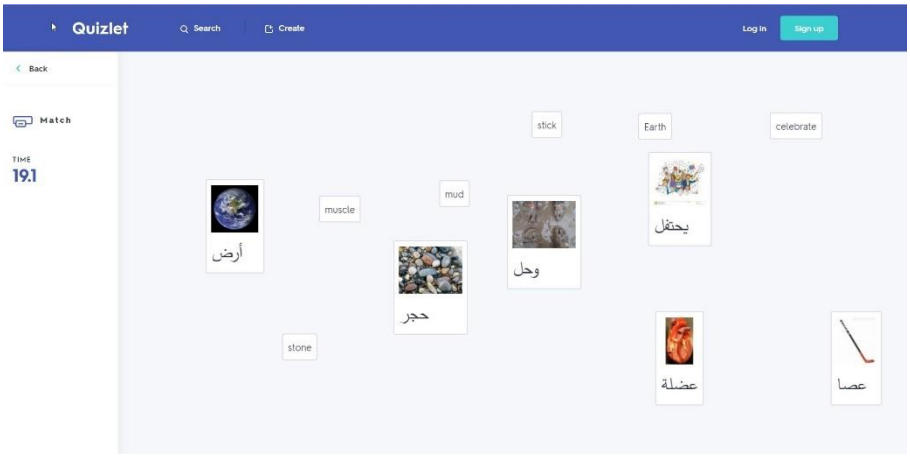


Figure 7

P13 Quizlet Activity Spelling for Macroteaching

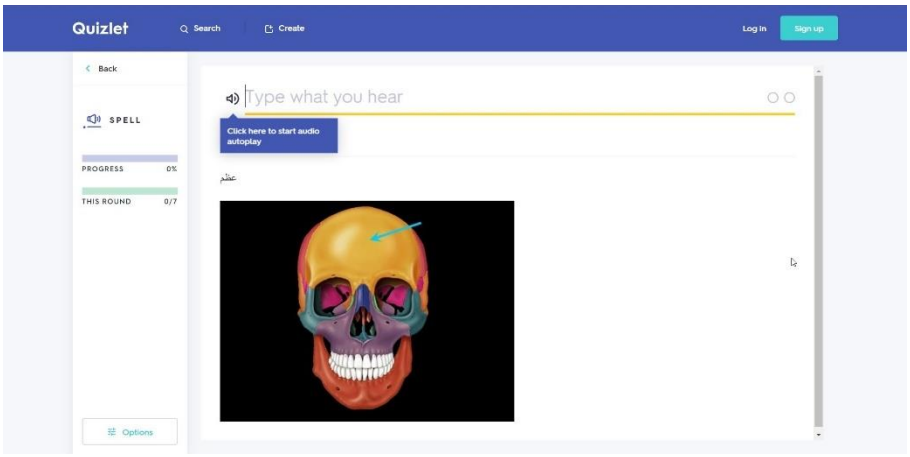
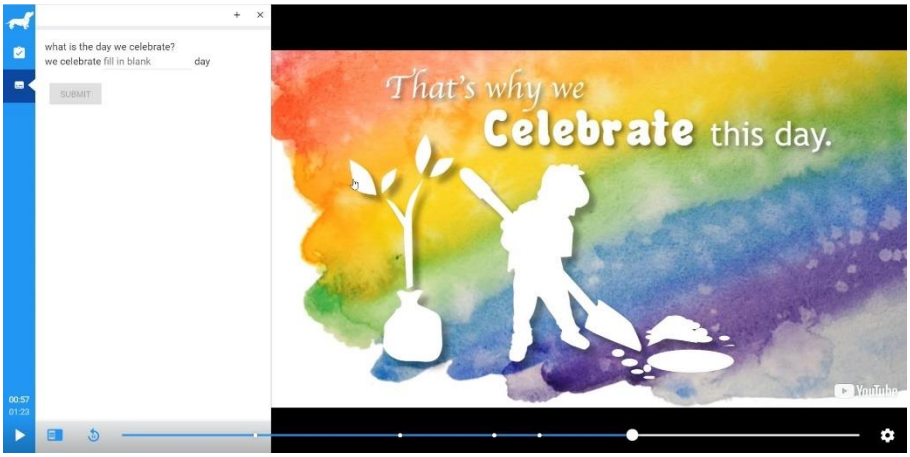


Figure 8

P13 PlayPosit Activity for Macroteaching



Theme 1: Design Activities (SRQ1)

The data analysis has led to the identification of the theme Design Activities, which highlights the development of TPACK in preservice English teachers. This theme is connected to sub-research question one: *What is the relationship between design activities based on TPACK and TPACK development in preservice English teachers?* It explores how TPACK is developed through the creation and implementation of design activities, including lesson plans and activities. The data analysis has resulted in three sub-themes: *Representation of TPACK in Design Activities, Lesson Plans* and *Activities.* These sub-themes are detailed in Table 6.

Table 6
Theme 1: Design Activities with Sub-Themes and Codes

Theme	Sub-theme	Codes precourse	Codes in-course & postcourse
Design activities	Representation of TPACK in Design Activities	TK	TK
		CK	CK
		PK	PK
		PCK	PCK
		TPK	TPK
		TCK	TCK
		-	TPACK
		TPACK Percentages	TPACK Percentages
	Lesson Plans	Curriculum Alignment	Curriculum Alignment
		-	Book Adaptations
	Activities	-	Instructional Design activities
		-	ICT Tool Integration
		-	Problem-solving activities

Sub-theme 1: Representation of TPACK in Design Activities

The data analysis has resulted in the sub-theme *Representation of TPACK in Design Activities*, which shows evidence of TPACK constructs in these activities. The design activities created by participants in the course were compared to the pre-course lesson plans

and activities, revealing significant differences and indicating the presence of TPACK and all its constructs in the design activities.

Code 1: TK. The data analysis has indicated that participants showed evidence of their knowledge of technology. This is demonstrated in their ability to use technology tools to create activities and their understanding of how these tools can be used. Before the course, the participants exhibited limited TK (e.g. knowledge about operating PowerPoint, digital books). In contrast, during the course, the participants demonstrated knowledge of a wide variety of basic and advanced technology tools such as Padlet, Socrative, Google Forms, PlayPosit, WriteAbout, Timeline, Voki, and Piktochart and both articulated and demonstrated how these tools are used. This is illustrated by the following excerpts from one of the course participants who stated: "Storybirds [*sic*] lets anyone make visual stories in seconds using a large range of artwork from illustrators and animators" (P11, Activity). Another course participant discusses Padlet, which "is a free, online 'virtual wall' tool where users can express thoughts on topics of their choice. It's like a piece of paper, but on the Web" (P22, Activity).

Code 2: CK. The participants showed evidence of Content Knowledge (CK), particularly in the development and use of the English language, in their lesson plans before the course and in their design activities during the course. The data analysis indicated that participants demonstrated their understanding of the content and structure of the English language and how it can be developed. For instance, language development is demonstrated by a participant discussing teaching a literary text in English. According to the participant, the lesson aims to help students "identify and describe events, setting and main characters in literary texts, using lower-order thinking skills" (P19, Lesson Plan).

Code 3: PK. The data analysis showed evidence of participants' pedagogical knowledge (PK) in designing effective teaching and learning activities before and during the course. They demonstrated PK by using methods related to how students learn, lesson planning, and student assessment. For example, one participant stated, "working in pairs will motivate students to participate and be engaged" (P13, Lesson Plan), while another participant highlighted, "Brainstorming is an interesting kind of introduction, it grasp [*sic*] the students' attention" (P14, Lesson Plan).

Code 4: PCK. The data analysis indicated that participants demonstrated evidence of pedagogical content knowledge (PCK). Although they were able to teach using teaching and learning methods suitable for the English language classroom and facilitated students' learning both before and after the course, the precourse methods relied heavily on teacher-centred methods like lectures and presentations. During the course, however, the participants showed the integration of more student-centred learning methods, such as problem-based learning and peer collaboration. For instance, one study participant taught a unit called "The Amazing Amazon" from the coursebook, designing a problem-based learning activity to teach content by making "the subject more relevant to the students by motivating them to find solutions for the environmental problems" (P17, Lesson Plan).

Code 5: TCK. The analysis of the data indicated that participants showed evidence of Technological Content Knowledge (TCK) in their design activities. Before the course, participants showed very limited instances of TCK, focusing mainly on teacher-centred uses of technology to teach content, such as teaching vocabulary and grammar using PowerPoint or using Youtube for listening. During the course, participants appropriately selected and integrated technology into the English language classroom and demonstrated an understanding of how technology changes the way English is taught and learned. For instance, P18 created a lesson plan in which students participated in a post-reading activity

following the completion of a short story from an 8th-grade English coursebook. The activity required students to use the ICT tool Voki to create the main character and have the character deliver a speech from a future point in time after the story ends. P18's rationale for creating the activity "is to not only achieve the task post-reading, but to encourage the students to practise speaking using the technology tool" (P18, Lesson Plan & Activity). Another example is P22, who designed a lesson that adapted an activity from an 8th-grade textbook. The original activity instructed students to engage in a discussion with a partner. P22 transformed this activity by using the ICT tool Padlet to encourage a whole-class discussion in English, both orally and in written form, according to their statement.:

> With the help of Padlet Teacher [*sic*] asks students to write their opinion using the expressions written in Exercise E on the tool, which is Padlet. Students write, add photos, record their voice…In addition, students are asked to write a comment on each other's writing. Leading them not only to write and express what is inside of them but to also listen to other people [*sic*] perspective. (P22, Lesson Plan and Activity)

After taking part in the microteaching activity for P22's lesson, P4 stated that the lesson was transformed into one that allows all students to take an active role: "the use of Padlet will make sure that students are taking part in the lesson and have a voice" (P4, Feedback).

Code 6: TPK. The data analysis has revealed evidence of Technological Pedagogical Knowledge (TPK) in the design activities. Before the course, the participants showed teacher-centred and superficial uses of technology to support pedagogical practices (e.g., projecting images on the board to elicit a discussion). During the course, however, the participants demonstrated the ability to integrate technology with different instructional methods to enhance lessons, students' learning process, and their own teaching approaches. This is

illustrated in the wide range of instructional methods they used when integrating technology into their lessons. For example, one participant designed an activity to engage students in a communicative and collaborative design activity in which students "will be able to cooperate and communicate with each other" (P13, Lesson Plan) to design a digital infographic. Another example is P4, who engaged students in pair work to create an online timeline using different illustrations based on a reading comprehension text, explaining that "involving the students in a [*sic*] pair work will aid them to understand how it is like to be in a team and to help each other. In Addition [*sic*], by working together they will get the chance to think together and to finish the task easily" (P4, Lesson Plan).

Code 7: TPACK. The participants' design activities showed evidence of TPACK, referring to their technology integration to develop students' English language competence while using effective pedagogical approaches. This is illustrated in P9's design activity aiming to enhance students' English language skills in English literature by using technology with a variety of teaching methods. These methods included collaboration and peer assessment as students collaborated in groups to create a story on Padlet and then engaged in peer assessment by "read [ing]each other's stories and to rat[ing] them from 1-5, according to creativity, accuracy" (P9, Lesson Plan). Another example is P12's design activity involving students in collaborative inquiry using Google Slides while learning new vocabulary from their coursebook. This was followed by a comprehension activity using the tool PlayPosit, in which students log in to "PlayPosit and watch the video and answer questions about the rainforest" (P12, Lesson Plan). For homework, P12 instructs students to review their collaborative vocabulary activity in order "to review the words because they will do a review activity next time using a new web site [*sic*] called 'Socrative'" (P12, Lesson Plan).

Code 8: TPACK Percentages. The data analysis examined the overall distribution of TPACK constructs in the participants' lesson plans and design activities submitted before and

during the course. To account for the larger volume of in-course data, the number of coded segments assigned to each construct was calculated as a percentage of the total coded segments per phase. This method allowed for a comparison of how emphasis on each construct changed over time and reflected the relative prominence of each component without being weighted by frequency alone.

As shown in Table 7, the pre-course data consisted mainly of CK, PK, TK and PCK. These four constructs represented the participants' early focus on content knowledge and teaching practices suitable for English language instruction with knowledge of technology. TCK, and TPK appeared less frequently in the pre-course lesson plans, and TPACK was not identified at all during this phase.

The in-course data showed a difference. While CK and PK remained present, their percentage decreased. TK, TCK, and TPK increased significantly, reflecting the participants' growing ability to select and integrate technology in ways that supported both pedagogical and content goals. PCK also increased slightly in proportion, showing continuity and development in participants' use of teaching methods that align with content. TPACK appeared only in the in-course data, as it was not identified in any of the pre-course submissions. This shows the shift in the participants' planning, as content, pedagogy, and technology were no longer treated as separate areas but considered together to form TPACK in the design process.

Table 7
Percentage Distribution of TPACK Constructs in Pre- and In-Course Design Activities

TPACK Construct	Precourse (%)	In-Course (%)
CK	27.6%	9.0%
PK	23.9%	8.2%
TK	17.9%	21.2%
PCK	16.8%	18.4%

TPACK Construct	Precourse (%)	In-Course (%)
TCK	6.3%	18.3%
TPK	7.4%	14.9%
TPACK	0.0%	10.2%

Note. Percentages represent the proportion of each TPACK component out of the total coded segments per phase (precourse = 351; in-course = 1226). Data were drawn from participants' submitted lesson plans and design activities.

These findings support the earlier analysis of constructs. The shift from CK, PK, and PCK to increased use of TK, TCK, TPK, and TPACK reflects changes in participants' design activities. The growth in PCK shows greater alignment between pedagogy and content, while the rise in TCK and TPK indicates expanding use of technology to support both. The presence of TPACK confirms progress towards more integrated lesson design.

Case Illustration: Participant 14. This section presents a specific example of a participant who showed marked growth across TPACK constructs. While the data analysis examined trends across the entire cohort, this case illustrates how one participant developed from limited technological integration to TPACK integration by the end of the course.

Participant 14's design activities show a shift from a focus on content and pedagogy in the precourse phase to a representation of all TPACK constructs in the in-course phase (Table 8). In the pre-course lesson plan, CK and PK were dominant, with the lesson structured around vocabulary instruction, brainstorming and oral practice. PCK appeared in how the participant linked language content to instructional methods, while TK was present but minimal, evident in the single use of a PowerPoint presentation containing four images to introduce the topic. The lesson plan noted that "in order to grab students['] attention, teacher uses Visual aids such as a PowerPoint Presentation" (P14, Lesson Plan). TCK was also limited, with technology used to present images for comprehension of the content. There was no evidence of TPK or TPACK, which suggests that technology was treated as a separate

element rather than integrated within pedagogy or content to support both instruction and learning.

Table 8
Percentage Distribution of TPACK Constructs in Pre- and In-Course Design Activities (P14)

TPACK Construct	Precourse (%)	In-Course (%)
CK	29.4%	9.1%
PK	41.2%	9.1%
TK	5.9%	13.6%
PCK	17.6%	18.2%
TCK	5.9%	22.7%
TPK	0.0%	20.5%
TPACK	0.0%	6.8%

Note. Percentages represent the proportion of each TPACK component out of the total coded segments per phase (precourse = 17; in-course = 44). Data were drawn from P14's submitted lesson plans and design activities.

In contrast, the in-course design activities showed evidence of all TPACK constructs. TK was evident in the use of new and varied digital tools such as Quizlet, Blogger, and the Timeline app, each introduced with explanation and justification for use. For example, P14 introduced the tool Quizlet by explaining its purpose, guiding students through its features, and encouraging autonomous use. As noted in the lesson plan, the participant "opens Quizlet website and starts to explain each and every detail of it, suggests different things and activities that students can do using Quizlet, and tells the advantages and disadvantages of it" (P14, Lesson Plan). This shows the participant's awareness of the tool's educational potential and reflects growth in TK as they moved beyond superficial use to introducing and contextualising technology in relation to student learning. CK and PK, although lower in frequency than in the pre-course phase, were not isolated but appeared to be integrated in lesson designs that integrated technology. PCK remained consistent across the design

activities through the use of teaching and learning methods adapted to language content, especially in reading, writing, and speaking tasks.

TCK appeared as the technology tools were selected to support content learning. For example, the participant used Quizlet not only for vocabulary practice but also to develop spelling and pronunciation skills through online flashcards, spelling, and games. Blogger was introduced to support writing tasks, with students encouraged create biographies and to embed multimedia such as images and videos to engage with the content. The latter lesson plan explained that students were to "make their own biography… in writings, pictures, songs, videos, records [*sic*] or anything they feel related to," and then post them on a shared blog (P14, Lesson Plan).These activities show the P14's understanding of how digital tools can transform the way language content is represented, engaged with, and communicated.

TPK was present in the design of activities that aligned technology use with pedagogical goals. P14 included activities such as group reflection, online competitions, peer feedback, and presentation. These approaches moved beyond tool use and reflected an understanding of how digital resources could actively shape learning experiences. For example, in the Blogger activity, students were not only required to create content but were also asked to "have a look in each other's blog and learn from each other," and to "choose two of his [*sic*] classmates and reflect or say his/her opinion about his work" (P14, Lesson Plan). These pedagogical choices reflect a shift from passive tool use to intentional integration, where digital resources support student-centred learning experiences. This construct was not evident in the precourse lesson plan, where technology was only used for presentation purposes. Its presence in the in-course data shows an important shift in the participant's design and a marked improvement in their ability to connect digital tools with instructional strategies.

Most important, TPACK appeared clearly in the in-course phase, marking a significant development in the participant's design activities. The analysis considered each submitted lesson plan and design activity holistically, with activities first coded for evidence of TPACK as an integrated construct and then examined for their underlying component elements. The percentage of TPACK (6.8%) reflects entire activities that demonstrated the integration of content, pedagogy, and technology together, rather than in isolation. This is in contrast to the pre-course lesson plan, which showed only separate and limited instances of some TPACK constructs, and no evidence of TPACK as a whole. For example, in one activity, students used the Timeline app to collaboratively create digital biographies of inspiring figures. They gathered information from multiple sources, inserted multimedia elements, and published their work on a class blog. The task was introduced with a model, included opportunities for presentations, revision and feedback, and concluded with peer reflection through a digital questionnaire. This design combined content knowledge (through the research and writing tasks), pedagogical knowledge (through modelling, collaboration, and feedback), and technological knowledge (through the integration of multiple digital tools). More importantly, these elements were not used separately; rather, they were interdependent and shaped the learning experience as a whole.

Therefore, this case illustrates not only the growth in individual constructs but the shift towards integrated design thinking. By the end of the course, Participant 14 was no longer using technology to support isolated TPACK constructs but was integrating it in a way that provided evidence of holistic TPACK.

Sub-theme 2: Lesson Plans

The data analysis has resulted in the sub-theme *Lesson Plans*, referring to participants' lesson plans related to technology integration. One code was identified for the precourse data and two codes for the in-course and postcourse data.

Code 1: Curriculum Alignment. The data analysis has resulted in the code *Curriculum Alignment* for the precourse, in-course and postcourse data. However, in contrast to the precourse data, the in-course and postcourse data show a different picture when aligning technology with curriculum goals.. The precourse data indicates that participants' lesson objectives and choice of curriculum domains and benchmarks do not meet the curriculum requirements for technology integration, even though they submitted the precourse lesson plans as technology-integrated lessons. In fact, the data analysis has shown that participants did not provide evidence of ICT integration to enable learners "to make full and appropriate use of digital tools in their language learning" (Ministry of Education, 2018b). Instead, they primarily focus on learning objectives related to the teacher-centred use of technology. For example, P5 does not engage students in the use of ICT tools, but describes how the

> Teacher opens a PowerPoint presentation that includes four pictures of the four seasons. Teacher asks students starting with one picture: what season does this picture indicate? Teacher asks the students to tell her what characterizes each one and write words from the students on the board. (P5, Lesson Plan)

This represents all pre-course lesson plans in which technology is utilised for presentations and demonstrates a mismatch between the plans and the objectives of the Israeli English Curriculum.

The in-course and postcourse data, however, show an alignment between technology integration and curricular goals. This is evident in the participants' reference to the

curriculum domains, their learning objectives, and their lesson procedure for integrating technology in which the learners use technology to learn the language. For example, P22 planned a lesson based on the domains of Presentation and Appreciation of Literature from the Israeli English Curriculum. They name, based on the lesson procedure, the relevant curriculum benchmarks for technology integration which require students to engage in "providing a written response to a literary text using digital media tools, such as podcasts and Web 2.0 tools" (P22, Lesson Plan). The lesson plan outlines utilising an ICT tool, WriteAbout, to involve students in composing an essay that connects the literary text from the coursebook to its context. Afterwards, students participate in peer feedback. This example is illustrative of the lesson plans created during the course in which participants align technology with the principles for ICT integration according to the Israeli English curriculum.

Code 2: Book Adaptations. The data analysis has resulted in the sub-theme *Book Adaptations*. The participants' lesson plans have shown that they were able to select topics with traditional representation from their coursebooks and enrich these topics with the use of technology. Their lesson plans transformed the coursebooks into interactive activities that engaged learners in exploring the course material while using technology tools to complete tasks in a manner different from the book's instructions. These activities were collaborative and focused on student-centred learning. This is illustrated by P24, who transformed a coursebook activity for learning vocabulary using an online tool. The original coursebook activity requires students to "look at the new words and write their meaning…use the glossary at the back of the workbook" (P24, Lesson Plan). However, P24 transforms the activity using the online tool Quizlet and instructs students to first: "Click on the "learn", "write", and "spell" buttons to practice the words. Click the "test" button to test yourself with the words. Click on "Match" and "Gravity" buttons to play games with the words" (P24,

Lesson Plan) and second, to take part in a vocabulary comprehension competition using Quizlet Live, a collaborative competition, as they describe the instructions they will give students: "race with your classmates to win the first place by answering the questions quickly" (P24, Lesson Plan).

Sub-theme 3: Activities

The data analysis has resulted in the sub-theme *Activities*. This sub-theme refers to creating activities with the use of technology as part of the design process.

Code 1: Instructional Design Activities. The data analysis revealed that participants designed instructional activities focused on knowledge building and knowledge expression [2] for English language learning. These activities aimed to engage students in technology-based curriculum tasks that would strengthen their English language skills and allow them to showcase their knowledge of the language. Table 9 shows samples of such activities created by the participants.

Table 9
Sample Instructional Activities Created by Participants

Knowledge building	Knowledge Expression
"The students will practice the vocabulary using Educaplay". (P2)	"Create your own BLOG…use the past simple and past progressive to talk about what you did/ what was happening". (P10)
"Answer the quiz by logging into Edmodo". (P15)	"Use Padlet…write a short essay. The essay has to include 4 paragraphs… read and assess your classmates' writing". (P3)
"Make a post on padlet… Choose 5 of the new words… use one of the 5 words to describe each type of sport". (P17)	"Make a small research about the main ideas of the texts that we have learned in the unit, using Piktochart". (P17)
"Go to socrative.com and write the room name. Then the website divides the students into group. Each group competes with the other. The questions are related to the whole unit. The group that gets the highest score wins". (P9)	Students will log in to their accounts on VoiceThread, answer the questions of the tasks, and add pictures. Afterwards, students have to share their VoiceThread with their classmates. Each [*sic*] students have to comment on one of his classmates' VoiceThread". (P5)

[2] Terms developed by Harris and Hofer (2009) to describe instructional activity types for developing TPACK

Knowledge Building. The instructional activities designed by participants aimed to help students build and process knowledge of the English language while using technology. Participants incorporated technology to create a variety of learning experiences. Firstly, the activities aimed to activate prior knowledge, as illustrated by P10, who elicits "the difference between blog and diary by Padlet" (P10, Activity). Secondly, the activities included vocabulary-building tasks for practising vocabulary items. Thirdly, activities included enhancing listening comprehension skills through media engagement. Finally, the activities included building knowledge through assessment.

Knowledge Expression. In addition to knowledge building, participants designed activities for knowledge expression. This was achieved through activities that required students to produce written or oral products. Examples include creating timelines, writing and evaluating blog posts, developing illustrations, producing artefacts, and delivering presentations on specific topics.

Code 2: ICT Tool Integration. The data analysis revealed a significant expansion in participants' use of ICT tools for instructional design compared to their previous reliance on tools primarily for content delivery and listening to recorded text. During the course, participants explored and implemented a diverse range of ICT tools to create engaging English language learning experiences. Table 10 provides an overview of the ICT tools used before and after the course, along with their corresponding purposes.

Table 10
Sample Technology Tools Integrated by Participants Before the Course and During and After the Course

Precourse ICT Tools	Purpose	In-course & Postcourse ICT Tools	Purpose
CD	Listening comprehension	Blogger	Writing Collaboration Peer feedback

Precourse ICT Tools	Purpose	In-course & Postcourse ICT Tools	Purpose
PowerPoint	Teacher presentations	Padlet	Brainstorming Peer feedback Collaboration/ cooperation Writing Speaking Literature
YouTube	Listening comprehension Grammar rules	Storybird	Writing Peer feedback Grammar practice Vocabulary practice
Digital books	Listening comprehension	Voicethread	Speaking Peer feedback Writing Presentations

Participant reflections highlight the transformative impact of these tools after creating and teaching the activities:

> I used Educaplay website and created a matching activity… After dealing with a website that was not introduced in the class, I came to realize how flexible and easy it could be to use a new technological tool. While in the second PBL activity, I had to make a Bridging activity, I also used a new website called Edublogs where students had to write their own essays and share them with each other. (P2, Blog)

> I used VoiceThread with a video on the topic of bullying, to be used in class as a starter of a discussion at the beginning of the video I embedded a question to kick off the discussion, and right before the end, I placed another question to further integrate the students' opinions with what the video offered. (P1, Blog)

Code 4: Problem-Solving Activity. Participants engaged in problem-solving activities that required technology integration into instructional design. This process demonstrated the development of TPACK as participants selected and implemented ICT tools

to address real-world problems aligned with curriculum objectives. The following participant accounts illustrate this:

> During the course, we were given a set of problems and asks [*sic*] to create activities using technology... In the first lesson plan, I created a post-reading activity using Voki website where students need to cooperate in pairs and to create their own Voki character to answer the following question: "How can we save the Amazing Amazon?" While in the second task I chose to create an activity that focuses on the domain of presentation using Story-bird website to let students practice writing in the past tense. (P11, Blog)

> In the technology course I participated in two PBL (problem-based-learning) activities. In these activities we were given a list of problems in the book 'just imagine' and we were asked to look for ICT/tools to help us solve these problems. Basically, we planned lesson plans which were based on applying technology in order to solve the problems. Thus, I was responsible of [*sic*] teaching a reading comprehension text in an interesting way… I had to find a suitable tool and connect it to the topic I was asked to teach…. I decided to integrate google maps [*sic*] and Padlet in my lesson, since I found this website beneficial, related to the topic and relevant. (P16, Blog)

Theme 2: Experiences in Technology-Enhanced Teaching (SRQ2)

The analysis of the data has resulted in the theme *Experiences in Technology-Enhanced Teaching,* which addresses sub-research question two: *What is the relationship between microteaching, macroteaching lessons and the development in TPACK of preservice English teachers?* This theme refers to participants' practical experiences and outcomes from

microteaching and macroteaching. Table 11 presents the sub-themes and codes identified through a pre-, in-, and post-course analysis.

Table 11
Theme 2: Experiences in Technology-Enhanced Teaching with Sub-Themes and Codes

Theme	Sub-theme	Codes precourse	Codes in-course & postcourse
Experiences in Technology-Enhanced Teaching	Microteaching experience	-	Microteaching Promoted Self-Reflection
		-	Learning through Peers in Microteaching
			TPACK in Microteaching
	Macroteaching experience	-	Managing Class Time
		-	Mentor Teacher Collaboration
		Technical challenge	Technical challenge
			TPACK in Macroteaching

Sub-theme 1: Microteaching Experience

The data analysis has resulted in the sub-theme *Microteaching Experience* only for the in-course and postcourse data. This refers to participants' technology integration into teaching simulations. This sub-theme has resulted in three main codes.

Code 1: Microteaching Promoted Self-Reflection. Participants engaged in critical reflection on their microteaching experiences, particularly focusing on effective technology integration into their lessons. They showed evidence of examining both the execution and outcomes of their lessons. This reflective process extended to exploring alternative pedagogical approaches to enhance future instruction. For instance, one participant carefully considered how to modify lesson elements based on their microteaching experience:

> In the second task I chose "The domain of social interaction", I used the tool of Padlet for doing the activity in this tool my role was to post pictures of superheroes and let the students to press on agree or disagree and to write comments for each other, However it did not fit the three elements of TPACK because I needed to do a spoken

> activity instead of written activity. Therefore, I changed the tool from Padlet to Voicethread, In this tool my role was to ask the students to sit in pairs and to interview each other about asking each other about superheroes and to answer it by [*sic*] a recording. (P15, Blog)

A similar approach to lesson planning and refinement is evident in another participant's reflection:

> I realized I could've plan [*sic*] many things differently, and make the tasks more correlating [*sic*] to the aim of my lesson and to the purpose of integrating technology, where all the students' learning should be based on working on devices. For instance, I could've ask the students the Padlet question as a prereading activity, or I could've create a google form quiz as LOTS question about the paragraphs of the text, and lastly I could've use [*sic*] the feedback cards as a google form quiz to end the lesson and check the students' opinion about it. (P16, Blog)

Code 2: Learning through Peers in Microteaching. Participants demonstrated the acquisition of practical knowledge through active observation and engagement in peer-led microteaching sessions. Participants attribute this knowledge gain to their exposure to various ICT tools and their integration with pedagogy and content showcased during their peers' microteaching sessions. Participants emphasised the applicability of these tools in teaching English and their instructional practices. For instance, one participant described discovering a new tool that held great potential for enhancing student learning across multiple language skills:

> This tool was totally new to me. Thanks for [*sic*] my colleagues who presented about it… What I liked about this tool is that it can improve the students' speaking listening and writing skills. They can practice their speaking skills by recording their voice.

> And if they want to write not speak they can practice their writing skills in this way…So this website can give students a chance to practice three skills at once.
>
> As a future teacher, I will use this website… When I teach them about a specific country, I will ask them to go to the website and record\write their opinion about this country; what they think about this country, what they will do if they have the chance to go there and so on. (P8, Blog)

Code 3: TPACK in Microteaching. The data analysis revealed evidence of TPACK and its constructs, TK, CK, PK, TPK, and TCK, in the participants' microteaching sessions. For instance, an analysis of P19's second microteaching session revealed clear evidence of TPACK:

> The technology selected in this lesson was appropriate for the aims of the lesson. The aim was for students to engage in post-reading about the poem. The choice of Piktochart was appropriate as it enabled students to present summaries, analyze and present personal reflection on the poem "Olympic Race". The technology was used in a way that supports the pedagogical approach in this lesson as the tool enabled students to work in cooperative groups to create content related to the poem and present this content to the class. (Observation 38)

Similarly, P11's microteaching session demonstrated a strong application of TPACK. The following excerpt depicts a description coded as TPACK:

> P11 used one of the topics from the coursebook for technology integration. The topic is about connectors of sequence and the book requires students to write a paragraph using these. P11 used the online tool Storybird and asked students to use the connectors of sequence to write a digital story. This is a good selection of technology to teach English. The final stage of the lesson includes peer feedback on these stories.

> In summary, this lesson shows TPACK as the selection of the technology is used to teach English using different pedagogical approaches. (Observation 29)

Sub-theme 2: Macroteaching Experience

This sub-theme explores participants' experiences in applying technology within real-world classroom settings through macroteaching. Participants described the impact of macroteaching on their teaching practices and identified specific challenges encountered during this process.

Code 1: Managing Class Time. The data analysis revealed that participants encountered challenges in effectively managing class time during their technology-integrated macroteaching sessions. When planning and executing lessons, the participants had inaccurate estimation of the time required for technology-enhanced lessons and the time spent guiding students to use ICT tools. However, their experiences in time management challenges were used to develop strategies for improving future lesson plans. This is exemplified by P4, who discussed the challenges faced in their first attempt at macroteaching while incorporating technology and the time required to carry out the planned activity:

> Since it was my first attempt to allow my students to use technology during the lesson, I have made a few mistakes which I hope to improve in the soon [*sic*] future. One of the mistakes was that I gave my students too much to learn in 45 minutes... So, in order to avoid such mistake I will do the same as you have done with us the time you taught us about the blog; first, you dedicated one lesson for us to know how to use the website by writing something simple, then you gave us homework to use the blog at home…I will give up on the homework part and I will ask the students to do the task in class. In short, I will dedicate two lessons; one for introducing the website

> and making sure that my students can manage Storybird, then the following lesson will be for doing the task. (P4, Application Report)

This view is echoed by another participant who encountered difficulties related to managing class time, attributing these challenges to their limited experience with integrating technology into macroteaching:

> I should've take [*sic*] the time case into consideration and to try [*sic*] to reduce the tasks, especially because it was the first time for students in such a room and in a technology lesson as well. Thus, all of this requires time and I should've plan [*sic*] my lesson according to it. To sum up, it was not one of my best lessons, however this lesson taught me very important points that I should take into consideration in the future in order to enhance my lessons and abilities as a future teacher. (P17, Application Report)

Code 2: Mentor Teacher Collaboration. The data analysis has shown mentor teachers played a dual role in pre-service teachers' technology integration during macroteaching, acting as both supporters and knowledge seekers. While participants often cited positive feedback from mentor teachers as evidence of successful technology use, their accounts also emphasised limitations in mentor teacher support for developing advanced technology integration skills. Mentor teachers were impressed by pre-service teachers' technological proficiency and expressed interest in adopting similar practices. However, their ability to provide guidance and support for further development was constrained by their limited technological expertise. This is illustrated in the following excerpts:

> I gave them a task, to create their own Avatar …the teacher liked it as well and she said that this is her first time that she see Voki and she intends to use it in her lesson, not only that but she also asked me about more interesting websites and I gave her

some of those you gave us during the course and she was really happy about it. (P14, Interview)

I remember when I presented the timeline and Padlet, the teacher was so impressed, and she started, from the beginning when I started the activity- you need to teach me this activity, you need to teach me how to create, so I felt so confident and I know how to use it and I'm going to teach the teacher. (P20, Interview)

Code 3: Technical Challenge. The data analysis revealed that participants faced challenges when integrating technology into their teaching practices at school due to technical constraints. Interestingly, technical challenges were mentioned as an issue hindering the participants' ability to integrate technology effectively into teaching practices across all phases of the study. For example, P10 described the lack of technological infrastructure at a previous practicum placement before the course: "because the old school in [city], they didn't have PowerPoint presentations, or an access to any technology. It's an old school so it was hard, really was hard." (P10, Interview). Similarly, P21 encountered technical problems during a technology integration macroteaching session, highlighting the ongoing nature of these challenges:

In the second lesson, we had some technical problems. The Wi-Fi was very problematic. Although the computer room have [*sic*] 25 computers, and I have 31 students. I had to borrow 6 computers and prepare all the computers for the lesson. I was very excited because students liked the idea of writing through [*sic*] the computer. But I was upset because of these technical problems. Because I worked and prepared very hard. (P21, Interview)

Code 4: TPACK in Macroteaching. The data analysis has identified evidence of TPACK and its constructs, TK, CK, PK, TPK, and TCK, in the participants' macroteaching

sessions in real school settings. For example, P1 integrated Voki for knowledge expression following a story reading, thus demonstrating evidence of TPACK:

> My students responded to a Voki I had created, of one of the character [*sic*] of the story, the secret, they recorded themselves advising the character of the reporter, to what in [*sic*] their opinion in regards to the inquiry he had…When using voki my domains were social interaction and presentation, as the students were able to respond and react to the character, and present their opinions and ideas through creating a character of their own. (P1, Application Report)

Another participant, P3, also demonstrated evidence of TPACK in their macroteaching application report, describing a writing activity incorporating Padlet:

> After we were done with Kahoot, students practiced writing in Padlet, after I explaind [*sic*] to them what a movie review is, I asked them to write their own using Padlet…They had to vote and write comments for their classmates. (P3, Application Report)

Theme 3: Integrating Technology to Support Pedagogical Practices in English Language Instruction (SRQ3)

An analysis of the research data resulted in the theme *Integrating Technology to Support Pedagogical Practices in English Language Instruction* addressing sub-research question 3: *How is TPACK development reflected in the microteaching lessons, macroteaching lessons and the design activities of preservice English teachers?* This theme explores technology integration into diverse pedagogical approaches within English language teaching, examining how TPACK is applied to enhance the four language skills. It investigates the evolution of participants' technology integration capabilities from pre- to

post-course, focusing on their capacity to improve English language learners' skills. The theme is further divided into two sub-themes, detailed in Table 12 with corresponding codes.

Table 12
Theme 3: Integrating Technology to Support Pedagogical Practices in English Language Instruction with Sub-Themes and Codes

Theme/ category	Sub-theme	Codes precourse	Codes in-course & postcourse
Integrating Technology to Support Pedagogical Practices in English Language Instruction	Teaching methods	-	Homework Assignment
		-	Modelling
		Discussion	Discussion
		Give Lectures and presentations	-
		-	Collaborative Activities
		-	Assessment
	Developing Students' English Language Skills	Vocabulary	Vocabulary
		Grammar	Grammar
		Speaking	Speaking
		Writing	Writing
		Reading	Reading
		Listening	Listening
		-	English literature

Sub-theme 1: Teaching Methods

This sub-theme focuses on instructional methods and techniques that integrate technology to facilitate and enhance language learning. A distinction emerged between the precourse and the in-course and postcourse data. The precourse data indicated a reliance on traditional methods, such as discussions, lectures, and PowerPoint presentations for technology use. In contrast, the in-course and postcourse data highlighted a broader application of technology to support a diverse range of teaching methods.

Code 1: Discussion. Technology integration within classroom discussions changed from the precourse stage to the in-course and postcourse stage. Before the course, technology integration in discussions typically involved using presentation tools like PowerPoint to display images or sentences, which served as a basis for oral discussions. For example, P4 described this approach: "I will show them my presentation; where in the first slide I will discuss with them the title of the unit, and I will explain it to them" (P4, Lesson Plan). In contrast, the in-course and postcourse data demonstrated a more interactive use of technology to facilitate student engagement in discussions. For example, P1 "used padlet [*sic*] for the discussion to ensure an active social interaction" (P1, Lesson Plan). P22 also emphasised the role of technology in managing larger class discussions:

> I like discussions… last year- So it was like 15 students; we discussed issues; it was much easier. But for now, I have 30 students in class… I cannot do it orally. So Padlet, helped me in a way that I could write instructions on Padlet, they can see on the board, on the projector on the projector, and then I can go around them and give each and every one of them a chance to answer and discuss it all together. (P22, Interview)

In addition, P11 designed a Voki-based activity where students work in pairs to record themselves discussing the lesson's theme (Figure 9). The instructions were: "Choose and create a character, and then answer the question: How can we protect the Amazing Amazon. You can add any visual aids: pictures, videos, and etc [*sic*]. Present your Voki character in front of your classmates (P11, Lesson Plan and Activity).

Figure 9

Voki Avatar Presentation Sample (Design Activities)

Code 2: Give Lectures and Presentations. The precourse data revealed that participants primarily used technology for lecturing or giving presentations. There was a prevalent use of PowerPoint for presenting and explaining grammatical structures, vocabulary, images, text excerpts, and instructions. For instance, P13 described: "The teacher presents the new vocabulary through a PowerPoint presentation with pictures" (P13, Lesson Plan). However, this traditional approach was largely replaced by more interactive and student-centred methods in the in-course and post-course phases.

Code 3: Homework assignment. In-course and post-course data revealed a shift towards technology-enhanced homework assignments. Participants incorporated online tools in homework assignments to foster student engagement and collaboration. For example, P4 assigned a blogging activity that encouraged peer interaction: "after they finish, they will share their stories on their blogs… Later on, as a homework I will ask them to see each other's stories and to comment on each other's blogs" (P4, Lesson Plan).

Code 4: Modelling. In the in-course and postcourse data, participants employed teacher modelling as a pedagogical teaching method. This involved demonstrating the use of technology tools to guide students through tasks. P18, for instance, provided a sample blog post as a model for students (Figure 10): "The teacher shows the students her own blog with

the example of writing the letter to earth" (P18, Blog). Similarly, P4 modelled the use of Timeline Knight Lab by creating a sample timeline (Figure 11): "to guarantee that my students got the idea, I will show them an example of an already summarized paragraph on Timeline Knight Lab" (P4, Lesson Plan).

Figure 10

P18 Blog Letter Writing Model

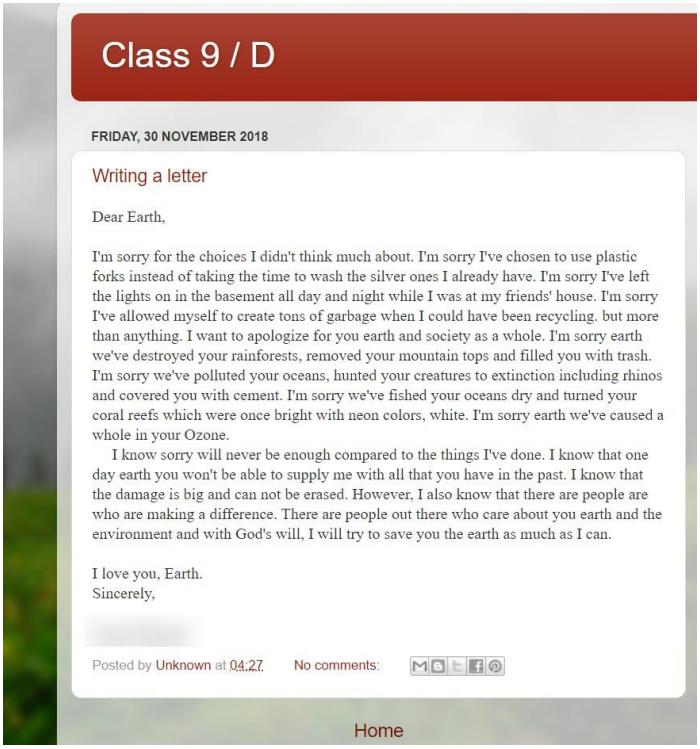
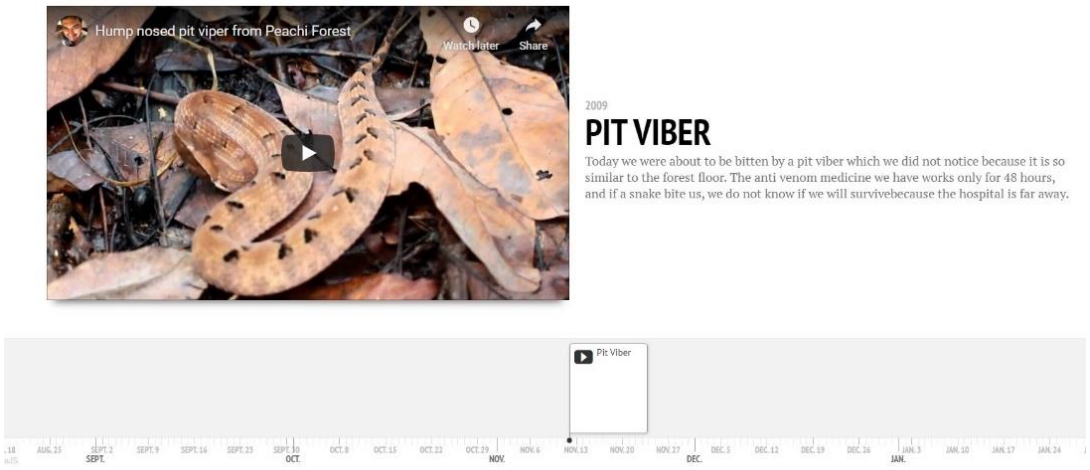


Figure 11

P4 Sample Timeline Modelling



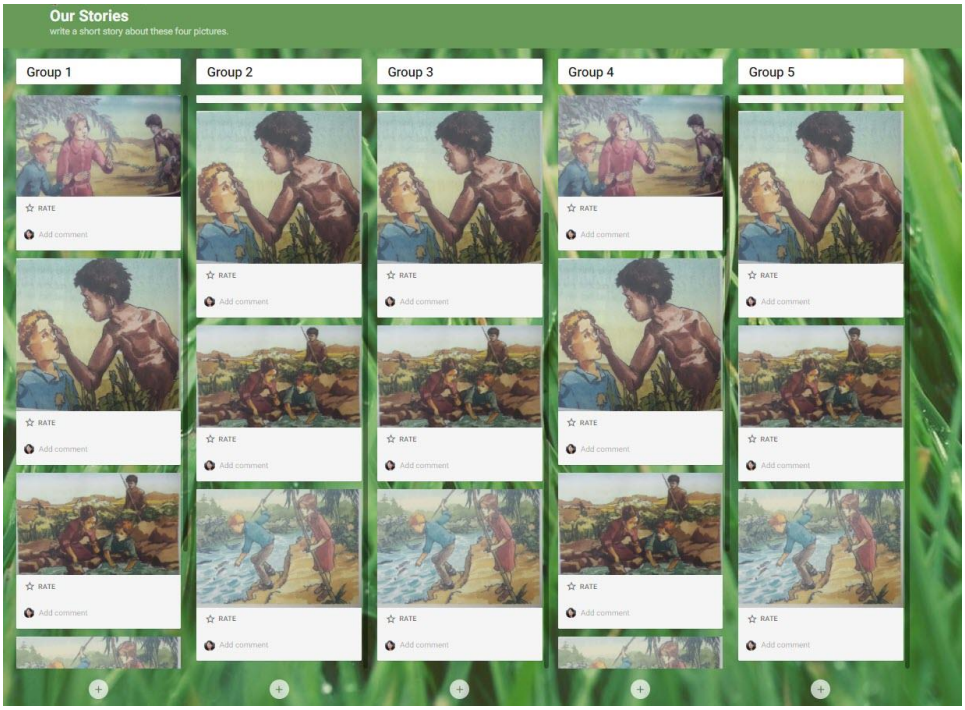
Code 5: Collaborative Activities. The study showed that participants utilised technology to facilitate collaboration, specifically in writing activities, project-based learning, digital products, and developing English language skills.

Collaborative Writing. Participants incorporated technology to facilitate collaborative writing tasks. For example, P9 designed a Padlet-based collaborative. Students were divided into groups consisting of four members, each responsible for creating a story by writing paragraphs based on images posted on Padlet. Before writing, students discussed the images to ensure a coherent sequence:

> The teacher asks the students to sit in groups of 4. After arranging the groups, the teacher gives each group a number…The teacher writes on the board the link for the writing activity on Padlet (Figure 12) and explains that each student in each group is responsible for writing a short paragraph about the picture he/she got under the shelf of each group. but before starting to write, the group should sit and discuss the pictures together in order to build a coherent sequence that is related to each picture. (P9, Lesson Plan)

Figure 12

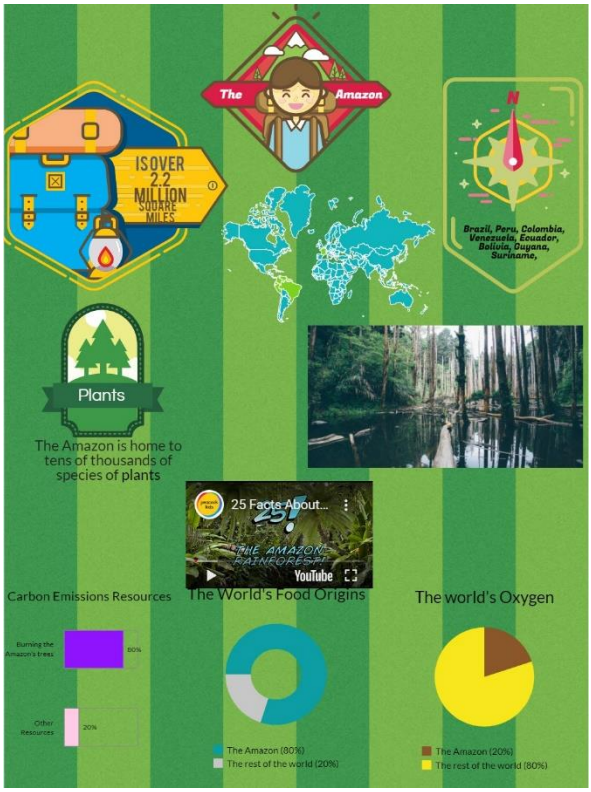
P9 Padlet Collaborative Writing Activity (Design Activity and Lesson Plan)



Project-Based Learning. Participants employed technology to engage students in Project-Based Learning, a collaborative instructional approach, fostering independent knowledge construction and content discovery. For instance, P9 guided students in creating infographics (Figure 13) summarising a unit from their coursebook, students were "asked to make an Infographic about the unit. They can talk about Ed's blog, the poem, the Amazon or about the whole unit… to present it in front of the class" (P9, Lesson Plan).

Figure 13

Sample Project-Based Learning Presentation (Design Activity and Lesson Plan)



Collaborative Digital Products. Participants engaged students in creating digital products through collaboration. P14, for example, tasked learners with creating digital biographies using tools like Timeline and Blogger.com. Working in pairs, students conducted research, presented their findings to the class, and received online peer feedback:

> I was working on the Presentation Domain, I used both; [*sic*] Timeline and Blogger.com… to create a biography about an inspiring character, to present it in front of the class and to share it later on, on their own blogs. They were asked to gather interesting information, photos, videos and anything they found relevant about inspiring characters that were given by me (the teacher) and to create a biography. The work was in pairs…and each one of them will present his/her part. After they are done with the presentations [*sic*] they were supposed to share it on blog and to

comment on their favorite presentations expressing their opinions and thoughts. (P14, Application Report)

Collaborative Language Building. Participants utilised technology to facilitate collaborative language learning. For example, P12 designed a group activity where students searched for vocabulary on websites and compiled their findings on a shared Google Presentation (Figure 14) including "a translation, definitions, two sentences: one from the website and one describing the picture, rhyme, synonyms" (P12, Lesson Plan).

Figure 14

P12 Activity (Design Activity & Microteaching)

In addition, participants designed collaborative activities that integrated technology to foster both speaking skills and peer assessment. For example, P5's lesson involved 8th-grade students in a collaborative VoiceThread activity following a comprehension text about world festivals. Transforming an originally oral task into a digital format, students engaged in peer feedback, speaking practice, and content creation. They recorded conversations about a festival, answered questions, and added visuals, before sharing and commenting on each other's work: "answer the questions of the tasks, and add pictures. afterwards, students have to share their VoiceThread with their classmates. each student has to comment on one of his classmates' VoiceThread" (P5, Lesson Plan and Activity).

Code 6: Assessment. During the course, participants integrated technology into both peer and summative assessment practices.

Peer Assessment. Participants employed technology to facilitate peer assessment, allowing students to provide feedback and receive constructive criticism based on rubrics. For example, P2 incorporated peer assessment into an essay writing task, requiring students to evaluate each other's work using a rubric and provide written feedback:

> I will attach a rubric in the blog in [*sic*] which they need to use to evaluate their peers and give a grade accordingly. I will comment on their blogs (the essay itself), in addition I will comment on their evaluations. (P2, Lesson Plan)

Similarly, P16 engaged students in writing a post-reading essay on friendship, a follow-up activity for a unit from the coursebook. Students were instructed to upload their essays to VoiceThread, where their peers could provide oral comments. The lesson plan excerpt explains:

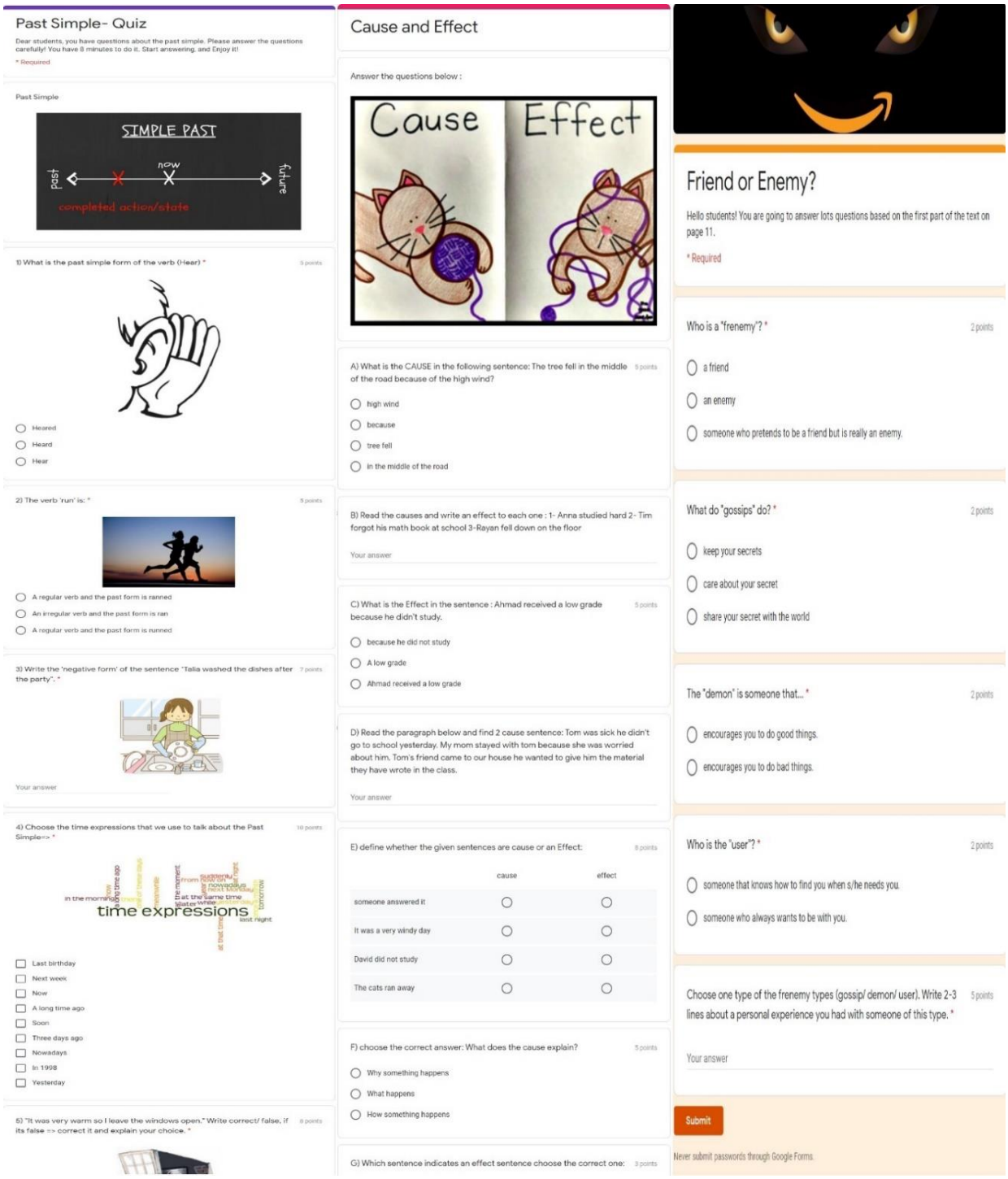
> I ask the students to read two of their classmates' essay [*sic*] and comment on them by recording themselves. (If there was no [*sic*] enough time I will let the students read 2 of their classmates' essays, and to think of the comments they want to give by writing some notes and then to record themselves at home). (P16, Lesson Plan)

Summative Assessment. Participants created various technology-based assessments to evaluate student learning. They created online quizzes and tests to assess students' learning, covering grammar, higher-order thinking skills, literary texts, vocabulary comprehension, reading comprehension, and written proficiency. For example, P21 "created a quiz on Google forms about past simple" (P21, Blog), P16 "made a quiz about cause and effect" (P16, Blog) after teaching it as part of a literary text, and P2 created a quiz including "lots questions based

on the first part of the text on page 11" (P2, Activity) to check for basic comprehension of a text. These quizzes are illustrated in Figure 15.

Figure 15

Sample Assessment Forms Created by P21, P16 and P2



Sub-theme 2: Developing Students' English Language Skills

The data analysis resulted in the sub-theme *Developing Students' English Language*, revealing a clear progression in participants' use of technology to enhance students' English language proficiency from pre-course to post-course.

Code 1: Vocabulary. Vocabulary acquisition was considered an important aspect of language learning by the participants. Participants demonstrated a significant evolution in vocabulary teaching methodologies from pre-course to post-course. Before the course, participants used technology in a traditional and teacher-centred method, such as PowerPoint presentations, to teach vocabulary. For example, P8 integrated technology into vocabulary instruction by utilising a PowerPoint presentation (Figure 17).

Figure 16

PowerPoint for Technology Integration in the Precourse Vocabulary Instruction

After taking the course, the participants demonstrated a clear shift towards more learner-centred and technology-rich approaches to vocabulary instruction. Participants began using technology more innovatively to teach vocabulary, incorporating writing activities and vocabulary practice and retention.

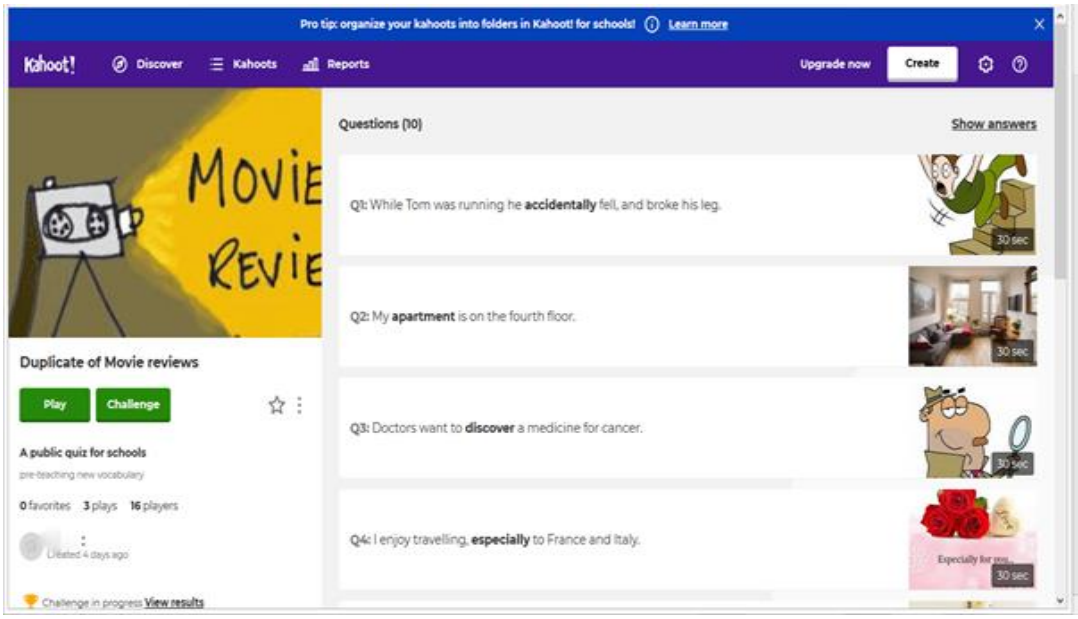
Writing. Participants incorporated writing activities to reinforce vocabulary learning. For example, P7 utilised a travel blog on Tumblr for vocabulary practice: "write at least three

entries of a travel blog using Tumblr… Use at least five New Words from page 11" (P7, Activity).

Practice and Retention. Participants employed online quizzes and games to enhance vocabulary acquisition. P24 utilised Socrative for individualised vocabulary practice: "Teacher introduces Socrative website… Students practice the use and the meanings of the vocabulary individually by Socrative quiz" (P24, lesson plan). P3 incorporated Kahoot for a gamified vocabulary learning experience: "In Kahoot (Figure 18), students were provided with simple sentences, with a highlighted word which they had to guess its meaning from the context, a picture was also provided to make it easier" (P3, Application Report).

Figure 17

P3 Kahoot Vocabulary Practice in Macroteaching Application Report



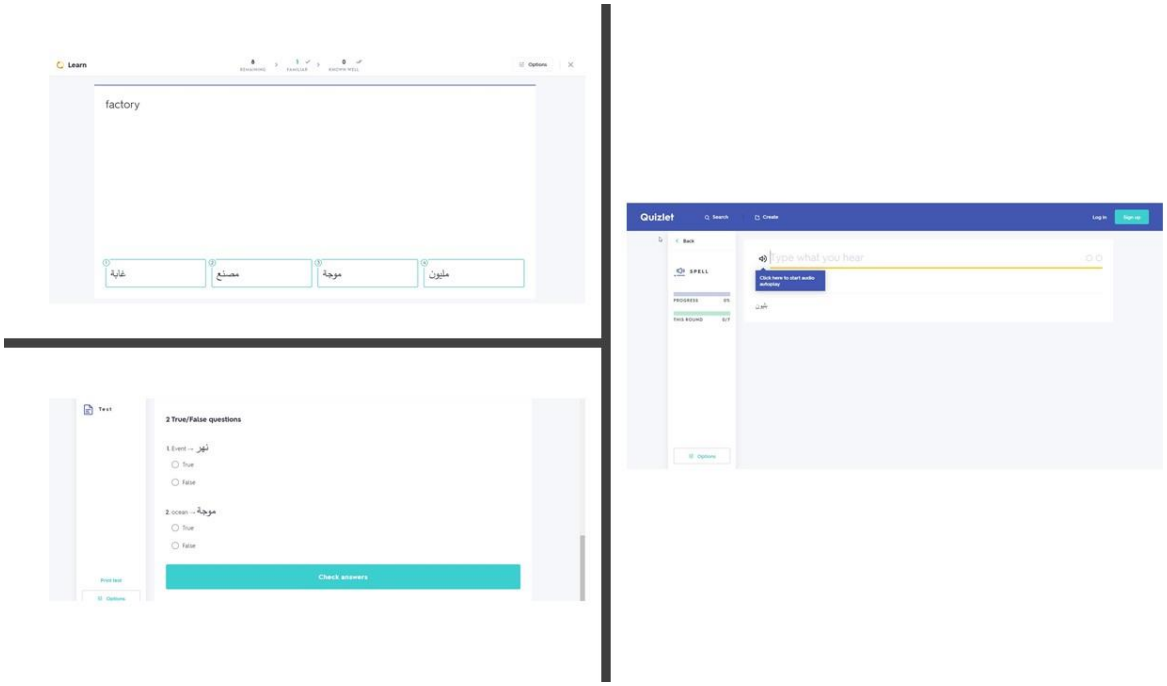
Moreover, P14 used Quizlet (Figure 19) to promote vocabulary practice and retention:

> The teacher will ask each and every one of the students to do (learn-write-spell) for all words by his own... In this way the students will practice the spelling as will [*sic*] as the sounds and pronunciation of the words, and if they did it incorrectly the website

will correct him/her so they can do [*sic*] how it is correctly written or spoken… the teacher will ask them to go over the test, and the one who is getting [*sic*] the highest grade in less time will have 1 point to his final grade. (P14, Lesson Plan)

Figure 18

P14 Quizlet Activities (Design Activity & Lesson Plan)



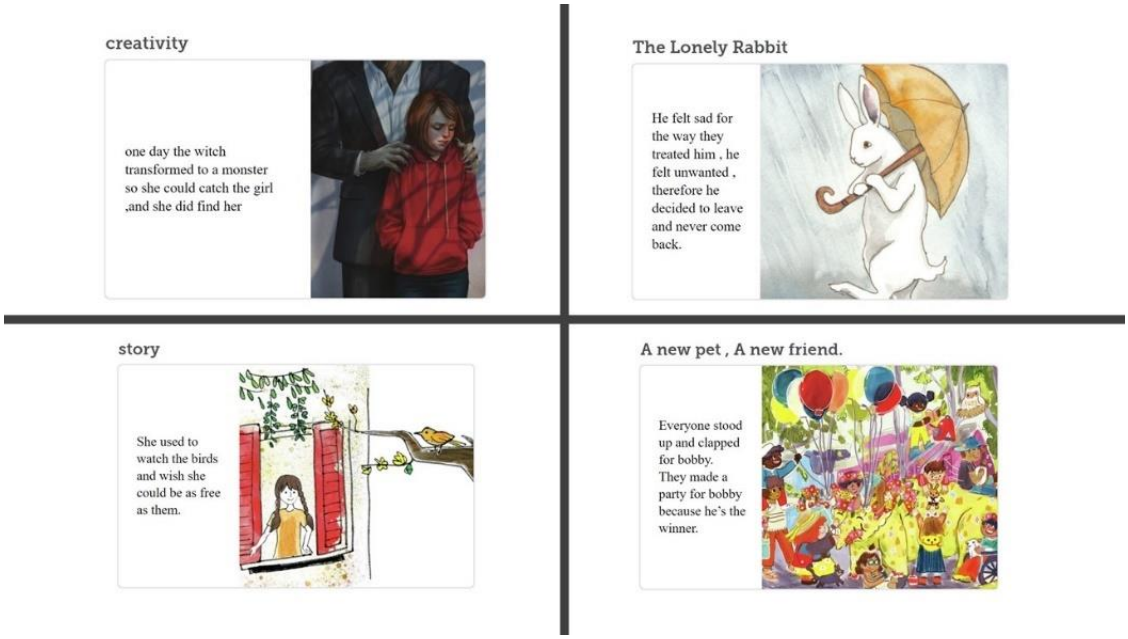
Code 2: Grammar. The data revealed a significant shift in how participants developed their students' English grammar skills before and after the course. Before the course, grammar instruction was traditional, focusing on explicit rule teaching and practice drills. For instance, P1's technology-integration lesson involved students underlining verbs in song, learning future tense rules from the board, and filling "in the blanks in a worksheet where they have to use the future from [*sic*] correctly" (P1, Lesson Plan).

In contrast, the design activities in the course introduced more interactive, technology-driven methods for grammar learning, such as digital storytelling, grammar reviews, and assessment.

Digital Storytelling. Participants utilised digital tools to embed grammar practice within meaningful writing and comprehension tasks. For example, P11 utilised a digital storytelling website (Storybird) for an integrated grammar and writing activity (Figure 21), where students were tasked with creating a picture book and writing their own story, using the past simple tense, one sentence for each picture, and incorporating as many connectors as possible (P11, Lesson Plan).

Figure 19

Stories Created for Practising Past Simple on Storybird During Microteaching



Gamified Grammar Review. Participants incorporated technology through game-based learning into grammar instruction. For instance, P7 utilised Kahoot for a competitive grammar review session: "The students' role was first to access Kahoot.it by entering the pin game and their names, and then answer multiple choice questions about comparative adjectives. They had kind of a competition" (P7, Application Report).

Formative Assessment. Participants used technology to conduct formative assessments, providing immediate feedback to students and informing instruction. For

example, P20 employed Socrative for a formative assessment of past perfect tense, enabling teachers to identify student misconceptions and adjust instruction accordingly:

> I used the Socrative tool as a review for the grammar lesson; Past perfect. I wanted to check students [*sic*] understanding of the topic…Socrative included different questions and sentence completion questions…This tool eased and provided me with the information about who misunderstood the tense and what unclear past perfect rules the students didn't understand. (P20, Application Report)

Code 3: Speaking. The data analysis has shown significant changes in the way the participants developed their students' English-speaking skills. Pre-course speaking activities were predominantly teacher-centred, with limited opportunities for student interaction and output. For example, P17's students practice speaking with technology by describing online images "showing various people engaged in different activities and invit[ing students] to compose their own description. (They do it orally)" (P17, Lesson Plan).

The in-course and postcourse data showed fundamental changes in the way English language learners developed their speaking skills through technology. The participants devised speaking practice activities that employed technology for student-centred activities, such as oral peer-assessment, online character development avatars, and responses to literary texts.

Oral Peer Assessment. Participants utilised technology to facilitate peer assessment and feedback, enhancing students' speaking and critical thinking skills. P16, for example, used Voicethread to engage the students in oral peer assessment: "to read two of their classmates' essays and comment on them by recording themselves" (P16, Lesson Plan).

Character Development Avatars. Participants employed online avatars for speaking practice. For instance, P2 used Voki to develop speaking skills related to the coursebook:

> I took students to the computer lab, taught them how to use the website Voki, since I was focusing on developing their speaking abilities. I asked the students to create their own characters… I asked them to record… and present it in front of the class. (P2, Application Report)

For homework, they were asked to create an avatar based on their favourite hero from their book unit and share it through Google Plus (P2, Application Report). P2 observed high student engagement, noting that even absent students completed the task with help from peers: "Surprisingly, most of the students did the homework willingly" (P2, Application Report).

Speaking about Literature. Participants integrated technology to enhance students' ability to engage in critical discussions about literature. P18 used Voicethread for a critical reading and speaking activity (Figure 22):

> Voice thread can enhance the students [*sic*] speaking skill... I applied this tool by copying a video from youtube [*sic*] which is a bibliography about Arthur Miller the writer of "All My Sons", and I asked the students…to read about the author and his life and [The] American Dream and to record themselves responding to the task. (P18, Blog)

Figure 20

Using Voicethread for Speaking Practice

Code 4: Writing. The study revealed a significant shift in how participants approached writing instruction, transitioning from traditional pen-and-paper tasks to technology-integrated activities that fostered creativity, collaboration, and critical thinking. Before the course, technology was used as a presentation tool prior to writing tasks. For example, P5 asked students to "open their notebooks and write a small paragraph about the most season they like and why" (P5, Lesson Plan). P6 asked the students "to write wishing cards for their Moms" (P6, Lesson Plan) after using PowerPoint to present information about Mother's Day.

Post-course, participants integrated ICT tools to enhance writing practice, incorporating elements such as essay writing, peer assessment, and digital storytelling.

Essays and Peer Assessment. Participants incorporated technology to support essay writing and peer assessment. For instance, P9 designed an activity where students not only wrote about thematic connections but also assessed peers using a rubric:

> Now we are going to use an application called Padlet, in which you are asked to write a short essay of [*sic*] how the text 'Earth Day' is connected to the song 'Whose garden was this'...When done with the writing, students assess their classmates [*sic*] work, by adding a comment which includes an approximate grade according to a rubric. (P9, Lesson Plan)

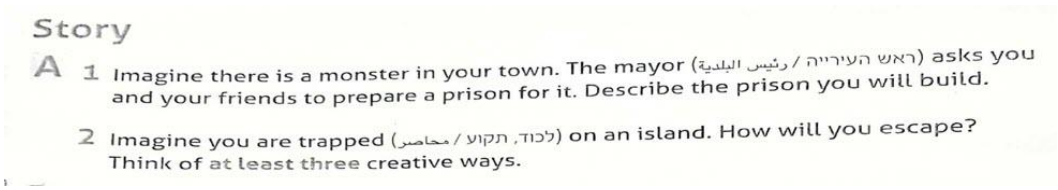
Similarly, P21 engaged students in writing on an online tool called WriteAbout, fostering peer interaction through reading and assessing their peers' posts: "read other's [*sic*] posts and comment/correct things. In this way students can engage and share things together" (P21, Lesson Plan).

Storytelling. Participants transformed traditional writing tasks into digital storytelling projects. For example, P4's lesson plan demonstrated a digital story activity for answering a prompt from the school coursebook. However, what is interesting is that P4 transforms the instructions from the book (Figure 23), which were based on an oral discussion, into a collaborative writing and digital storytelling activity followed by an oral presentation:

> I will show the students a question which is taken from the book…I will divide them into groups of two, then I will ask each pair to write the answer of [*sic*] the question and to compose their own scenario using Storybird… Students will present their ideas by using the Storybird website to make visual stories. (P4, Lesson Plan)

Figure 21

Instructions from the Course Book Transformed in Design Activity & Lesson Plan


Story

A 1 Imagine there is a monster in your town. The mayor (ראש העירייה / رئيس البلدية) asks you and your friends to prepare a prison for it. Describe the prison you will build.

2 Imagine you are trapped (לכוד, תקוע / محاصر) on an island. How will you escape? Think of at least three creative ways.

Code 5: Reading. The use of technology in developing reading proficiency was an area where notable differences were found. Before the course, participants used traditional reading methods, including read-aloud sessions and silent reading after listening to the digital books. For example, P1 described a lesson where the "teacher reads the first paragraph aloud with the class and asks them a few comprehension questions frontally" (P1, Lesson Plan). P13's lesson included [*sic*] vocabulary presentation followed by reading "they [students] start reading the text and at each paragraph the teacher asks them for a word meaning and a question about the paragraph" (P13, Lesson Plan).

In contrast, the in-course and postcourse data showed a significant shift in the participants' instructional activities for teaching reading. They designed activities to enhance reading comprehension, including prediction activities, text analysis, text extension, extensive reading, critical reading, and peer assessment.

Prediction Activities. Participants designed pre-reading prediction activities with ICT tools to engage students in critical thinking. For example, P24 used Padlet for a prediction activity: "Look at the pictures and describe what you see. What do you think our lesson will be about?... Connect the picture to one of the characters and relate it to the myth" (P24, Activity).

Text Analysis Activities. To enhance analytical skills, participants designed activities that encouraged students to construct meaning from texts. For example, P19's activity involved students using "Padlet to show their understanding of the text" (P19, Lesson Plan & Activity) by creating individual boards with posts, including pictures, videos, and sentences that correspond to the text.

Extension Activities. Participants utilised ICT tools for reading comprehension to extend meaning through artefact creation. For instance, P7 assigned a creative writing task

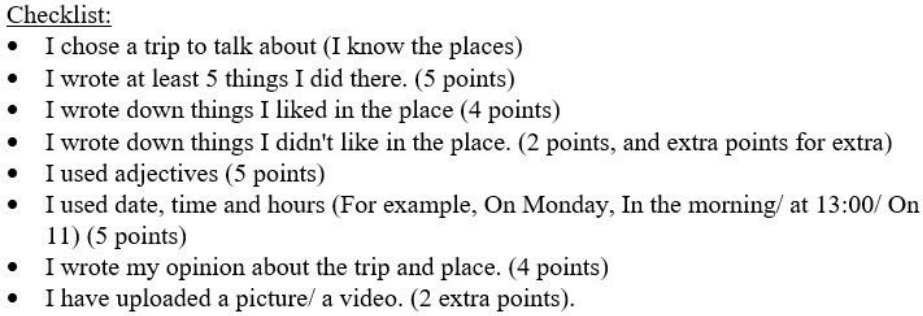
related to a reading text, encouraging students to imagine themselves as a famous explorer: "Imagine that you are Ed Stafford, and write a story using Blogger (of 5-6 pages) about one of your adventures" (P7, Activity).

Extensive Reading. Participants created extensive reading opportunities with technology, encouraging students to engage with longer texts and develop a love for reading. P18, for example, designed a book report activity on Padlet for extensive reading, encouraging students to read novels and submit book reports: "I chose the theme of Book Club, to encourage the students to start reading. I picked several novels and I wanted each student to choose a book and to read it and submit a book report" (P18, Blog).

Critical Reading and Peer Assessment. The participants integrated technology to foster critical reading and peer assessment. P21's lesson required students to write blog posts based on a reading comprehension text and provide feedback to peers: "read one or two other blogs and write a comment on it. In their comments they should write down if their classmate has missed things from the checklist (Figure 24)" (P21, Lesson Plan), a process that requires critical reading and understanding.

Figure 22

Peer Assessment Checklist



Checklist:

- I chose a trip to talk about (I know the places)
- I wrote at least 5 things I did there. (5 points)
- I wrote down things I liked in the place (4 points)
- I wrote down things I didn't like in the place. (2 points, and extra points for extra)
- I used adjectives (5 points)
- I used date, time and hours (For example, On Monday, In the morning/ at 13:00/ On 11) (5 points)
- I wrote my opinion about the trip and place. (4 points)
- I have uploaded a picture/ a video. (2 extra points).

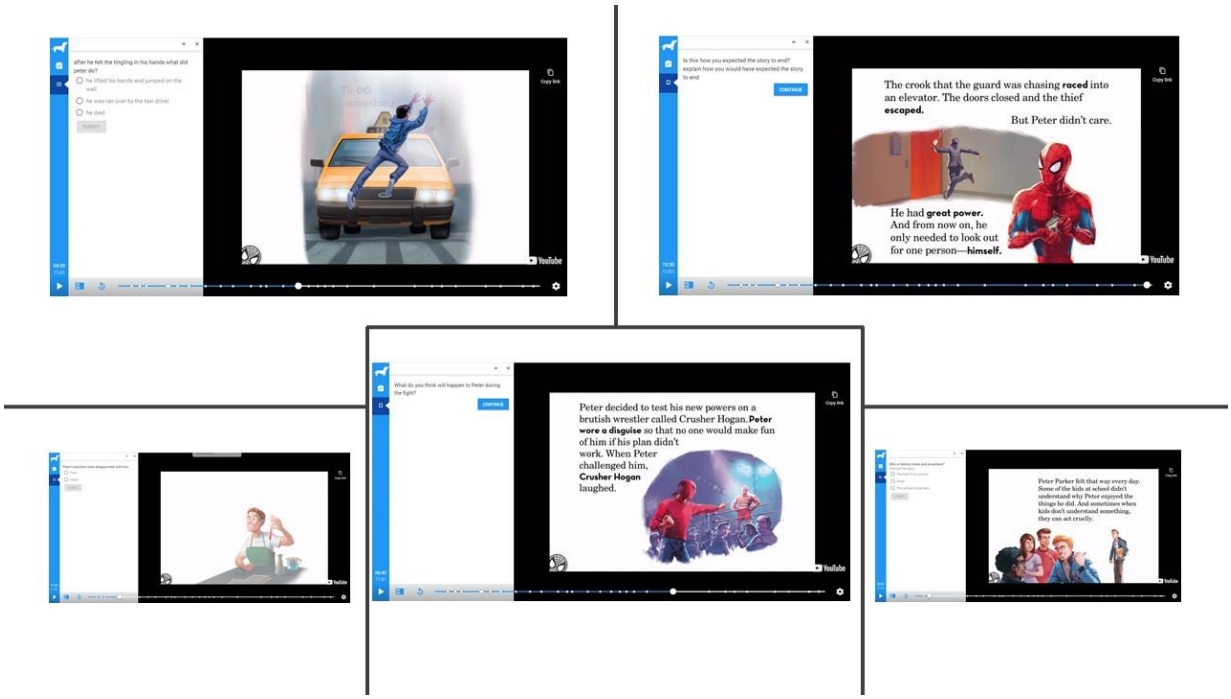
Code 6: Listening. Technology integration transformed listening comprehension instruction. Before the course, the participants' students practised listening comprehension by listening to an audio recording of a text using a digital book or a CD player, followed by

comprehension questions from the textbook. This is illustrated by P22 who "let [*sic*] the digital book read it- work for the students in order for them to hear the [pause]…pronunciation" (P22, Interview). In addition, when asked about how technology is used to teach the English language, P11 said: "For listening, for example, when we use the audio CD, when they hear on the computer how they read, so they will listen and then they will hear different accents" (P11, Interview).

In contrast, after completing the course, participants incorporated new technology-enhanced activities to develop listening comprehension skills. These activities included interactive video tasks and the use of digital tools for comprehension checks. P3's lesson plan illustrates this: "Today we are going to be listening to a story of a different superhero, and we will be answering different questions while watching and listening to the story using a tool called PlayPosit (Figure 25)" (P3, Lesson Plan).

Figure 23

P3 Listening Practice Activity in Lesson Plan Using PlayPosit



Code 7: English Literature. The study revealed a significant shift in how participants approached literature instruction, with technology integration emerging as a key component post-course, even though it was a curriculum requirement. The in-course and postcourse data showed that the participants utilised technology tools to engage their students in analysing literary works such as short stories and poems and delivering formative and summative assessments.

Literary Analysis. Participants utilised technology to support in-depth literary analysis. This is illustrated by P1 who, using Padlet, "created a shelf on the poem The Road Not Taken, focusing on the figures of speech, the shelf allows students to add figures of speech, their definition as well as where these figures of speech appear in the poem" (P1, Blog). In addition, P4 engaged students in a post-reading task about a literary piece using Storybird, a digital storytelling tool, that students use to "predict a different ending of the story" (P4, Application Report).

Assessment. To enhance the assessment process of literature instruction, participants incorporated technology tools. P18, for example, used Socrative to create a quiz for assessing students' understanding of the short story "The Enemy" making the assessment process more engaging and interactive.:

> I did a quiz using Socrative I Took [*sic*] the story "The Enemy" which is taught for 5 pointers and created a quiz using Socdrative in order for me as a teacher to check the student's answers and have a full assessment, and it can be fun and the students find it more interesting rather than paper and pencils which is the traditional way. (P18, Blog)

Summary

The purpose of this chapter was to present the results pertaining to the way in which a TPACK-based course affects preservice teachers' TPACK development. More specifically, this chapter presented the data analysis with an emphasis on research question one and the findings related to the TPACK development of preservice English teachers. The chapter highlighted three key themes: *Design Activities, Experiences in Technology-Enhanced Teaching,* and *Integrating Technology to Support Pedagogical Practices in English Language Instruction*. These themes were explored in relation to how preservice English teachers' TPACK develops through design activities, microteaching and macroteaching, and technology integration into pedagogical practices. The findings indicate that the course facilitated significant growth in participants' ability to align technology with curriculum goals and enhance language teaching.

Chapter Five: Findings on Perceptions and Attitudes Towards Technology Integration

Introduction

This chapter presents the findings related to research questions two and three (RQ2 and RQ3), focusing on the perceptions and attitudes of participants toward technology integration and the impact of the TPACK-based course on these perceptions. A vignette is employed to illustrate the evolution of these perspectives throughout the study. This vignette provides a detailed account that highlights changes in attitudes and perceptions over time in the course, adding depth to the thematic findings. Following the vignette, two key themes are explored: Perceptions and Attitudes Towards Technology Integration (Theme 4), which addresses research question two (RQ2) regarding how participants' views on technology in teaching were shaped by the course, and Perceived Value of the Course (Theme 5), which addresses research question three (RQ3) by examining how the course impacted participants' conceptions of learning and teaching with technology. Table 13 summarises the themes relevant to research questions two and three, outlining their respective sub-themes.

Table 13
Themes and Sub-Themes Arrangement According to Research Questions Two and Three

Research Question	Themes	Sub-themes
RQ2: To what extent are the perceptions and attitudes of preservice teachers towards the integration of technology into English Language Teaching influenced by the TPACK-based course?	Theme 4: Perceptions and attitudes Integration of Technology into Teaching	1) Prior experience with learning 2) Readiness for teaching with technology 3) Affordances of technology integration 4) Constraints of technology integration
RQ3: How does the course impact the conceptions of preservice teachers of learning and teaching with technology?	Theme 5: Perceived Value of the Course	1) Impact on English Language Learners 2) Impact on the Preservice Teachers 3) Value of the Course Design

Vignette

This vignette presents the case of P13, illustrating how their perceptions and attitudes towards technology integration evolved during the course. It serves as an example to highlight key aspects of the data, reflecting RQ2 and RQ3, and illustrates the shift in P13's perceptions and experiences from before, during, and after the course, showing how their technological proficiency, approach to teaching, and student engagement evolved.

Before the course, P13 struggled with limited technological proficiency and recognised the need for better preparation in technology integration. P13 had limited technological proficiency, relying mainly on PowerPoint presentations. They acknowledged the need for more engaging tools but felt constrained by their lack of knowledge, stating, "my knowledge in technology is not… I'm not good at it so much…I just- I use PowerPoint, but I felt like [it] is not enough…I just stick to the PowerPoint with pictures and videos" (P13, Interview). In addition, P13 recognised technology's role in learning, discussing how both their prior learning experience with technology and role models impacted their readiness for teaching during the practicum:

> I had a course with … [lecturer name], [gender] doesn't know this much as [*sic*] technology, just used to read… when I start practice teaching… I start without technology. It was like a disaster… I gave them a worksheet, we read the text…they didn't understand what the text is, they just [*sic*] reading. (P13, Interview)

Furthermore, P13 acknowledged their lack of knowledge in technology integration and expressed a desire for courses focused on technology integration, stating, "I need a course to teach me how to use these things... I just know PowerPoint" (P13, Interview).

The course transformed P13's technological proficiency and approach to teaching by equipping them with new skills and tools. P13 reflected on their technological readiness,

stating, “being able to handle using technology in class improved my performance in class…because I was exposed to these kind [*sic*] of helpful, and creative tools from this course” (P13, Blog). Collaborative design activities were particularly impactful, allowing participants to engage in planning and designing classroom instructional material, as P13 noted, “we all enjoyed every tool, designing and creating.... and also presenting …we don’t always get the chance to present our ideas” (P13, Interview). This experience helped P13 move beyond reliance on PowerPoint to using more engaging methods, stating, “at first, I wasn’t using technology so much like just PowerPoint…but now I can use it in many different ways … in a more appealing way” (P13, interview).

The course also encouraged curriculum integration, as P13 explained, “I have set goals in my lesson plans where student achievements are met through the integration of technology… I intend to use more technology in my class” (P13, Interview). They observed a positive impact on student engagement, stating, “integrating technology made a huge change and difference in my lesson, mainly it introduced students to new simple, easy, smart tools which enhance and foster their thinking skills, and engage them more, to interact effectively” (P13, Application Report). Despite constraints like limited resources, P13 “used timeline, playposit, quizlet, and padlet, for different purposes like teaching vocabulary, answering LOTS questions, and communication and sharing ideas” (P13, Application Report), noting how technology can “stimulate students to use their thinking skills” (P13, Application Report).

In addition, the course had an impact on P13’s career aspirations and teaching confidence, particularly in developing technology integration. They mentioned that their first objective as a future teacher would be to “create a class blog” (P13, Interview) to encourage collaboration among students. They also noted their growing confidence in using technology,

stating, “you see how confident and how I feel like more comfortable, like I have these tools, I can do whatever it takes” (P13, interview).

Furthermore, the course design also played a crucial role in P13’s development. They highlighted the value of peer learning, ICT tools, design activities, micro- and macroteaching, and reflective practices, sharing that these enhanced their learning experience:

> We all enjoyed every tool, designing and creating, which is easier for us. And also presenting … we we tried to use these tools in class. And then I started to use it at practice teaching. So it was much easier …these reflections about each one of us made it really easier. And I feel more comfortable and independent. I can do this. (P13, Interview)

In conclusion, P13’s experience in the course illustrates a transformation in their attitudes towards technology integration and highlights the perceived value of the course in enhancing both their teaching practices and their students’ learning experiences.

Theme 4: Perceptions and Attitudes Towards Integration of Technology into Teaching

This theme explores the preservice teachers’ perceptions and attitudes regarding the integration of technology into English Language Teaching. It directly addresses research question two (RQ2): *To what extent are the perceptions and attitudes of preservice teachers towards the integration of technology into English Language Teaching influenced by the TPACK-based course?* The analysis yielded four sub-themes detailing participants’ views on technology use in teaching, as outlined in Table 14.

Table 14
Theme 4: Perceptions and Attitudes Towards Integration of Technology into Teaching English with Sub-Themes and Codes

Theme/ category	Sub-theme	Codes precourse	Codes in-course & postcourse
Attitudes and perceptions towards	Recognition of the Importance of	Impact of Prior Learning Experience	Impact of Prior Learning Experience

Theme/ category	Sub-theme	Codes precourse	Codes in-course & postcourse
integration of technology into teaching English	Technology in Learning		
		Role Models as a Motivator for Technology Integration	-
	Readiness for teaching with technology	Technological Readiness	Technological Readiness
		Need for courses	-
		New methods	New methods
		Readiness for Curriculum Integration of Technology	Readiness for Curriculum Integration of Technology
		Technology acceptance	Technology acceptance
	Affordances of technology integration	Change in pedagogies	Change in pedagogies
		Increase in productivity	Increase in productivity
		Technology Enhances Students' Learning	Technology Enhances Students' Learning
	Constraints of technology integration	Availability of Resources	Availability of Resources

Sub-theme 1: Recognition of the Importance of Technology in Learning

The first sub-theme, *Recognition of the Importance of Technology in Learning*, highlights participants' experiences with technology and their acknowledgement of its significance in teaching and learning. Participants frequently referenced their experiences as students and their role models as influential factors in shaping their attitudes towards technology.

Code 1: Impact of Prior Learning Experience. Participants emphasised the influence of their previous learning experiences on their current teaching approaches. They expressed a desire to differentiate their teaching methods from traditional practices by

incorporating technology. For instance, P22 described the negative impact of their technology-limited high school experience on their learning, which influenced their current views on technology integration:

> We should like drop the traditional away… it didn't actually benefit me as a student, because I remember in high school, they wrote things on the board; I didn't understand, I just copied them. So, it was actually difficult… the whole world is developing so we can't count on the traditional way. (P22, Interview)

Following the course, P22 expressed regret about not having access to such tools earlier, stating: "I wish I had this in my school. Because it would have changed me a lot, it would have changed my personality, it would have changed the way I write" and describes the transformation in the course, stating: "I've always used the traditional way but after taking this course I've learned that the web is filled with activities and sites that can turn the equation of teaching process with the help of technology" (P22, Interview). Similarly, P3 reflected on the difference between their past experience as a student and their experiences in the course:

> During the course every time i [*sic*] came across a new tool i [*sic*] was surprised all over again, and i [*sic*] think that is because of my experience as a student in school, back when i [*sic*] was in school teachers never introduced students to such great ways of teaching, which would have made the lessons much more successful. (P3, Blog)

Code 2: Role Models as a Motivator for Technology Integration. The participants viewed their teacher educators as role models who could either motivate or demotivate them to use technology in their teaching practices. Interestingly, many participants described how lecturers who avoided technology negatively impacted their learning, while those who integrated technology inspired their interest. The first view is illustrated in the interview

excerpt by P22 describing a lecturer who "doesn't use technology, [lecturer] actually only writes on the board. So basically, I don't understand anything from the lecture" (P22, Interview). P1 shared a similar experience and the effect it had on their learning experience:

> And for other lecturers who used the language, sorry, the technology less, it was quite, to be honest, it wasn't engaging. I would go, I usually sit in the front, but in some lessons, because too boring and frontal and no engagement, no discussion, no technology. (P1, Interview)

In contrast, participants expressed positive views of educators who effectively integrated technology:

> I think the most times [*sic*] I saw the use of technology is with you. In your lectures. I have never seen anyone use technology this much, and that's when I got interested. I thought the lessons get much more fun and become successful if you use technology because you have applied it, and we have seen it. (P3, Interview)

Sub-theme 2: Readiness for Teaching with Technology

Participants discussed their *Readiness for Teaching with Technology* in teaching English, focusing on *Technological Readiness, Need for Courses, New Methods, Readiness for Combining Technology with the Curriculum* and *Technology Acceptance*

Code 1: Technological Readiness. Prior to the course, participants expressed concerns about their limited technological skills beyond the use of PowerPoint for presentation purposes. Talking about this issue before the course, one participant said:

> I need to be more aware of how to use it. For example, I learned PowerPoint when I was in elementary school and that's it. I don't know if there are things in PowerPoint that I can use that I don't know about. Or maybe there are programmes that I don't

> know, so I need to be more knowledgeable about technology and the tools of technology that I can use in education to be able to actually do something with it. (P1, Interview)

In contrast, during and after the course, participants reported improved technological skills and increased readiness to teach with technology. Commenting on their gained skills and readiness for technology integration, P13 stated: "I saw myself improve, I improved my technological skills. And I was able to pass these ideas and skills to my own students at practice teaching" (P13, Interview). Another participant, P12, described the transition from limited technological skills to readiness to teach with technology:

> After taking this course I realized that my knowledge of using and integrating technology in my lesson plan was very limited and basic. This course helped me think out side [*sic*] the box, now i [*sic*] would even try and look for new websites to help me use technology so i [*sic*] would get students [*sic*] interest. (P12, Blog)

Code 2: Need for Courses. Prior to the course, the participants emphasised a need for dedicated courses to prepare them for technology-integrated teaching. For example, P17 stated: "Actually, we need more courses in technology because we have a limited [*sic*] knowledge" (P17, Interview). Similarly, P22 emphasised: "I need the course you're giving and more courses like that, because I'm a third-year student. This is my second year of practice teaching. And this is the first course I think, with technology" (P22, Interview). P13 echoed this view, expressing a lack of technological knowledge beyond PowerPoint: "a course to teach me how to use these things, like I don't know. I just know PowerPoint" (P13, Interview). Interestingly, no requests for additional training were made throughout and after the course, indicating that the course fulfilled the participants' initial learning needs.

Code 3: New Methods. A common view amongst participants is that their readiness for teaching with technology is closely connected to knowledge of technology-related teaching methods. Prior to the course, the participants expressed their interest and readiness for integrating technology into their teaching practices but acknowledged a need for new methodological approaches. P1 stated: "That's the main thing, I think. I need to learn the ways, the methods, the applications of technology, so I don't just waste my students' time" (P1, Interview). P16 expressed a desire to learn new methods to engage students with technology beyond simple YouTube videos:

> Well, I expect to learn new methods of how to engage technology in the class, and how to use different applications that maybe I don't know about. And yes, I think that it's going to be a beneficial course because I don't think that I know how to use technology very much. I usually just go to YouTube and show the students a short movie. (P16, Interview)

During and after the course, the participants felt ready to teach with technology due to their gained knowledge about teaching methods for technology integration. Writing about this issue, one of the participants stated: "I noticed a big change after taking the course, my knowledge in teaching methods started to expand and my ability to access more areas in the educational filed began to develop" (P19, Blog). P20 emphasised the transformative impact of the course on their teaching repertoire: "This course changed the whole picture and made us different and special. We are now provided with new teaching techniques and different methods of teaching, that made and will make our lessons rich, understandable, enthusiastic and vital" (P20, Interview). The acquisition of new methods was linked to increased student engagement and motivation, as highlighted by P1:

> Through the tools and the methods we have learned throughout the course, I feel that I'll be able to bring my students closer to the language and make them more interested in learning it because this is actually a problem…because they tell you to the face that they hate English. So, I hope that if we implement technology with teaching English, we can have them have a more positive outlook at [*sic*] the language and learning it. (P1, Interview)

Code 4: Readiness for Curriculum Integration of Technology. Prior to the course, the participants expressed uncertainty about integrating technology into the English curriculum. Some participants questioned their abilities, while others demonstrated a limited understanding of curriculum requirements. For example, when questioned about technology integration with the curriculum, P14 stated: "Well I'm not really sure that I know. I don't want just [*sic*] to answer. If I'm not sure, I will not answer (P14, Interview). P18 related to the curriculum but focused on teacher-centred technology integration while showing uncertainty about other curriculum skills: "Presentation- when I did like a PowerPoint, they can see how- I can show them I did the slide and this thing. And they can do that at home when they have to present. Grammar, No idea" (P18, Interview). This contrasts with the curriculum's emphasis on student learning outcomes rather than teacher actions.

After taking the course, the participants felt ready to integrate technology with the English curriculum as they showed an awareness of how technology can be combined with the curriculum requirements. After completing the course, P9 expressed newfound clarity:

> Another thing that it showed me, how can I use or how, what is the correct way of using the curriculum, and specifically, the type erm, section that talks about technology and using it and how to like erm, relate this to my lesson plan. So, because

> most of the times [*sic*] I only saw it on [*sic*] the curriculum. And I didn't know actually how it was related to the [*sic*] teaching. But I see it now. (P9, Interview)

P3 noted how each tool supported curriculum domains:

> Well most of the tools, basically all of the tools support all of the domains. You can use different tools to support different domains. For instance, the domain of Appreciation of Literature we can use Storybird to- for writing. You can use Padlet also for writing, Voicethread for speaking. It's- all of the tools are actually right on the spot for all of the domains. (P3, Interview)

Code 5: Technology Acceptance. The data analysis revealed a connection between the participants' readiness to teach with technology and their acceptance of its integration. Before the course, the participants had mixed views about technology integration into teaching practices. A few participants expressed reservations, such as P23, who preferred traditional teaching methods:

> I need not use technology a lot it seems that students enjoy when they hear the teachers' voice and concentrate more. My plans for future lesson plans are using less technology, trying to activate them more, trying to give each student a chance to share his/ her answer. (P23, Interview)

Most participants, like P21, embraced technology as a valuable tool and expressed readiness to use it in their teaching practices:

> I think is an important thing to use technology as teachers, with students, especially with students today, because all students- all their lives are about technology, they use technology in everything… we have to use technology and and I did use technology last year. I like to use technology. (P21, Interview)

Post-course, a marked shift in technology acceptance was evident. All participants expressed a strong belief in the importance and necessity of integrating technology into teaching practices. This indicates a significant shift in technology acceptance. P17 highlighted the alignment of technology with students' interests: "it is very important to integrate technology these days, because we are dealing with this kind of pupils who are so in technology, so we need to follow what they are interested in" (P17, Interview). P12 echoed this view, emphasising technology's role in enhancing student engagement and learning:

> Technology [*sic*] very important to me. In the class, it's a must, I believe. Because without it first English is hard for them… some of them don't even like that language. So, it's going to be even harder. But when you provide something from their everyday use, it would be easier for them. (P12, Interview)

Sub-theme 3: Affordances of Technology Integration

The sub-theme *Affordances of Technology Integration* refers to the participants' beliefs regarding the affordances of integrating technology into teaching. This sub-theme explores these perceived affordances, focusing on *Change in Pedagogies, Increase in Productivity,* and *Student Change*.

Code 1: Change in Pedagogies. The data analysis has shown that participants believed that technology integration into teaching could lead to a change in pedagogies. This belief remained consistent throughout the pre-, in- and postcourse data. Participants believed that technology integration could transform teaching practices, especially bringing about changes in frontal teaching and traditional teaching methods. For example, one participant in the pre-course data stated: "Maybe the answer is in the technology, maybe also we can use it as a way to bring out their creativity that was buried because of all the typical and traditional" (P1, Interview). Similarly, P16 believed that technology could engage students, stating:

> I think that they will really help me as a future teacher to do my best and bring out the creativity of my students, not just teach a regular lesson where they need to write only and where it is focused only on input, not output. Here, the students will bring out their creativity and they will learn more. (P16, Interview)

The participants perceived traditional teaching pedagogies in a negative light compared to pedagogies that integrate technology. This is illustrated by P22 in the precourse interview: "I don't know students just enjoy technology. So, I think I'll use technology more than that. Because they hate the traditional way. With the traditional way, they don't concentrate" (P22, Interview). The same view was expressed by participants during and after the course. P11, for example, stated: "After using these tools I learned that the teacher can either make the lesson boring using traditional methods of teaching or to [*sic*] make it very interesting, in which students are motivated to participate in the lesson" (P11, Blog).

Code 2: Increase in Productivity. The data analysis has shown that participants believed technology integration was associated with an increase in productivity. This was attributed to easier teaching processes, increased speed, and reduced effort in teaching practices. The participants, across all data, reported integrating technology made teaching an easier task. This is illustrated in the precourse data by P23, who stated: "it is easier to transfer knowledge to the students, to explain, for them to see visually, it is easier than just explaining" (P23, Interview). Likewise, another participant explains, in the in-course and postcourse data, that increased productivity is associated with an easier teaching and learning process:

> Actually, it's made my lessons easier. The vocabulary activities, the writing activities, it's made it much easier than asking students to write on [*sic*] their notebooks and

> students also enjoy it. So, it made it more, it makes it easier for me in the lesson. (P21, Interview)

Participants also referred to the increased productivity associated with the use of ICT tools. For example, P13 described using technology for rapid information gathering: "I would definitely use this with my students, especially in collecting information or reviews about any topic I'm teaching, because it provide [*sic*] an easy and quick method to gather info from students" (P13, Blog).

In addition, participants believed that technology increased their productivity in relation to the effort they put into their teaching practice and the time saved during lessons. They highlighted the need to save class time through technology integration, as one participant mentioned before the course: "That's the main thing I think. I need to learn the ways, the methods, the-the applications of technology, so I don't just waste my students' time" (P1, Interview). During the course, participants described reduced workload and time savings, allowing for a greater focus on lesson objectives. For example, P22 stated: "It was also easier for me as a teacher to teach specific domains, less effort more results. I learned not only to work hard but also to work smart in order to achieve my goal" (P22, Blog). This view was also shared by P16 who believed that technology "shortens the teachers' effort and battles against time within a certain lesson and enhances the quality of a lesson" (P16, Blog) and P2 who stated: "Now I have plenty of websites where students can practice vocabulary, while I save time and energy and they have fun and cooperate" (P2, Blog).

Code 3: Technology Enhances Students' Learning. Participants strongly believed that the affordances of technology were associated with enhancing students' learning. They believed that integrating technology brought about changes in the way students learn, as it has the potential to motivate learners, increase their engagement, and improve their grades.

Firstly, the participants viewed technology as a motivating agent for students. This belief was expressed by P16 in the pre-course data:

> I feel like through technology, you can do many activities, you can engage [*sic*] many activities that help the students to be more motivated and encouraged and they would like the lesson more than just to teach them from the books. (P16, Interview)

P11 echoed this sentiment, suggesting that technology can alleviate student anxiety:

> Students usually do not like to write, and feel confused and uncomfortable to speak and present in front of their classmates; therefore, I believe that using these types of tools motivates the students and make [*sic*] them feel more comfortable to express themselves and more active during the lesson. (P11, Blog)

Secondly, participants believed that integrating technology-enhanced students' engagement in class. This view was expressed by P20 before the course as they stated: "using technology is more important for them. And more attracting, it does entice their -their attention and encourage them to participate in the lesson and to concentrate with the teacher" (P20, Interview). This perspective was echoed by participants during and after the course, as illustrated by P13, who connected the students' active role in a lesson to the use of technology:

> A successful lesson requires a good classroom climate, engaging methods to use in order to teach, motivate all students in class to participate, and stimulate students to use their thinking skills as much as possible. all these elements were achieved by the integration of technology in this lesson, which made a more appealing way for students to learn. (P13, Application Report)

Finally, participants believed technology could positively affect students' grades. P7 illustrated this in the pre-course data: "When they like the way English is taught, their grades

will improve and everything in English will improve. When I don't use technology, the lesson might be boring and this will affect their grades" (P7, Interview). The during and post-course data supported this view, with P11 stating: "I think if the whole system would use technology, students would change. I think it would also affect their grades, their everything" (P11, Interview). Similarly, P20 noted: "I believe students will success [*sic*] more. We will have higher grades because like technology attracts students and like it raises their interests" (P20, Interview).

Sub-theme 4: Constraints of Technology Integration

The sub-theme *Constraints of Technology Integration* refers to the participants' beliefs regarding the limitations encountered when integrating technology into teaching. Participants identified resource availability as the primary constraint to technology integration.

Code 1: Availability of Resources. Participants believed that the constraints of technology integration were primarily associated with the availability of resources. While they were willing to use technology, the lack of resources hindered their efforts, affecting their overall view of technology integration. This sentiment was expressed in the pre-course data by P9:

> We don't have projectors, and we don't have internet access. So, I intend to, but it depends on the school, it depends on the resources that I'm looking at. But personally, yeah, I would like to have an [*sic*] internet access, computer. (P9, Interview)

This view was also reflected in the during and post-course data, where participants discussed their willingness to incorporate technology into their teaching but were restricted by resource limitations. P18 illustrated this challenge:

> In my school, there is nothing called technology. I can reflect on the negatives of not having a projector in class, I wasted a lot of money printing colourful pictures and etc. and I was forced to teach sometimes in the most traditional way, which I hate the most. (P18, Interview)

Theme 5: Perceived Value of the Course

This theme examines the preservice teachers' perceptions of the value of the TPACK-based course in shaping their conceptions of learning and teaching with technology. It explicitly addresses research question three (RQ3): *How does the course impact the conceptions of preservice teachers of learning and teaching with technology?* This theme explores participants' perceptions of the course's value in shaping their understanding of technology-integrated teaching and learning. The analysis identified three sub-themes, as outlined in Table 15.

Table 15
Theme 5: Perceived Value of the Course with Sub-Themes and Codes

Theme/ category	Sub-theme	Codes in-course & postcourse
Perceived value of the course	Impact on English Language Learners	Course Impact on Students' Language Development Course Impact on students' role Course Impact on Students' Critical Thinking Skills Course Impact on Student Competitiveness
	Impact on the Preservice Teachers	Career Confidence Active Engagement Skill Development
	Value of the Course Design	Value of Peer Learning in the Course. Value of Learning Teaching Methods Value of Learning Theories Value of Learning Technology Tools

Theme/ category	Sub-theme	Codes in-course & postcourse
		Value of Design Activities Value of Macro- and Microteaching in the Course. Value of Reflective Practices

Sub-theme 1: Impact on English Language Learners

The data analysis resulted in the sub-theme *Impact on English Language Learners*, which refers to participants' perceptions of how their learning process in the course affected their English language students. They believed that participating in this course directly influenced their students' English language development, role in the lesson, critical thinking skills, and sense of competition.

Code 1: Course Impact on Students' Language Development. Participants attributed significant English language development gains to their students, linking these developments to course-informed teaching practices. They observed improved comprehension, vocabulary acquisition, and overall language proficiency. For example, P20 described how a technology-integrated lesson enhanced students' reading comprehension:

> In practicum… after I presented the Timeline to them, it was their turn to use the Timeline tool… I divided the class into groups, and each group had the chance to summarise a paragraph. Each paragraph has a subtitle. They fully understood the text and at the same time, they enjoyed the lesson. All of the students participated and comprehended the text very well, where [*sic*] it made the text's questions easy to answer. (P20, Interview)

Code 2: Course Impact on Students' Role. Participants perceived the course as affecting their students' role in the English language classroom. They noted a shift in student

roles from passive recipients to active participants in the learning process. P2 described how technology tools enabled a shift from teacher-centred to student-centred instruction:

> Now, after I took the technology course, I use technology tools differently. That is, I used to present, and let students watch a video. Now I can think outside the box and use technology tools that can activate the students and engage them. Thus, students are not passive anymore, rather, they are responsible for doing the activities themselves after I teach them about the tool. (P2, Interview)

Furthermore, the participants believed the course helped them create a collaborative learning environment for their students. This is reflected in one participant's reflections on the difference between the precourse lesson plans and those created during the course, highlighting the students' shift from passive observation to active engagement and collaboration:

> The use of the technology has changed a lot from the first lesson plan to the last 2 lesson plans. In the first lesson plan students didn't get the chance to use the technology themselves. All they did was only to see the presented information on the screen. However, the last 2 lesson plans actually engaged the students with [*sic*] using technology. Students themselves use the computers to complete the tasks and they had to finish the tasks together as a group, which enhances the importance of the [*sic*] collaborative work. (P9, Blog)

Code 3: Course Impact on Students' Critical Thinking Skills. Participants made a connection between the course and the enhancement of their students' critical thinking skills. They believed the course promotes these skills. P13 illustrated this by stating: "integrating technology made a huge change and difference in my lesson, mainly it introduced students to new simple, easy, smart tools from the course which enhance and foster their thinking skills"

(P13, Application Report). Similarly, P9 highlighted the value of learning technology tools in the course and the impact on students' thinking skills:

> Today we learned about Storybird… In class, I'll use this tool to ask the students to write stories or poems. This website is good form [*sic*] inhancing [*sic*] the students' writing skill, and it also triggers their higher order thinking skills since that it [*sic*] requires making connections and sequencing. (P9, Blog)

Code 4: Course Impact on Student Competitiveness. Participants believed the course helped them create a positive sense of competition among students. One participant reflected on creating an activity based on a tool learned in the course and teaching it in a real classroom setting, noting the effect it had on students:

> I tried it as a teacher, in which [*sic*] I prepared a quiz in past simple as a revision. I think Soctarive is a very beautiful and easy way for both teachers and … it also creates a sense of competition between the students, so that; [*sic*] they would always keep on reviewing the material to be ready for any quiz. (P11, Blog)

Another participant shared a similar view, reflecting on their practical application as part of the course requirements:

> Today I used Padlet and Kahoot and I think they went good…Well, I see- I saw how the students were exciting [*sic*]. So, normally, when we teach, let's say, vocabulary, we just give them the worksheet match, and or just read the sentences and write the correct answer. But here they read, also the sense of competition between the students. (P7, Interview)

Sub-theme 2: Impact on the Preservice Teachers

The data analysis has resulted in the sub-theme *Impact on the Preservice Teachers*, which highlights participants' perceptions of the course's value for themselves as preservice English teachers. They identified benefits across various dimensions, including benefits for their careers, confidence, skill development, and active engagement.

Code 1: Career. Participants believed that the value of the course lies in its direct connection to their careers as English language teachers. They reported that the course positively affects their future careers. This is illustrated by one of the participants who stated: "As a student for this course, [*sic*] technology course opened a [*sic*] new horizons for me, I've learned about a variety of websites that I can use in my stage [inservice teaching] and my future career" (P14, Interview). P24 highlighted the course's role in securing employment:

> To be honest, this course is actually one of the reasons I got the job at the school I teach in. when I went to the interview and I was asked in what way I can add to teaching English, I told them that I have taken technology course that integrates technology in teaching English, and they just loved the ideas because it is new for them. (P24, Interview)

Code 2: Confidence. Participants perceived the course as valuable for the confidence it gave them. They felt more confident planning lessons, designing activities, and integrating technology into their teaching practices. P1 described the course as instrumental in developing confidence to create engaging lessons:

> My lesson plan changed especially as it strayed further away from the traditional methods of teaching, which I used to have in my lesson, my confidence that I can create better lesson, with more engaging tasks and contents is reflected in the lesson plan I write, as it facilitates the mission of bringing my students to enjoy the process of learning and enjoy learning the language itself. (P1, Blog)

P20 expressed increased confidence in implementing technology in the classroom:

> Now I can, like create or I prepare an assignment for my lessons and take the students to the computer lab and do it confidently because I'm, like erm, exposed to this- those tools that we learned, and yeah, I'm confident because I know how to use those tools. (P20, Interview)

This newfound confidence extended to overcoming the fear of incorporating new technologies into teaching practices, as stated by one of the participants: "The more I moved through the course, the more self-confidence I gained and the encouraged me to integrate technology in my lessons and not to be afraid of such idea because it's considered to be new" (P24, Interview). Similarly, P11 expressed a similar idea when referring to the value of the course in boosting confidence levels:

> First, I think the course erm, raised my self-confidence while teaching. You saw today [how] the lesson went, I think, it was good since I used technology. So, when when I see the students participate and exciting, so it raised [*sic*] my self-confidence while teaching. (P11, Interview)

Code 3: Active Engagement. Participants reported heightened engagement and motivation throughout the course. This is evident in P2's reflection on their design activities: "I felt motivated while making up the activity, I wished our teachers made us such ones" (P2, Blog). P6 initially approached the course with a focus on passing, but increased engagement led to a deeper investment in the course:

> At the beginning my interest was just to pass the course and that's it, I was working only for this goal, but while observing others' presentations and explanations about how they use technology I decided to give more attention to the course and to the

> tools. I felt how much this course is great because I felt a big difference in the practice teaching. (P6, Blog)

Code 4: Skill Development. Participants reported significant growth in their technology integration and teaching skills as a result of the course. P9 described increased competence after taking the course:

> I even see it when I use technology from the course in my classrooms…I tell the students that we're going to learn something using technology, I see that they're more interested in, and even my mentor gets even more interested in what I'm going to teach. So these things show that it actually gives you more competence with what you're doing. And when you come prepared…it makes you more competent. (P9, Interview)

P2 highlighted the development of a broader technological repertoire:

> Before we took the course, what I knew about integrating technology was very basic, let's say, programmes like PowerPoint was [*sic*] the maximum I had. I once used Google Maps and so on, but after, you know, taking the course and making a couple of lesson plans about how I can integrate technology in a different way, I thought about it differently. And the tools you taught us are actually very valuable if we use them in the right way. (P2, Interview)

P8 emphasised the practical application of learned skills and their positive impact on both teacher and student:

> Over the course of the semester, [*sic*] have used some of the websites that we have learned in the course. And I applied them with the students. And I saw how technology helped them, and helped me as well as a teacher to reach my, my aim for the lesson… I've noticed that they- they start asking me like, what is the next activity

> that you will you will do for us? Are you going to do an activity using the technology or it's just a simple lesson? Yeah, they they start asking me, so I noticed that technology really has a big effect on me as a teacher and on the students. (P8, Interview)

Sub-theme 3: Value of the Course Design

The data analysis resulted in the sub-theme *Value of the Course Design*, reflecting participants' views on the course's structure and activities. Participants valued the course's design, highlighting its contributions to their learning experience. Specific aspects appreciated by participants included peer learning opportunities, teaching methods, theoretical knowledge, ICT tools, design activities, macro- and microteaching experiences, and reflective practices.

Code 1: Value of Peer Learning in the Course. Participants expressed a positive attitude towards peer learning, emphasising the benefits of collaborating with peers to create activities and lesson plans. As P2 noted:

> I liked the group work when we had to divide things between, and we used to help each other like which tool to use for which activity and so on. So, instead of just being exposed, for instance, to social interaction, and make an activity according to it, no I was actually helping other students who were responsible for the part of Presentation and offer [*sic*] some tools for them. (P2, Interview)

Collaborative learning with peers also contributed to increased confidence, as P24 explained: "because the course was both theoretical and practical. And we taught each other. As a result, we gained self-confidence in using the tools we were introduced to in the course" (P24, Interview).

Code 2: Value of Learning Teaching Methods. Participants expressed a positive attitude towards the course's emphasis on teaching methods with technology integration. They highlighted the acquisition of new teaching strategies to enhance their teaching pedagogies. As P1 noted: "I have a more positive perspective. I wasn't against it, but now I'm more with it because I saw new ways and new methods of teaching that, as I said, can really help me in my class" (P1, Interview). P18 similarly emphasised the value of learning new methods, particularly for diverse classrooms: "It's helped me a lot. It gave me new methods to like to use, especially for heterogeneous classes" (P18, Interview).

Code 3: Value of Learning Theories. Participants recognised the importance of theoretical foundations for effective technology integration. The TPACK framework was particularly valued for its practical application in lesson planning. P11 stated: "We learned about the importance and the principles that underlie the integration of information and communications technology within language teaching and learning" (P11, Blog) and further described how the TPACK framework informed their teaching process:

> The most useful thing I learned in the course is how TPACK can be used in the classroom. As [*sic*] future teacher, I can make a significant change while planning my lessons, and while applying them later in the classroom. Using TPACK taught me how to improve my planning process, where I first choose the learning outcomes and objectives -content that I will be working on during my session. Then I choose the activity or the task -pedagogy based on the learning outcomes and objectives. Finally, I can choose the ICT tools that aim to support the activity I chose and help the students in the learning and understanding process. (P11, Interview)

Code 4: Value of Learning Technology Tools. Participants saw a connection between learning technology tools in the course and their future careers as teachers. They

recognised the direct correlation between ICT proficiency and effective teaching. P15 highlighted the future-oriented value of these skills:

> It was very useful to learn the tools because it [*sic*] will help in the future in [*sic*] career, and I would like to use the tools that we have learned during my career in the future and during the practice teaching. (P15, Blog)

P2 described a shift from passive to interactive learning experiences enabled by technology tools:

> I could tell that there is a dramatic change. In the past, I used to deal with very simple technological tools and stick to them like PowerPoint or Youtube. With these websites, students are not engaged, that is they only watch, read or listen. But with the help of the course, now I am able to let students themselves interact with technology by speaking (recording), writing, commenting, uploading pictures, and expressing their opinion... Now I have plenty of websites where students can practice vocabulary, while I save time and energy and they have fun and cooperate. (P2, Blog)

Code 5: Value of Design Activities. Participants valued the design activities, which helped them develop their knowledge of technology integration. They believed that, through creating lesson plans and activities; they gained practical knowledge and confidence in using technology. P20 highlighted the connection between design activities and improved teaching practices:

> The activities were successful and useful in developing my knowledge in the use of technology, because technology provides more opportunities to teach the lesson in an appropriate way that helps students to gain more knowledge and understand the main idea of the content. (P20, Blog)

P8 emphasised the collaborative nature of the design process and its benefits for learning:

> This course taught me a lot and certainly it was one of the courses that helped me to improve my way of technology and enriched me a lot as well. It was a good idea to work on [*sic*] groups and each one of us finds [*sic*] a suitable solution for the problem that she got. In this way, we can learn and benefit from each other. (P8, Blog)

P9 noted the usefulness of technology applications across different curriculum areas as a result of engaging in design activities:

> I learned from my tasks and from my classmates' tasks that [*sic*] teacher can work on every domain there is using technology. Not only that but also for teaching specific things such as vocabulary, poems, reading comprehension and etc. Therefore, working on these things enhanced my knowledge in the use of technology in classrooms. (P9, Blog)

Code 6: Value of Macro- and Microteaching in the Course. Participants found the practical application of technology in macro- and microteaching sessions valuable. They appreciated the opportunity to test their lesson plans in a controlled environment before classroom implementation. In addition, they valued the opportunities to practise in real-classroom settings. This is illustrated in the excerpts by the following participant, highlighting the value of microteaching:

> Probably preparing the lesson plans [*sic*] and actually applying it or trying to apply it first because I think it's important to try it first before you do it with actual students since it's difficult, you wouldn't know how they'd react or if it would work with certain students. So, I think the fact that we first we get; we see how it is, how it works and then we get to try it. I think that's very good. (P3, Interview)

P24 emphasised the practical nature of the course and the impact on their teaching practice, stating: "I was able to apply the things that I have learned in the course to my students, and

they just loved it. It is one of the few courses where you literally apply the things that you learn" (P24, Interview).

Code 7: Value of Reflective Practices. Participants expressed a positive attitude towards the reflective practices in the course, noting their importance for professional development. P16 highlighted the connection between reflection and improved practice: "I felt that the more I spent time in the course the more it benefited me to reflect on my experiences and to think of methods or ideas to improve the way I integrate technology within my lessons" (P16, Blog). P13 described how reflection facilitated technology integration into teaching: "when I started this course, we all present the tools, we- we tried to use these tools in class…It was really much easier for me. And these reflections about each one of us made it really easier" (P13, Interview).

Summary

The purpose of this chapter was to present the findings related to the perceptions and attitudes of preservice teachers towards technology integration in English Language Teaching, as well as the impact of the TPACK-based course on their conceptions of learning and teaching with technology. The analysis was organised around two key themes: Attitudes and Perceptions Towards Integration of Technology into Teaching, and Perceived Value of the Course. The first theme explored how participants' prior experiences, readiness for teaching with technology, and perceptions of the affordances and constraints of technology integration evolved throughout the course. The second theme examined the course's perceived impact on both the participants and their students, highlighting the role of the course design in enhancing participants' understanding and application of technology in teaching. Through these themes, the findings stress the significant influence of the course on reshaping preservice teachers' attitudes towards and conceptions of technology-integrated language teaching.

Chapter Six: Discussion

Introduction

This chapter provides a summary and discussion of the findings on the development of TPACK among preservice English teachers through a course designed around the TPACK framework. It is organised into three main sections, each corresponding to a specific research question: RQ1 investigates the development of TPACK among preservice English teachers; RQ2 examines their perceptions and attitudes towards technology integration in teaching English; and RQ3 assesses the impact of the course on their conceptions of teaching and learning with technology.

Summary and Discussion of Findings

This section outlines the research questions, presents a summary of the findings, and provides an analysis of these findings in the context of existing literature.

RQ1: TPACK Development of Preservice English Teachers

The first question in the study sought to explore the way in which preservice English teachers' TPACK changes throughout the course. The three sub-research questions focused on the development of TPACK through design activities, microteaching, and macroteaching. The study's findings indicate that preservice teachers demonstrated development in their TPACK. This development was observed as they engaged in design activities and practical teaching exercises, including both microteaching and macroteaching. The preservice teachers were able to integrate technology with pedagogy and content, demonstrating an enhanced understanding and application of TPACK principles.

SRQ1: Relationship Between Design Activities and TPACK Development. With respect to the first sub-research question, the findings of this study indicate that the design activities created by participants in the course demonstrate a strong representation of TPACK

constructs. Preservice teachers were able to integrate technological, pedagogical, and content knowledge, with evidence of all TPACK constructs present in their design activities. This demonstrates that the preservice teachers developed an understanding of how to connect technology, content, and pedagogy.

Representation on TPACK in Design Activities. Before the course, the participants showed limited knowledge and use of TK, such as operating PowerPoint and digital books. In contrast, during the course, the participants showed knowledge of a wide variety of basic and advanced technology tools such as Padlet, Socrative, PlayPosit, WriteAbout, Voki, and Piktochart and both articulated and demonstrated how these tools are used. Studies like those by Bich Dieu et al. (2019) and Kurt et al. (2013) similarly found that design activities enhance preservice teachers' TK. A possible explanation for this result is that the increase in TK, supported by the findings of previous studies (Aktaş & Özmen, 2020, 2022), shows that preservice teachers' TK developed when they were introduced to new technologies. Another explanation for the development of TK is that the design activities helped participants engage in learning experiences in which they explored ICT tools for their technical features and educational potential before creating technology-based activities (Baran & Uygun, 2016; Kontkanen et al., 2016).

Regarding CK, PK, and PCK, the participants showed evidence of all three, with a major development in the latter. Although the participants had CK, PK and PCK before the course, likely due to their prior coursework in English teaching methods and content courses, they developed and expanded their PCK during the course. This growth included moving from limited, teacher-centred practices like lecturing to more integrated, student-centred methods like problem-based learning and creating assessments for English language learners. This development is consistent with the findings of Aktaş and Özmen (2020) and Shin et al. (2009), who also observed significant growth in previously gained PCK and gained new

knowledge through design-based activities. This finding might be explained by the fact that the design activities were based on English language teaching topics, a result also reported by Cetin-Dindar et al. (2018), who found that PCK developed when preservice teachers engaged in subject-specific course activities. These findings support the idea that design activities are most effective when applied to content-specific courses (Kayaduman & Delialioğlu, 2017; C.-J. Lee & ChanMin, 2017).

Regarding TCK, the participants showed significant development during the course. Before the course, their use of technology was limited and teacher-centred, primarily focused on presentation tools (e.g., PowerPoint, YouTube) for basic content teaching tasks, such as teaching vocabulary and grammar. However, during the course, they demonstrated an improved ability to select and integrate technology to support English language instruction in innovative ways. Participants created student-centred activities that promoted active learning and collaboration within the English language classroom. This development in TCK aligns with previous studies (Agyei & Voogt, 2015; Aktaş & Özmen, 2022; Koçoğlu, 2009; Kurt et al., 2013; C.-J. Lee & ChanMin, 2017), which found that design-based activities enhance preservice teachers' ability to integrate technology into content teaching. This outcome is contrary to that of Lu (2014) who found that preservice teachers had limited and superficial reflections in TCK, and Syamdianita and Cahyono (2021) who noted challenges in implementing TCK due to issues with content knowledge. The observed increase in TCK in this study could be attributed to the structured design-based activities that specifically focused on integrating technology into content-based teaching and the collection of evidence-based sources of data.

In terms of TPK, the participants also showed substantial growth. They moved from limited and teacher-centred instructional methods with technology to incorporating a variety of strategies that integrated technology with different instructional methods to enhance

lessons, the students' learning process and their own teaching approaches (e.g., collaboration on digital infographics; pair work on a digital timeline). This aligns with Lu's (2014) study, which demonstrated that participants developed TPK by articulating how technology can enhance instructional strategies and facilitate student learning after participating in design activities. This finding further supports evidence from previous observations that while preservice teachers are digital natives, they are not skilled at integrating technology into teaching (Lei, 2009; Stockless et al., 2022). They often underuse technology in teaching or adopt structured, teacher-centred approaches (Jeong, 2017; Mouza et al., 2014; Sointu et al., 2016; Tondeur et al., 2017) and their knowledge of pedagogical technology is limited and might show a lack of connection to innovative teaching methods (Instefjord & Munthe, 2016; Kontkanen et al., 2016). The development in TPK in this study is supported by previous studies (Bich Dieu et al., 2019; Kim & Lee, 2018; Lu, 2014; Muslimin et al., 2022) showing that design-based learning activities enhance preservice teachers' technological pedagogical knowledge.

Regarding TPACK, participants' lesson plans evolved during the course, moving from a lack of TPACK integration before the course to demonstrating technology integration, content, and pedagogy in their design activities. Participants were able to use technology to develop students' English language competence by employing various pedagogical approaches. For instance, they created collaborative digital storytelling writing activities using Padlet. This enhancement in TPACK aligns with existing literature indicating that design-based activities promote TPACK development. Previous studies (Ersanlı, 2016; Koçoğlu, 2009; Kurt et al., 2013; Kwangsawad, 2016; Öz, 2015) showed that these activities help preservice teachers understand the interrelationship between technology, content, and pedagogy. Consequently, these findings suggest that integrating design activities into teacher

education programmes can be a promising strategy to support preservice teachers' development of TPACK (Kayaduman & Delialioğlu, 2017).

This development in participants' design activities is also reflected in the distribution of TPACK constructs across the precourse and in-course phases. While CK, PK, and PCK dominated the precourse lesson plans, there was a shift in emphasis during the course, with an increased representation of TK, TCK, and TPK. The data also showed that PCK continued to develop and appeared more frequently during the course, indicating that participants were not only retaining but expanding their pedagogical content knowledge. The most significant change, however, was the emergence of TPACK in the in-course design activities. This construct was entirely absent in the pre-course submissions but became evident once participants began to engage in lesson planning that combined content, pedagogy, and technology. These findings reinforce the qualitative analysis presented earlier and provide further evidence that the design-based learning activities supported participants' TPACK development.

Lesson Plans. The findings revealed significant progress in TPACK regarding alignment with curricular goals and book adaptations. Based on the theme Design *Activities* and sub-theme *Lesson Plans*, participants' pre-course lesson plans that included the use of technology did not effectively integrate it with curriculum goals, focusing primarily on teacher-centred activities and demonstrating a mismatch between the lesson plans and the objectives of the Israeli English Curriculum. However, during the course, participants aligned their technology use with the curriculum's domains and benchmarks. For example, they incorporated technology tools into their lesson plans, clearly referencing curriculum requirements and objectives for technology integration. In addition, the participants demonstrated their ability to transform traditional coursebook activities into technology-enhanced tasks, fostering student-centred learning. This result is consistent with studies that

found a relationship between design activities and improvement in aligning curricular goals with technology integration (Kurt et al., 2014). A possible explanation is that preservice teachers developed stronger skills in analysing the curriculum to identify opportunities for technology integration. Additionally, participants adapted coursebook topics, enriching them with technology to create student-centred and collaborative learning experiences. This finding was also reported by Ersanlı (2016) and Kurt et al. (2014). A possible explanation is that creating effective learning materials with technology can showcase expertise, allowing preservice teachers to demonstrate their understanding of the principles of teaching and learning with technology through book adaptations. Another possible explanation is that, by transforming traditional materials, they could experiment with different technological tools and approaches, thus exploring their own creativity in designing activities. These findings seem consistent with other research that found that engaging in design activities contributed to preservice teachers' knowledge about teaching with technology and curriculum implementation (Bich Dieu et al., 2019; Kayaduman & Delialioğlu, 2017).

Activities. Participants' design activities revealed changes in instructional design activities, ICT tool integration, and the impact of problem-solving activities. Based on the theme *Design Activities* and sub-theme *Activities*, their instructional design activities combined knowledge-building and knowledge-expression tasks, using a wide range of ICT tools. This diverse use of technology tools marked a clear advancement in their ability to integrate technology meaningfully into lessons. According to Harris and Hofer (2011), effective instructional planning should prioritise curriculum content, teaching and learning contexts, and pedagogy, while incorporating digital tools to support various types of learning activities (e.g., knowledge building and expression). This approach allows teachers to diversify their instructional strategies and make appropriate educational uses of technology. In line with this perspective, the participants in this study demonstrated an increased

knowledge of ICT tools and their pedagogical affordances, enhancing their ability to create technology-integrated lessons. These findings reflect the development of TPACK, highlighting the participants' increased knowledge of technology and their ability to employ various ICT tools aligned with teaching content knowledge through different pedagogical approaches. Furthermore, the problem-solving activities they participated in demonstrated a strong TPACK development as they used ICT tools to address real-world problems, resulting in enhancing students' engagement with the content. This finding is consistent with that of Kharade and Peese (2014), who found that PBL significantly improved the TPACK capabilities of pre-service language teachers. The approach involving design-based learning reflects the findings of Ersanlı (2016), Koçoğlu (2009), Kurt et al. (2013), Kwangsawad (2016), and Öz (2015), who noted that design activities significantly enhance preservice teachers' understanding of the interplay between technology, content, and pedagogy.

In conclusion, the preservice English teachers in this study developed their TPACK through design activities, demonstrating an increased ability to integrate technology into their teaching practices. This growth was evident in their expanded knowledge of technology tools, development of student-centred approaches, and alignment of technology with curriculum goals.

SRQ2: Relationship Between Microteaching, Macroteaching and TPACK Development. The findings from this study highlight the role of both microteaching and macroteaching in the development of TPACK among preservice English teachers. A strong relationship between practical application and TPACK development has been found as research in the field of TPACK development in preservice teacher education has shown that designing activities and engaging in the practical application of the activities are effective strategies for TPACK development (Aktaş & Özmen, 2020; Andreasen et al., 2022; Durdu & Dag, 2017; Foulger et al., 2012; Kwangsawad, 2016; Martin et al., 2020; Mouza et al., 2014).

The findings in this study, based on the theme *Experiences in Technology-Enhanced Teaching*, demonstrate how microteaching and macroteaching experiences contribute to TPACK implementation.

Microteaching. The findings indicate that the participants developed self-reflection, analysing their teaching processes and considering improvements as a result of their microteaching experience. This self-reflection is crucial as it encourages teachers to critically evaluate and enhance their instructional methods. For instance, one participant switched from Padlet to Voicethread after realising the need for a spoken activity instead of a written one. This aligns with previous studies (Bich Dieu et al., 2019; Jang & Chen, 2010; Kurt et al., 2013; C.-J. Lee & ChanMin, 2017; Mouza & Karchmer-Klein, 2013; Saralar-Aras & Türker-Biber, 2024) that emphasise the importance of reflective practices in professional development and TPACK enhancement. A possible explanation for this might be that the design activities, which were implemented in the microteaching and reflected upon, likely contributed to moving participants into a reflective mode where they consciously thought, analysed and learned (Koehler & Mishra, 2005a), thus developing practical wisdom (Mouza & Karchmer-Klein, 2013) for TPACK implementation.

The findings reveal that participants felt that they benefited from peer-led microteaching sessions, gaining practical knowledge and exposure to various ICT tools integrated with pedagogy and content. This peer learning experience is important for TPACK development, as it encourages the practical application of theoretical concepts in a supportive environment (Martin et al., 2020). Participants emphasised the value of learning from their peers' experiences, which provided diverse perspectives on using technology in teaching. This finding is consistent with that of Aktaş and Özmen (2020) who found that observing peers during microteaching allows participants to witness effective technology integration strategies in action, thus developing a deeper understanding of how these tools can be used in

the classroom. A possible explanation for this finding is that participants may have benefited from observing and imitating their peers' effective technology integration strategies in microteaching, leading to enhanced TPACK development in their own microteaching lessons. While research on TPACK development in microteaching in preservice education mainly focuses on the teacher's development (Foulger et al., 2012; Martin et al., 2020), the perspective of participants as learners in this process is often overlooked, limiting the understanding of the full impact of microteaching. To gain a comprehensive understanding of microteaching, future research should investigate the learning outcomes and potential benefits for participants as learners in microteaching.

The findings revealed that participants were able to integrate technology into their lessons during microteaching sessions, demonstrating the development of TPACK. Observations showed that technology was appropriately used to support pedagogical approaches and content delivery. For instance, P19 utilised Piktochart to facilitate students' post-reading activities about a poem, enabling collaborative content creation and presentation. This finding supports previous research into the connection between microteaching and TPACK (Aktaş & Özmen, 2020; Durdu & Dag, 2017; Foulger et al., 2012; Martin et al., 2020), highlighting the positive impact of microteaching on TPACK development and resulting in developing a deep understanding of the relationship between technology, pedagogy, and content. A possible explanation for this finding is that the hands-on experience and observation of effective technology integration strategies during microteaching sessions allowed participants to apply theoretical concepts in practical settings, thereby enhancing their TPACK development. Another possible explanation is that microteaching provided participants with a way to experiment with technology integration in teaching, thus resulting in a deeper understanding of how technology can enhance teaching and learning.

Macroteaching. The findings of this study showed that managing class time during macroteaching sessions presented significant challenges for preservice English teachers. Despite prior teaching experience through microteaching, participants struggled as they miscalculated the time needed to incorporate technology into their lessons, often underestimating the time required to teach students how to use new ICT tools. For instance, one participant noted their struggle with fitting a comprehensive technology-based activity into a single lesson, leading to a rushed and less effective teaching session. Difficulties preservice teachers face in managing classroom time while integrating technology is not surprising, as Ertmer (1999) noted that the introduction of technology can force even experienced educators to revisit foundational issues such as classroom management, discipline, role definition, and lesson development. Thus, this process can be especially challenging for those new to the profession. Challenges in time management is a finding that matches the results obtained by Mouza and Karchmer-Klein (2013). However, based on the results of this study, this challenge served as a significant learning experience, encouraging participants to develop strategies for improving future lesson planning. This challenge may highlight the need for more extended, hands-on practice with technology integration in authentic classroom settings before pre-service teachers take on full teaching responsibilities. The literature supports this, suggesting that teaching with technology in real classroom settings requires repeated experience and ample practice to acquire TPACK (Mouza et al., 2014; Mouza & Karchmer-Klein, 2013; Özgün-koca et al., 2009; So & Kim, 2009).

Participants identified collaboration with mentor teachers as influential in their success with technology integration during macroteaching. Positive feedback and support from mentor teachers boosted preservice teachers' confidence and validated their efforts. However, what is surprising is that the participants described themselves as having superior technological knowledge compared to their mentor teachers, which was contrary to the usual

expectation. Zipke (2018) found that pre-service teachers often felt constrained by their guest status in classrooms, but this differs from the finding presented here. Participants in this study demonstrated a willingness to experiment with technology, even taking on a mentorship role with their cooperating teachers. Therefore, while mentor teachers in macroteaching contributed to preservice teachers' sense of satisfaction, they did not advance their professional development in using technology. This result reflects that of Stockless et al. (2022) and Tondeur et al. (2020), who reveal that while mentor teachers encourage technology use, their ability to provide in-depth guidance on technology integration is often limited. In addition, the literature emphasises the importance of mentor teachers in modelling effective technology use (Buss et al., 2018; Foulger et al., 2012; Mouza et al., 2014), and this study reinforces the need for mentor teachers who have knowledge in educational technology and are able to support pre-service teachers in their implementation in the field (Öz, 2015). Thus, this finding suggests a need for updated professional development for mentor teachers to ensure they can provide the necessary support and guidance in technology application.

Technical challenges were a recurrent issue, impacting the effectiveness of macroteaching sessions. Participants reported difficulties such as unreliable internet connections and inadequate technological infrastructure in schools. These challenges often led to frustration and disrupted lessons. The literature corroborates these findings, noting that technical issues can hinder the implementation of technology in education (Abedi et al., 2024; Farhadi & Öztürk, 2023; Le & Song, 2018; Mouza & Karchmer-Klein, 2013; Siregar et al., 2024; Zipke, 2018). To address these barriers, it is essential for educational institutions to invest in technological infrastructure and provide technical support to preservice teachers. This would ensure that preservice teachers can focus on delivering effective lessons rather than troubleshooting technical problems.

Despite the previous challenges, the findings demonstrate that the participants' reports on the enactment of macroteaching lessons contributed to the development of their TPACK, as they showed evidence of TPACK and all its constructs. Participants showed an understanding of how to integrate technology with pedagogy and content, creating and teaching lessons based on TPACK. For instance, one participant used Voki to enhance students' social interaction and presentation skills in an English lesson, while another employed Padlet for a collaborative English writing activity, demonstrating the development of their TPACK knowledge. This result aligns with previous studies that highlight the importance of practical application in developing TPACK (Andreasen et al., 2022; Kurt et al., 2014; Kwangsawad, 2016; Mouza et al., 2014). Kurt et al. (2014) emphasise the importance of field experiences in developing pre-service teachers' ability to understand the significance of lesson planning and preparation, the effectiveness of various instructional approaches, and the complexities of integrating technology into instruction. This stresses the need for incorporating macroteaching experiences into teacher education programmes, which should combine coursework with fieldwork.

In accordance with the present results, previous studies have demonstrated that teaching experience is an important factor in the development of TPACK, as a profound understanding of TPACK is developed in practice (Voogt et al., 2016). It is possible, therefore, that the microteaching and macroteaching experience in the course resulted in a shift from a conceptual understanding of technology integration to practical engagement with this knowledge, which contributed to the development of the preservice teachers' TPACK. Thus, it can be argued, in line with previous studies (Agyei & Voogt, 2015; Akkoç, 2011; Bich Dieu et al., 2019; Cavin, 2007; Durdu & Dag, 2017; Harte, 2017; Kurt et al., 2014; Meagher et al., 2011; Turgut, 2017b), that the practical application process in the course

enhanced preservice teachers' skills in integrating technology into their teaching practices, ultimately contributing to their TPACK development.

SRQ3: Reflection of TPACK Development in Microteaching, Macroteaching and Design Activities. The development of TPACK among preservice English teachers showed their shift from teacher-centred methods to more student-centred approaches. Before the course, participants relied on basic tools for traditional instruction. However, as the course progressed, they integrated technology to enhance both their teaching methods and English language skills instruction.

Teaching Methods. The findings indicate a shift in teaching methods from a teacher-centred to a student-centred approach as preservice English teachers progressed through the course. Before the course, technology use was limited to basic presentation tools like PowerPoint, primarily for teacher-centred discussions, lectures, and presentations. This aligns with studies suggesting that preservice teachers initially face difficulties in integrating technology beyond teacher-centred lessons (Kontkanen et al., 2016; Tondeur et al., 2017; Voogt et al., 2016). The participants' reliance on the use of technology for presentations mirrors the finding of Mouza et al. (2014), who observed a similar initial focus on teacher-centred approaches among pre-service teachers. The pre-course reliance on presentations could be attributed to the lack of experience in technology integration, stressing the need to support preservice teachers in implementing student-centred instruction (Sointu et al., 2016).

In contrast, the findings of the in-course and postcourse data demonstrate a transition to more diverse and student-centred teaching methods, showing deeper technology integration to support pedagogical practices. For example, discussions evolved significantly, with participants moving from traditional oral and teacher-centred discussions to more interactive, technology-facilitated discussions. Tools like Padlet were used to manage and

enhance classroom discussions, making it easier for students to actively participate, even in larger classes. Another example is technology integration into homework assignments, transforming traditional tasks into interactive activities that fostered deeper student engagement outside the classroom. This included using blogs and other digital tools, which provided platforms for students to share their work and receive feedback. This shift towards technology-infused student learning activities supports the findings of Drajati et al. (2021) and Aktaş and Özmen (2022), who found that integrating technology plays a role in fostering student engagement and interaction.

The findings show that modelling activities became a frequent teaching method in the course. This means that participants used technology to demonstrate tasks and processes, thus providing students with clear examples to follow. By using technology, participants were able to show students how to complete assignments, making the learning process easier to understand and supporting the development of their students' technological skills. Previous studies have emphasised the importance of teacher-educator role models in developing preservice teachers' technology skills (Baran et al., 2019; Durdu & Dag, 2017), yet the application of technology modelling as a pedagogical tool by preservice teachers has not previously been described. The use of modelling with technology may be explained by their own experience with role models (Chapter 2, theme 3) and thus understanding their students' needs. This suggests that the participants recognised the importance of serving as role models for their students and saw that demonstrating technology skills through modelling was an effective way to meet their students' learning needs.

Collaborative activities emerged as a key method for technology integration. Participants used various ICT tools to facilitate peer interaction and cooperative learning, allowing students to work together on digital projects and engage in peer feedback. In addition, the findings show an emphasis on the use of project-based learning, where students

independently created digital products like infographics and biographies, reflecting the effectiveness of technology integration in fostering self-directed learning. This shift in teaching methods aligns with prior research (Drajati et al., 2021; Ersanlı, 2016; C.-J. Lee & ChanMin, 2017) emphasising the importance of TPACK development in empowering pre-service teachers to design and implement collaborative learning experiences. A possible explanation for this might be that the course's emphasis on collaborative activities may have influenced preservice teachers to adopt similar approaches in their own teaching, leading to a shift from traditional teacher-centred to student-centred technology-enhanced methods.

In terms of assessment, the findings show that technology integration created a shift towards peer assessment and e-assessment practices. Participants incorporated digital platforms like blogs and VoiceThread for peer evaluations, allowing students to provide structured feedback and engage in reflective learning. This result was also reported by Drajati et al. (2021), who found that the participants used ICT tools to design activities for peer-reviewing. In addition, e-assessment became a popular method for evaluating student learning outcomes. Participants created quizzes and tests using digital tools to assess various learning outcomes, from grammar to higher-order thinking skills. The development of assessment tools supports the findings of previous studies (Aktaş & Özmen, 2022; Ersanlı, 2016; Syamdianita & Cahyono, 2021), that established a connection between TPACK development and the integration of new assessment methods by preservice teachers.

Developing Students' English Language Skills. The findings show that, before the course, preservice teachers primarily relied on traditional methods for teaching English language skills, such as grammar drills, presentations, and read-aloud lessons. Their use of technology was limited to visual aids, like PowerPoint presentations. This finding aligns with previous research suggesting that preservice teachers often lack the pedagogical knowledge to integrate technology (Instefjord & Munthe, 2016; Kontkanen et al., 2016). Their use of

technology was primarily superficial, focusing on visual aids rather than interactive or student-centred approaches. It can therefore be assumed that the preservice teachers in this study had limited TPACK prior to the course, as evidenced by their reliance on teaching content via traditional teaching methods and minimal technology integration.

The findings related to post-course data reveal a shift from traditional rote learning to more interactive, technology-driven methods in teaching language skills, including grammar and vocabulary. The Participants transitioned from using worksheets and basic presentations to employing knowledge-building and knowledge-expression activities with technology. For example, vocabulary practice included activities for knowledge building through platforms like Quizlet and Kahoot, in addition to knowledge expression through integrated writing activities using acquired vocabulary. Similarly, grammar instruction included knowledge building using tools like Kahoot for practice and knowledge expression through integrated digital storytelling with a grammar focus. This development supports the findings of previous (Ersanlı, 2016; Kharade & Peese, 2014; Öz, 2015) emphasising the positive impact of TPACK development on grammar and vocabulary-based activities.

The findings show a development in the teaching of receptive skills, particularly reading and listening, as a result of taking the course. The findings indicate a shift to more technology enhanced and pedagogically improved methods, incorporating ICT tools like Padlet for reading prediction activities and PlayPosit for interactive listening comprehension. While Kharade and Peese's (2014) study offers a general overview of the increased use of ICT in language teaching, and Ersanlı (2016) provides a broader list of software applications for language learning outlining their potential uses, this study offers a more detailed perspective on how these and other tools were integrated to enhance specific language competencies.

For productive skills, the data indicates an improvement in technology integration to support student-centred activities in speaking and writing. The participants shifted to using tools like Voicethread for peer assessment in speaking tasks and Padlet and WriteAbout for collaborative writing activities. This study builds on Ersanlı's (2016) work by moving beyond simply listing potential software applications and their possible uses and instead providing evidence of how these tools are integrated into student-centred activities to enhance productive skills in speaking and writing.

Moreover, the incorporation of technology in literature teaching, a previously neglected area, suggests a significant expansion of TPACK, as teachers were able to apply digital tools to enhance students' understanding and interpretation of literary works. While previous research, such as Kharade and Peese (2014), has touched on the use of technology in teaching literature, the specific application of digital tools to enhance literary understanding and interpretation remains relatively unexplored. This study contributes to filling this research gap by showing how pre-service teachers were able to use their knowledge of curriculum content and requirements to design and implement innovative technology-enhanced activities. By integrating technology into literature teaching, participants expanded their TPACK and created more engaging learning experiences for students.

This study provides a comprehensive perspective on TPACK development among preservice English teachers, offering insights that extend beyond previous research in the field. Unlike earlier studies that often focused on specific technologies or skills, this research demonstrates technology integration across all English language skills, including reading, writing, listening, speaking, vocabulary, and grammar. In addition, the study highlights technology integration into teaching English literature, even in the absence of specific curriculum guidelines, highlighting the preservice teachers' ability to transfer their knowledge and connect technology, content, and pedagogy.

Before the course, the preservice teachers exhibited knowledge in technology (TK), content (CK), pedagogy (PK), and pedagogical content knowledge (PCK) as they designed lessons to develop students' language skills. However, their technology use was limited to visual aids and presentations, with no application for teaching English literature, a key component of the curriculum. The course, however, advanced their technological content knowledge (TCK), as they learned to select and integrate appropriate technology tools for English teaching. It also enhanced their technological pedagogical knowledge (TPK), enabling them to change their instructional practices, and ultimately developed their TPACK, as evidenced by their effective selection and application of technology to teach English using diverse pedagogical approaches.

These findings support existing literature on the development of TPACK among preservice English teachers, showing that they not only developed instructional strategies for teaching English but also became more aware of their students' learning needs to develop English language skills (Ersanlı, 2016; Fook et al., 2011; Kharade & Peese, 2014; Koçoğlu, 2009; S. M. Lee & Kim, 2024; Öz, 2015). This study's unique contribution lies in its comprehensive approach to TPACK development, including all language skills and extending to technology integration in literature teaching, thus offering valuable insights for enhancing teacher education programmes.

RQ2: Perceptions and Attitudes Towards Technology Integration into Teaching English

The second question in the study sought to explore the perceptions and attitudes of preservice teachers towards technology integration into English language teaching and the extent to which they were influenced by the TPACK-based course. Specifically, it examines their recognition of technology's importance in learning, their readiness for teaching with

technology, and their understanding of the affordances and constraints of technology in this context.

Recognition of the Importance of Technology in Learning. The findings revealed that, while preservice teachers recognised technology's importance in education, their prior experiences as students and preservice teachers often lacked opportunities to observe effective technology integration in teaching. This gap negatively impacted their initial teaching practices, leading many to rely on traditional, teacher-centred methods. In contrast, their experience in the course and with role models who used technology in their teaching motivated participants to adopt similar approaches in their own classrooms. This aligns with Tondeur et al., (2020), who suggest that preservice teachers' attitudes towards technology integration are shaped by the presence or absence of ICT-competent role models in their teacher education experience. It could be, therefore, likely that the course provided participants with structured opportunities to observe and experience best practices in technology integration, filling the gap left by their past experiences. These findings stress the importance of a supportive learning environment rich in examples of successful technology integration in shaping preservice teachers' perceptions and experiences (Alnasib, 2023; Redmond & Lock, 2019).

Readiness for Teaching with Technology. Participants entered the course with a sense of unpreparedness for integrating technology into their teaching. They cited a lack of technological skills, knowledge of technology-related teaching methods, knowledge of how to align technology with curriculum requirements, and stressed the need for courses to address these challenges. In addition, participants expressed mixed views about the necessity of technology integration, likely due to their limited readiness and exposure to effective practices. However, the course experience led to a notable shift in their readiness and attitudes. Participants reported a significant increase in their technological knowledge, which

enhanced their readiness to use technology in their classrooms. They felt better prepared to integrate technology into their curriculum, recognising the importance of aligning technological tools with educational objectives and learning outcomes. This post-course shift towards a more positive attitude is aligned with previous studies (Chai et al., 2010, 2019; Kayaduman & Delialioğlu, 2017) suggesting that the Learning Technology by Design approach can enhance participants' attitudes and perceptions of technology. Interestingly, the need for additional courses was no longer expressed post-course. It is possible, therefore, that the course has contributed to bridging the gap between participants' perceived needs and their actual abilities in technology integration, leading to a more positive view and increased readiness (Baran & Uygun, 2016; Drajati et al., 2021).

Affordances and Constraints of Technology Integration. Throughout the study, participants consistently acknowledged both the affordances and constraints of technology integration in teaching. They believed that the affordances of technology include its potential to transform pedagogical approaches towards more student-centred learning environments. This finding aligns with existing literature, such as the work of Fook et al. (2011) who found that preservice teachers showed an awareness of the way in which technology changes their teaching practices to student-centred forms of instruction. Participants also noted that technology could increase productivity, specifically enhance teaching processes and make tasks quicker and more efficient, a benefit that has not been covered in previous studies on TPACK development among English preservice teachers. Based on this finding, it is possible to suggest that the participants exhibited an understanding of how technology can facilitate their teaching practices (Mishra & Koehler, 2006). In addition, participants expressed their belief that technology enhances student engagement and academic performance. This result corroborates the ideas of previous studies, which found that preservice teachers believed that technology integration improves students' learning process (Fook et al., 2011; Rehmat &

Bailey, 2014; Sadaf et al., 2012). However, despite these benefits, participants also identified the availability of resources as a significant constraint. Limited access to technological tools and infrastructure was a major challenge, consistent with earlier studies (Farhadi & Öztürk, 2023; Le & Song, 2018; Mouza et al., 2014; Siregar et al., 2024; Zipke, 2018) which highlight the negative impact of resource constraints on preservice teachers' perceptions and ability to integrate technology. This stresses the importance of providing preservice teachers with access to well-equipped learning environments during their training and practice teaching to fully prepare them for technology integration (Abedi et al., 2024; Mouza et al., 2014).

In conclusion, the study reveals a shift in preservice teachers' attitudes towards technology integration, driven by their experiences in the TPACK-based course. Initially, their limited exposure to effective technology use led to a reliance on traditional methods, but the course improved their technological skills and readiness, developing more positive attitudes. Despite this positive change, participants' recognition of the benefits of technology, such as enhancing student-centred learning and productivity, remained consistent. This is likely because these advantages were clearly demonstrated throughout the course, emphasising their importance. However, participants also consistently identified resource constraints as a challenge, reflecting the necessity for enhanced support and better access to technological resources to increase the benefits of technology integration.

RQ3: Impact of the Course on Preservice Teachers' Conceptions of Learning and Teaching with Technology

The third question in the study sought to explore the way in which the TPACK-based course impacted the conceptions of preservice teachers of learning and teaching with technology.

Impact on English Language Learners. The course was perceived by preservice teachers to have a positive impact on English language learners. Participants reported that their own learning through the TPACK-based course translated into what they believed was improved comprehension and development of English language skills among their students. These perceptions suggest that TPACK development during the course may have extended beyond theoretical understanding and into classroom practice. While these impressions were not independently verified through learner assessment, they offer insight into how participants interpreted the influence of their teaching on students' engagement and learning. This supports the idea that TPACK development in course experiences is not merely theoretical but has perceived tangible benefits in field practices, possibly bridging the gap between preservice training and classroom application (Kurt et al., 2013; Syamdianita & Cahyono, 2021). In addition, participants perceived a transformation in their students' roles from passive receivers of knowledge to active participants in the learning process. This shift aligns with existing studies that highlight the role of TPACK-based courses in promoting active learning environments, where school students engage more deeply with the material and with each other (Admiraal et al., 2017; Aktaş & Özmen, 2020; Drajati et al., 2021; Kharade & Peese, 2014). In addition, the course was also perceived to have strengthened students' critical thinking skills through technology integration, aligning with earlier research that connects the use of technology in teaching with cognitive development (Buss et al., 2015; Ersanlı, 2016). Moreover, participants noted that the course fostered a sense of competition among students, further motivating their learning. This observation echoes earlier studies that have highlighted the positive influence of TPACK-based courses on school students' competitiveness. For instance, Admiraal et al. (2017) identified an enhanced sense of competition among school students as a result of technology integration, specifically through gamified assessments like Socrative's Space Race. This finding aligns with this

study, where participants reported increased student engagement and active participation, driven by competitions with technology. The significance of these findings, as perceived by the participants, relates to their views on how the course influenced English language learners. The findings suggest that the course may have contributed to the field of English language teaching by supporting participants in developing an understanding of how technology can facilitate students' learning processes and language acquisition (Van Olphen, 2008). In addition, the findings suggest that the course supported preservice teachers in developing their understanding of how technology can transform educational practices and promote student-centred learning, beyond its traditional role as a mere delivery tool (Durdu & Dag, 2017; C.-J. Lee & ChanMin, 2017).

Impact on the Preservice Teachers. The findings indicate that the TPACK-based course was perceived by participants as having a positive influence on their career preparedness, confidence, active engagement, and skill development. Firstly, the participants perceived the course as valuable for its direct influence on their future careers as English teachers. They reported that the skills gained in technology planning and implementation enhanced their readiness to integrate technology into their teaching practices. This finding is consistent with those of previous studies (Chai et al., 2010; Drajati et al., 2021), which also noted that course experiences contributed to preservice teachers' preparedness and perception of their competencies for their future careers. Secondly, the participants believed that the course increased their confidence in lesson planning, activity design, and technology integration, corroborating findings from previous studies that link design-based learning with increased confidence (Bich Dieu et al., 2019; Foulger et al., 2012; Le & Song, 2018; Muslimin et al., 2022; Sancar-Tokmak & Yanpar-Yelken, 2015; Zipke, 2018). Thirdly, participants reported a shift from focusing solely on passing the course to a deeper engagement. It is possible, therefore, that the participants were driven by a recognition of the

course's practical relevance, which further enhanced their motivation for teaching with technology. Lastly, participants acknowledged the course's role in supporting their TPACK development, aligning with previous research suggesting that such courses can help equip preservice teachers with the necessary skills for technology-enhanced language instruction (Bich Dieu et al., 2019; Fook et al., 2011; Kayaduman & Delialioğlu, 2017; Koçoğlu, 2009). These findings stress the importance of integrating technology-focused training in teacher education to better prepare future educators.

Value of the Course Design. The current study found that the participants perceived the course activities and structure as valuable for gaining knowledge about teaching and learning with technology. The course was valued for several key elements: collaboration with peers, learning effective teaching methods, exploration of ICT tools, design and implementation activities, and reflective practices. Firstly, participants believed that working with and learning from peers contributed to their knowledge of technology integration. This finding supports the idea that designing activities in teams is a key method to TPACK development (Tondeur et al., 2012) through dialogue, interaction, collaboration, and co-construction of ideas (Koehler & Mishra, 2005a). This also corresponds with previous studies that highlight the positive impact of collaborative design activities on preservice teachers (Aşık et al., 2018; Cengiz & Kaçar, 2024; Jin & Harp, 2020; Kayaduman & Delialioğlu, 2017; Koçoğlu, 2009; Nguyen & Bower, 2018). Secondly, the participants believed that the course was important in helping them develop their knowledge about integrating teaching methods with technology and content. This supports the work of previous studies, which show that participants developed an understanding of the interrelationship of the three components of technology, content, and pedagogy (Bich Dieu et al., 2019; Kurt et al., 2013, 2014; Kwangsawad, 2016; Mei et al., 2018). Thirdly, the participants' conceptions of teaching with technology changed as they gained knowledge of learning theories related to

technology integration which supports the work of other studies that emphasise the importance of developing theoretical knowledge to contribute to an understanding of TPACK (Admiraal et al., 2017; Agyei & Voogt, 2015; Angeli & Valanides, 2015; Durdu & Dag, 2017; Jeong, 2017; Kurt et al., 2014). Fourthly, the participants viewed the course positively, reporting that it provided them with practical knowledge of ICT tools for teaching English, and supported in shifting their view of technology from a reinforcement tool into a tool to support students' development (Aşık et al., 2018; Drajati et al., 2021; Özgün-koca et al., 2009). This aligns with Baran and Uygun (2016) and Aktaş and Özmen (2022), whose participants also acknowledged the importance of investigating ICT tools in developing their technology integration skills. Fifthly, the design activities within the course were seen as essential for developing participants' knowledge of technology integration, a finding that matches those observed in earlier studies (Agyei & Voogt, 2015; Aktaş & Özmen, 2022; Baran & Uygun, 2016; Bich Dieu et al., 2019; Drajati et al., 2021; Kayaduman & Delialioğlu, 2017; Limbong, 2017; Nguyen & Bower, 2018). Sixthly, participants valued the process of practical application in micro and macroteaching and considered it useful for learning how to teach with technology. This aligns with previous studies which found that preservice teachers perceived practical application processes as having a positive impact on the development of skills and TPACK (Adipat, 2021; Agyei & Voogt, 2015; Akkoç, 2011; Aktaş & Özmen, 2022; Ansyari, 2012; Bich Dieu et al., 2019; Kurt et al., 2014; Kwangsawad, 2016). Finally, the participants perceived the reflective practices in the course as a valuable aspect of their professional development, which aligns with the findings of previous studies (Bich Dieu et al., 2019; Nguyen & Bower, 2018) that suggest reflective activities can support the development of TPACK.

It is interesting to mention that the participants identified the TPACK-DBL principles within the course as fundamental to their perceived TPACK development. Thus, this study

suggests that integrating TPACK-DBL may support preservice teachers' conceptions and practices regarding technology integration in teaching and learning. Engaging teachers in design activities may have shifted their practices from traditional instruction to advanced knowledge creation, offering a new perspective on teaching and learning (Chai et al., 2013). This aligns with previous studies (Baran & Uygun, 2016; Bich Dieu et al., 2019) that implemented the TPACK-DBL principles in their course design and reported positive influences on preservice teachers' understanding and development of TPACK.

This study produced results that corroborate the findings of a great deal of the previous work that shows TPACK development in design-based learning environments (Baran & Uygun, 2016; Syamdianita & Cahyono, 2021). However, the course design in this study differs from many previous studies in the field of preservice English teachers' TPACK development due to the employment of all TPACK-DBL principles combined in one course. Although Baran and Uygun (2016) state that TPACK-DBL principles can be integrated as a whole or in different combinations, there is something of a disadvantage to partial integration of the principles as there are flaws with some of the literature in the field of preservice English teachers' education that employ only some of these principles. For instance, one flaw is connected with the lack of opportunities for teaching in authentic settings (Kayaduman & Delialioğlu, 2017) and another is the focus on ICT tools in isolation from practical application (Limbong, 2017). Therefore, this study offers qualitative insights into the potential value of a comprehensive integration of all TPACK-DBL principles in preservice teacher education to maximise TPACK development.

Summary

The purpose of this qualitative case study was to investigate the development of TPACK in preservice English teachers through a course designed based on the TPACK framework. By employing self-report data, performance assessments, and observations, the

study aimed to explore not only the development of TPACK but also the preservice teachers' perceptions of technology integration as influenced by their participation in this course.

The study's findings in relation to RQ1 showed that preservice English teachers experienced development in their TPACK throughout the course. This growth was observed through their engagement in design activities, microteaching, and macroteaching, where they demonstrated what appeared to be an enhanced ability to integrate technology with pedagogy and content. Specifically, in relation to SRQ1, which examined the relationship between design activities and TPACK development, the findings indicate that the preservice teachers' design activities strongly reflected TPACK constructs. These activities revealed progress in their TK, PCK, TPK, and overall TPACK. This development can be attributed to the structured design-based activities within the course, which provided opportunities for participants to explore, adapt, and apply various technological tools in pedagogically meaningful ways, aligning with curriculum goals and enhancing their teaching practices. Thus, the study stresses the importance of incorporating design-based activities in teacher education programmes to foster TPACK growth.

The study's findings in relation to SRQ2 stress the key role of microteaching and macroteaching in developing TPACK among preservice English teachers. Microteaching allowed participants to engage in teaching activities that facilitated technology integration into their teaching practices and contributed to their overall TPACK growth. Despite challenges in time management and technical issues during macroteaching, these experiences provided opportunities for participants to apply theoretical knowledge in real classroom settings. These experiences were further enriched through collaboration with mentor teachers, even though the preservice teachers often found themselves more technologically proficient than their mentors. Despite technical challenges, the practical application of TPACK in these settings supported the participants' ability to integrate technology with pedagogy and content.

Overall, the study concludes that the combination of microteaching and macroteaching experiences contributed to the preservice teachers' TPACK development. This suggests that future teacher training should emphasise the integration of both microteaching and macroteaching to better prepare preservice teachers for the complexities of technology-enhanced teaching.

The findings related to SRQ3 show a transformation in the teaching methods and technology integration practices among preservice English teachers, reflecting a shift from traditional, teacher-centred approaches to more student-centred strategies. Before the course, participants exhibited limited TPACK, with technology primarily used for basic presentations and traditional instruction methods. However, through design activities, microteaching, and macroteaching experiences during the course, they appeared to have developed their ability to integrate technology into their pedagogical practices, enhancing both their teaching methods and the instruction of English language skills. This development was evident in the shift towards collaborative activities, interactive tools, and enhanced assessment methods, which not only improved classroom engagement but also supported the development of students' language skills across various domains, including grammar, vocabulary, reading, listening, speaking, writing, and literature. This study's distinct contribution is its holistic approach to TPACK development, incorporating all language skills, and providing valuable insights for advancing English teacher education programmes.

The findings from RQ2 demonstrate that preservice teachers initially had limited exposure to effective technology integration, leading to a reliance on traditional teaching methods and a sense of unpreparedness. However, their experiences in the TPACK-based course appear to have shifted their attitudes, enhancing their technological skills, readiness, and recognition of technology's importance in creating student-centred learning environments. While the course was perceived as one that bridged gaps in their knowledge

and increased their confidence in using technology, participants consistently identified resource constraints as a major challenge to effective integration. These results stress the role of well-structured teacher education programmes in shaping positive attitudes toward technology integration, while also highlighting the need for access to adequate technological resources to fully realise the potential of technology in education.

Findings from RQ3 reveal that the TPACK-based course influenced preservice teachers' conceptions of teaching with technology, demonstrating significant perceived benefits for both their professional development and their students' learning experiences. The course was valued for bridging the gap between theoretical knowledge and practical application, with preservice teachers noting enhanced student engagement, improved language skills, and increased motivation through technology integration. These findings emphasise the importance of TPACK in fostering active learning environments and enhancing cognitive skills. In addition, the course's emphasis on TPACK-DBL development principles was valued by participants, further supporting its efficacy in preparing future educators. By integrating TPACK-DBL principles comprehensively, the participants felt that this helped them develop a deeper understanding and practical skills in technology. This highlights the potential of well-designed TPACK-based training in enhancing preservice teachers' readiness and confidence in using technology for English language instruction.

Chapter Seven: Conclusion

Introduction

The purpose of this study was to explore how a course designed around the TPACK framework impacts the development of preservice teachers' TPACK. The findings offer insights into TPACK development, provide practical implications for English Language training practices, and suggest policy recommendations for improving teacher training programmes.

Overview of the Study

This qualitative case study investigated the development of Technological Pedagogical Content Knowledge (TPACK) in preservice English teachers through a course designed around the TPACK framework, using self-report data, performance assessments, and observations. Addressing RQ1, the findings revealed TPACK growth through design-based activities, microteaching, and macroteaching, which enhanced participants' ability to integrate technology with pedagogy and content. In relation to RQ2, the course shifted preservice teachers' perceptions from traditional methods to more student-centred approaches, improving their technological skills and readiness for effective integration. Regarding RQ3, the course was perceived to support the transformation of teaching methods and to enhance student engagement and language skills, bridging the gap between theoretical knowledge and practical application. Overall, the study highlights the perceived value of a well-structured, TPACK-based course in advancing preservice teachers' readiness and skills for technology-enhanced teaching.

Contribution to the TPACK Framework

This study aligns with and contributes to existing research on the theoretical framework of TPACK. The theoretical framework TPACK was used in this study to investigate the development of preservice teachers' TPACK. The study of the TPACK

framework and its practical application has been the focus of scholars from around the world (Koehler & Mishra, 2009) who have studied the development of TPACK, measured TPACK, and assessed preservice teachers' TPACK. This study contributes to the burgeoning body of literature investigating TPACK development and its application within educational settings, especially within teacher preparation programmes. The study suggests that educational technology courses grounded in the TPACK framework may have the potential to advance preservice teachers' understanding of the interplay between technology, pedagogy, and content, as evidenced by the participants' ability to connect these elements (Koehler et al., 2012).

This study aligns with previous research investigating the development of TPACK and its practical application using the TPACK-DBL (Baran & Uygun, 2016) model and expands the literature on TPACK-DBL, which is underexplored (Alemdag et al., 2019; Baran & Uygun, 2016; Bich Dieu et al., 2019; E. Lee et al., 2017; Wah, 2018). The study supports the body of literature showing that TPACK-based course experiences can enhance preservice teachers' TPACK (Mouza, 2016). Evidence from this study indicates that participants perceived engaging in brainstorming, artefact design, ICT tool investigation, reflective practices, and peer collaboration under TPACK-DBL principles as supporting their TPACK development. Since the findings suggest that the course structure was perceived to support preservice teachers' development of TPACK and positively influenced their perceptions, attitudes, and acceptance of technology integration, this study contributes to the body of literature investigating the perceived influence of the TPACK-DBL instructional design model on the development of TPACK, particularly in the field of preservice teacher education where research on TPACK-DBL is scarce (Bich Dieu et al., 2019; E. Lee et al., 2017). A key strength of this research is its comprehensive integration of all TPACK-DBL principles within a single course, offering a distinct advantage over studies that apply only

partial principles. The findings suggest that incorporating all TPACK-DBL principles is perceived as having the potential to enhance preservice teachers' TPACK development.

The findings contribute to the existing literature on the development of TPACK among English language teachers. Despite an increase in studies examining TPACK in preservice education, there is a notable lack of research focusing on its development in content-specific subjects and providing concrete evidence of such development (Mouza, 2016; Voogt et al., 2013). This gap is particularly evident in English preservice education, where studies utilising TPACK as an analytical lens are rare (Chai et al., 2013; Tseng et al., 2022) and especially in the Israeli context, where, to the best of my knowledge, there are no known studies addressing TPACK development in English preservice education. The findings demonstrate that the participants designed activities reflecting a connection between technology, content, and pedagogy, indicating TPACK development. In addition, the findings reveal that participants developed instructional strategies using technology to teach all English language skills, a contribution not previously described in the literature examining performance-based investigations. In addition, the study highlights a transformation in participants' planning and teaching practices, reflecting a shift from teacher-centred to student-centred technology use, connected to various pedagogical techniques for content delivery.

In addition, the findings of the study provide insight into the development of English preservice teachers' TPACK through the examination of their design and practical implementation activities. Despite an increase in studies examining TPACK in preservice education, there is a notable lack of research focusing on its development in content-specific subjects and providing concrete evidence for such development (Mouza, 2016). This study contributes to the very few studies in the field of English (Adipat, 2021; Drajati et al., 2021; Kurt et al., 2014; Kwangsawad, 2016; Syamdianita & Cahyono, 2021) investigating evidence

of TPACK development through performance-based methods, as the majority of the studies in the field of preservice English education rely on self-report surveys (Ciptaningrum, 2017; Fook et al., 2011; Kurt et al., 2013; Mei et al., 2018; Muslimin et al., 2022; Öz, 2015; Sahin, 2011; Turgut, 2017a; Yet & Noordin, 2017). Therefore, the strength of this study lies in its use of a performance-based assessment approach, which provided deeper evidence of preservice teachers' TPACK development and implementation through the exploration of design and practical implementation activities. The findings suggest a shift from a theoretical understanding of technology integration to a practical, hands-on application, demonstrating that design and practical activities in teacher education courses support TPACK development.

Implications

The study highlights the perceived usefulness of TPACK-DBL in supporting preservice teachers' technology integration skills, encouraging its use in teacher training programmes. For policymakers, it highlights the need to improve resource access in schools and provide targeted professional development for both preservice and inservice teachers to bridge gaps in technology integration.

Implications for ELT Training Practices

The findings of this study reveal several key implications for English language teacher training practices. The TPACK-based course design was shown to impact preservice teachers' perceptions and practices regarding technology integration. Therefore, teacher trainers are encouraged to incorporate TPACK-DBL principles into their technology integration courses, as these methods were perceived as enhancing preservice teachers' skills in integrating technology. This study contributes to the practice of English teacher training by illustrating how a course informed by the TPACK-DBL principles can support the development of TPACK among preservice teachers. The findings highlight the value of collaborative learning by design and practical application as elements that appeared to

support participants' TPACK development. Emphasising these aspects in teacher training will enable preservice teachers to forge connections between technology, pedagogy, and content, rather than focusing solely on isolated components. Therefore, creating a collaborative, student-centred learning environment that emphasises learning by design and practical application in content-specific subjects is can be valuable for supporting TPACK development.

Implications for Policy Makers

The findings of this study provide implications for teacher training policymakers. Existing literature highlights the role of field placements in enhancing preservice teachers' TPACK (Mouza et al., 2014). However, this study reveals that preservice teachers encountered implementation challenges in real school settings, primarily due to limited access to resources. Therefore, it is essential for policymakers to prioritise efforts to make technology more accessible in schools to support preservice teachers during their practicum. Ensuring adequate resources and support should be a top priority for the government and education ministries to provide preservice teachers with a quality experience before they enter the profession.

The study also stresses the impact of educational experiences on preservice teachers' technology use, which has implications for policymakers. Firstly, the findings indicate that preservice teachers' practices were influenced by their previous academic experiences. Secondly, the study emphasises the importance of field placements with mentor teachers who possess strong TPACK, as these mentors significantly impact preservice teachers' development (Buss et al., 2018; Foulger et al., 2012; Meagher et al., 2011; Mouza et al., 2014; Stockless et al., 2022; Zipke, 2018). Therefore, training academic staff to integrate technology into their own teaching practices is crucial, as it allows them to model effective

technology use for preservice teachers. Additionally, there is a need for professional development programmes for inservice teachers to enhance their own TPACK. Such training will enable them to implement technology in their own teaching and better support preservice teachers as they learn to use technology in real classroom settings.

The study indicates that participants perceived their TPACK to have developed through engagement with TPACK-DBL principles. The course included activities that integrated theory, ICT tools, collaborative design, reflective practices, peer feedback, and practical application. These findings suggest that TPACK-DBL principles may play an important role in supporting preservice teachers' TPACK development. Policymakers should consider incorporating these principles into future technology courses and inservice training programmes. Teacher education institutions and education ministries can utilise these insights to design and implement training programmes that foster the development of TPACK in both preservice and inservice teachers.

Limitations and Future Research

While this study contributes to theory, practice and policy, it has several limitations which should be considered. Firstly, there are limitations related to the design of the study. This study relies only on a qualitative study design, which is richly descriptive (Merriam, 2014) with multiple sources of data to provide a deep insight into TPACK development. Future research could benefit from employing a mixed-methods design, integrating both qualitative and quantitative data to offer a more comprehensive analysis and comparison of TPACK development. In addition, there are limitations concerning the researcher's bias and the dual role of the researcher and the instructor which were discussed in the methodology chapter and include the efforts put forth to reduce bias and ensure the reliability of the data.

Secondly, despite the use of a rich set of data from multiple sources such as self-report data (interviews, feedback and peer assessment forms, blogs, and application reports), observations and performance assessment (design activities), the data collection for macroteaching in real school settings relied solely on participants' self-reports. However, since there might be a disparity between reports of implementation and actual practice, self-report instruments of macroteaching are not enough. To address this, future studies should combine self-report measures with direct observations and performance assessments of field practices to validate preservice teachers' TPACK development and application in real-world settings. A focus on TPACK in real-school settings could produce interesting findings that examine the relationship between gained knowledge in courses and evidence-based practical application in the field.

Thirdly, it is important to note that due to the qualitative design of the study, it is not possible to establish causality between specific course elements and the development of TPACK constructs. Although the data suggest that participants' TPACK developed over the course duration, the study design does not allow for a definitive attribution of this development to particular features of the course. Multiple interacting variables, including prior experiences, peer influence, and contextual factors, may have also contributed to participants' learning. Future research employing longitudinal or experimental designs could offer more insight into the causal relationship between course components and the development of specific TPACK elements.

Fourthly, the 12-week duration of the course may have been insufficient for preservice teachers to fully develop TPACK. Given the complex nature of TPACK, which involves understanding the intricate relationships between content, pedagogy, technology, and their contextual interactions (Mishra & Koehler, 2006), long-term exposure to TPACK is recommended. Therefore, a natural progression of this work is to investigate how prolonged

engagement influences TPACK development and provides deeper insights into individual growth over time.

Fifthly, the participants in the study were recruited from two simultaneous courses at a single higher education institution in Northern Israel. Although the findings show the development of the participants' TPACK by relying on multiple sources of data, they may not represent all preservice teachers taking technology courses in Israel. I believe that the findings can be possibly transferred to English preservice teachers enrolled in similarly structured educational technology courses based on the TPACK-DBL model. The study provides detailed descriptions of the participants, setting, data collection methods, and analysis procedures, which can help others assess the potential for transferability. However, further research is required to confirm this transferability. Additionally, future studies that include data from multiple academic institutions with similar course designs would be a fruitful area for further work and enhance the generalizability of the findings.

Lastly, the study primarily focused on English preservice teachers. Although the findings provide valuable insights, there is a need for more research across different subject areas and educational contexts to determine if the TPACK-DBL model's effectiveness is consistent across various disciplines. Exploring the impact of TPACK-DBL principles in diverse educational settings could offer a broader understanding of their applicability and effectiveness in different teaching contexts.

Summary

This study aimed to investigate the development of English preservice teachers' TPACK through a course designed based on the TPACK framework. It addressed three key questions regarding TPACK development, as well as perceptions and attitudes towards technology integration. The study involved design activities, microteaching, and

macroteaching to assess TPACK growth, and evaluated how the course influenced participants' attitudes and perceptions towards technology in English language teaching. The findings indicate that participants integrated technology, content, and pedagogy in their design activities and practical applications, reflecting their TPACK development. In addition, the course positively influenced their attitudes and perceptions of technology integration in education. Overall, this study reinforces the perceived value of TPACK-based courses in fostering TPACK among preservice teachers and contributes valuable insights into its development despite certain limitations.

Glossary

Term	Definition
Access to Information	A domain of the Israeli English curriculum referring to learners' ability to access information in English from oral and written sources using print and digital media, and the use of this information for various purposes (Ministry of Education, 2018b).
Appreciation of Language Literature and Culture	A domain of the Israeli English curriculum that involves learners' ability to appreciate the English language and literature, develop an awareness of how English differs from other languages, and foster an understanding of other cultures (Ministry of Education, 2018b).
Artefacts	Tools or objects developed by individuals for use in teaching and learning about technology. They are the outcome of knowledge production in the learning process (Vries, 2016), and are relevant to the classroom, serving practical purposes. Artefacts can be physical (e.g., documents) or digital (e.g., online presentations, blogs).
Benchmarks	Indicators of learner achievement in the Israeli English curriculum, defining what learners should be able to accomplish when learning English (Ministry of Education, 2018b).
Content knowledge (CK)	Knowledge of a subject matter, including its theories, concepts, practices, and approaches for developing knowledge of the subject matter. (Koehler & Mishra, 2009; Mishra & Koehler, 2006).
Domains	Areas of language ability and knowledge in the Israeli English curriculum, including four interconnected domains: Social

Term	Definition
	Interaction, Access to Information, Presentation, and Appreciation of Language, Literature, and Culture (Ministry of Education, 2018b).
Information communication technology (ICT)	Tools and digital technologies used to access, manage, disseminate, create, explore, organise, evaluate, and communicate information (Partnership for 21st Century Learning, 2015).
Learning by Design	A collaborative learning approach where teachers work in small groups to investigate pedagogically related problems and develop solutions using technology (Koehler & Mishra, 2005a)
Macroteaching	Teaching in regular classes in real school settings for 45-50 minutes.
Microteaching	A teacher training technique involving practising teaching skills conducted with a small lesson, a concept or a small number of students (Remesh, 2014), aiming to develop and analyse teaching in controlled conditions (Lakshmi, 2009).
Pedagogical content knowledge (PCK)	The combination of content and pedagogy, referring to the knowledge of teaching approaches and how they fit the content (Mishra & Koehler, 2006).
Pedagogical knowledge (PK)	Knowledge about the processes, practices, and methods for teaching and learning (Koehler & Mishra, 2009; Mishra & Koehler, 2006).
Presentation	A domain of the Israeli English curriculum focusing on learners' ability to present ideas in various formats when speaking and

Term	Definition
	writing in English, using print and digital media (Ministry of Education, 2018b).
Preservice teachers	Students enrolled in a higher education institution undergoing training to become practising teachers.
Social Interaction	A domain of the Israeli English curriculum that refers to learners' ability to interact in English in various social contexts with people from different backgrounds using spoken and written language (Ministry of Education, 2018b).
Technological Content Knowledge (TCK)	Knowledge of how technology and content influence one another and understanding how technology application can change the subject matter (Koehler & Mishra, 2009).
Technology Integration	The use and incorporation of computer and ICT-related activities into the teaching of the curriculum to support teachers' instruction and students' learning in the classroom.
Technological Knowledge (TK)	Knowledge about standard and advanced technologies and how to operate them (Mishra & Koehler, 2006).
Technological Pedagogical Content Knowledge (TPACK)	The combination of knowledge of technology, content, and pedagogy resulting in effective teaching with technology (Koehler & Mishra, 2009; Mishra & Koehler, 2006).
Technological Pedagogical Knowledge (TPK)	An understanding of how particular technologies can change teaching and learning when used in specific ways (Koehler & Mishra, 2009).

Term	Definition

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Appendices

Appendix A

Research Participant Profile

Category	Description
Total Participants	24
Education Programme	English Language and Literature B.Ed. (Third Year)
Institution	Teacher education college in Israel
Course	*Models of Pedagogical Implementation of ICT into Teaching English*
Semester	First semester of the academic year
Course Duration	12 weeks
Classroom Setting	Computer lab with individual computers
Session Length	1.5 hours
Recruitment	Purposive sampling via email invitation with consent form

Appendix B

Precourse Interview Protocol

In this interview, we will discuss the subject of technology in education. I am interested in your opinion and your experience. There are no right or wrong answers, just be as honest as possible. You can answer the questions in English or in Arabic. I will be tape-recording our conversation since it is hard for me to write down everything while having a conversation with you. Everything you say will remain confidential.

Interview questions:

What are your views about technology integration in education?

Have you tried using technology during your teaching practice? What did you do? (If they did not ask why)

Share an experience that involved use of technology. If you did not, why? Would it have made a difference if you had used it?

What do you expect to learn in the technology course?

Do you think technology can enhance students' learning outcomes? Why?

What do you think you need to be better prepared to use technology in your teaching?

How do you think you can use technology to develop students' learning in all four domains of the curriculum?

Would consider the use of technology when you become a teacher? Why/ why not?

Why do you find the technology important or unimportant?

What might influence your decision to use technology in your classes?

What are your ideas and beliefs about teaching and learning in English?

What is your objective for using technology in English teaching?

How do you think the use of technology can make a change in teaching and learning (reflect on your experiences both as a teacher candidate and a student).

What are the non ICT/ ICT tools that you use in the teaching/learning process now that you have finished the course?

What do you think the use of technologies means? What does the use of technology mean to you?

Postcourse Interview Protocol

In this interview, we will discuss the subject of technology in education and your experience in the course. I am interested in your opinion and your experience. There are no right or wrong answers, just be as honest as possible. You can answer the questions in English or in Arabic. I will be tape-recording our conversation since it is hard for me to write down everything while having a conversation with you. Everything you say will remain confidential.

Postcourse interview questions

How has this course helped you to become a future teacher? In what ways has the course been helpful?

What is the most useful thing you learned/experienced that can help you in your future teaching?

Can you give an example of something new you learned during the course that you did not know before taking it?

After taking the course, do you feel more confident in integrating technology into your teaching practices? How so?

Now that you have taken the course, what are your thoughts about the integration of technology in education? Have your thoughts changed?

Did the course meet your expectations? Why?

How have you used technology in your teaching during the practicum after taking the course?

Has the way you use technology in education changed after taking the course?

How can you use what you learned to develop students' learning in all four domains of the English curriculum?

As you moved through the course, how were you able to integrate technology into your lessons?

would consider the use of technology when you become a teacher? Why/ why not?

What is your objective for using technology in English teaching?

How do you think the use of technology can make a change in teaching (reflect on your learning process).

What are the non ICT/ ICT tools that you use in the teaching/learning process after taking the course?

What do you think the use of technologies means? What does the use of technology mean to you?

Appendix C

Technology Integration Peer Feedback (Microteaching)

Observer:

Teacher:

Learning goal:

What is the technology used in teaching?

How did the student teacher use the technology?

How did the use of technology change the lesson? Would it be different without the use of technology?

TPACK- How did the student teacher integrate content, pedagogy and technology?

If you were the teacher, would you change anything? How?

Appendix D

Application Report

Please submit a report (at least 250 words) explaining your experience in integrating technology during your practicum. You may relate to the following questions:

What did you do during the lesson/s? what was your role?

What did your students do with technology? What was the students' role?

What type of technology did you use? Why did you choose that type of technology?

What is the purpose of using the tool/technology?

How did you integrate the technology into your lesson?

How did the technology change your lesson?

What domain of the curriculum did you use to apply the technology? Why did you choose this domain?

How did you integrate TPACK (content, pedagogy and technology) in your lesson?

How did your students react?

Do you think the lesson/s was/were successful? Why?

Is there anything you would change in the lesson/s? why?

What are your thoughts/ reflections about the lesson/s?

*you can add screenshots and/or links to illustrate

Appendix E

Observation Protocol

Date:

Name:

Aim of the lesson:

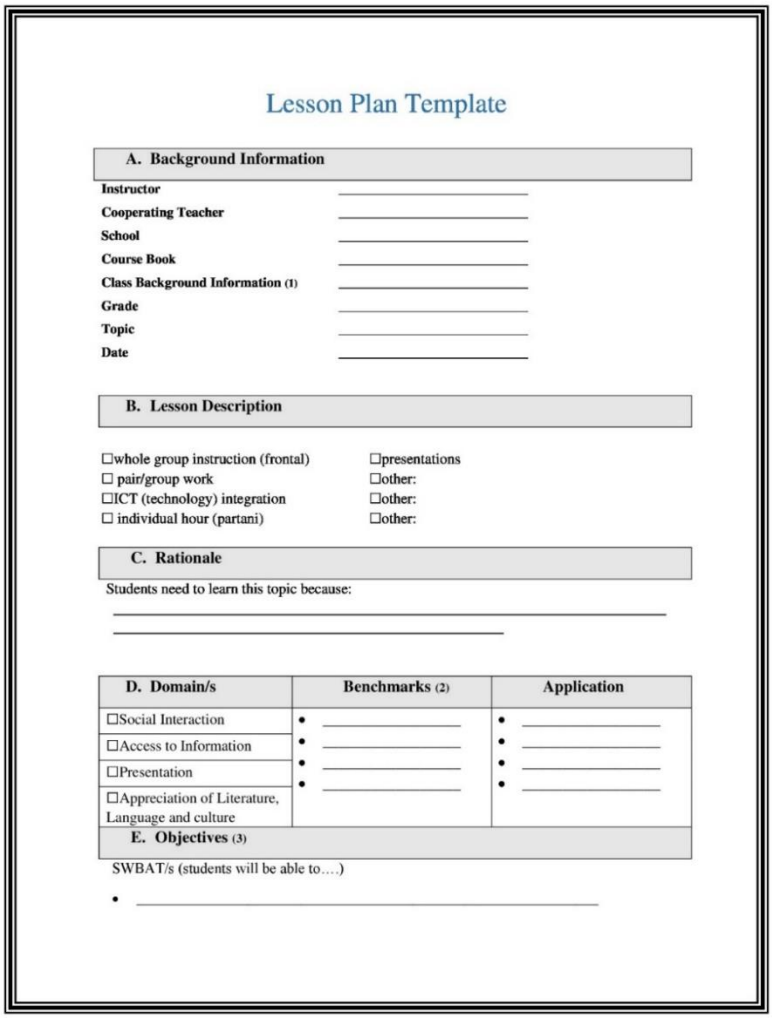
TPACK Constructs	Guiding questions	Answers
Technology Knowledge (TK)	Does the preservice teacher show knowledge of the technology tool/s? Does the preservice teacher show ability to use the technology for the purpose of using it in the lesson?	
Content Knowledge (CK):	Does the preservice show an understanding of the English language in terms of structure and content and how to develop the language?	
Pedagogical Knowledge (PK):	Does the student show an ability to use appropriate teaching methods? Does the preservice teacher structure the lesson to develop students' knowledge of the language?	
Pedagogical Content Knowledge (PCK):	Does the preservice teacher show the ability to teach English using different teaching methods which fit the content and promote learning?	
Technological Content Knowledge (TCK):	Does the preservice teacher show the ability to select the appropriate technology which fits the English classroom content and show an understanding how the use of the tool can change the way English is taught and learned?	
Technological Pedagogical Knowledge (TPK):	Does the preservice teacher show the ability to select technologies which enhance the lesson, students'	

	learning and the teaching approaches?	
Technological Pedagogical and Content Knowledge (TPACK):	Does the preservice teacher show the ability to select appropriate technologies to teach English using different pedagogical approaches?	

Additional comments:

Appendix F

Lesson Plan Template



Lesson Plan Template

A. Background Information

Instructor _____
Cooperating Teacher _____
School _____
Course Book _____
Class Background Information (1) _____
Grade _____
Topic _____
Date _____

B. Lesson Description

☐whole group instruction (frontal) ☐presentations
☐ pair/group work ☐other:
☐ICT (technology) integration ☐other:
☐ individual hour (partani) ☐other:

C. Rationale

Students need to learn this topic because:
_____
_____

D. Domain/s	Benchmarks (2)	Application
☐Social Interaction	• _____	• _____
☐Access to Information	• _____	• _____
☐Presentation	• _____	• _____
☐Appreciation of Literature, Language and culture	• _____	• _____

E. Objectives (3)

SWBAT/s (students will be able to….)

• _____

- _____
- _____

F. Additional Information	
Topic related vocabulary	_____, _____, _____, _____, _____, _____, _____, _____, _____,
Grammar	
Text type (4)	
Question/ item types (5)	
HOTS (6)	
Reading/ Listening/ Writing and Speaking Strategies (7)	

G. Lesson Procedure				
Time	**Stage of Lesson**	**Activity**	**Mode of Interaction** (Whole class/ Group/Pair /Independent work	**Materials/ Tools** (See Note 8 for possibilities)
	Opening (May include: warm-up, brainstorming, review of previously learned material ,introducing the topic)			
	Body (May include written / oral practice)			

	Closure (May include: summary of main points covered, pupils' reflection)			

Homework assignment:	
Teacher's reflection:	

Note 1	Heterogeneous class/Partani hour (enrichment, LD pupils, other)/ Streaming A,B,C,D(JH)		
Note 2	English Curriculum (http://www.education.gov.il/tochniyot_limudim/english.htm) Textbook Teacher's Guide		
Note 3	**Examples of verbs to use in defining objectives:** write , act out , talk about , design , use , complete , answer , ask, match, put in the correct order (sequencing), compare, predict, show understanding of cause & effect/different perspectives …, explain why/how … distinguish, identify, evaluate, produce, describe, respond, recognize, express, present, react, create, infer, assemble, change, compose, create, connect, ask, choose, practice, follow, share, initiate, define, describe, name, classify, explain, solve, predict, infer, summarize.		
Note 4	**Examples of text types:** advertisement announcement broadcast/radio program conversation excerpt from a lesson interview message news report weather report oral presentation timetable/schedule short expository text recipe list	story article biography book cover brochure blurb comic strip diary entry graph letter message notice/note instructions/directions labels poster	Postcard review riddles travel guide web page flyer description opinion email forum speech speech bubbles questionnaire captions
Note 5	**Examples of question/item types:** filling in a chart / table – matching - multiple choice-open-ended (e.g. w/h-questions and sentence completion) –sequencing- graphic organizers (http://edhelper.com/teachers/graphic_organizers.htm) (e.g. Venn diagram/cause & effect/ flow chart/pie chart/ bar graph/KWL chart/ story map)		
Note 6	**HOTs**: predicting, applying, inferring, sequencing, identifying parts and whole, classifying, comparing and contrasting, explaining patterns, explaining cause and effect, distinguishing different perspectives, problem solving, uncovering motives, generating possibilities, synthesizing, making connections, evaluating.		
Note 7	**Examples**: skimming, scanning, brainstorming, main idea/ supporting ideas, sequencing, cause and effect, compare and contrast, previewing and predicting, specifying purpose, identifying genre, questioning, recognizing topics, recognizing patterns of relationships, identifying and using words which signal the patterns of relationships, recognizing and using pronouns, referents, and other lexical equivalents as clues to cohesion, guessing the meaning of unknown words from the context, paraphrasing, summarizing, drawing conclusions, reading critically.		
Note 8	**Examples:** digital tools, flashcards, games, worksheets,…..etc		

Source: Ministry of Education, Israel

Appendix G

Participant information sheet

I am a PhD student at Lancaster University, and I would like to invite you to take part in a research study about The development of Pre-Service English Teachers' Technological Pedagogical Content Knowledge (TPACK).

Please take time to read the following information carefully before you decide whether or not you wish to take part.

What is the study about?

This study aims to research how a TPACK-based course affects pre-service teachers' TPCK development.

Why have I been invited?

I have approached you because you are taking part in the technology course at colleg and I am interested in understanding the development of preservice teachers' TPACK in the technology course.

I would be very grateful if you would agree to take part in this study.

What will I be asked to do if I take part?

If you decided to take part, this would involve the following:

- Two interviews (30-60 minutes)
- Designing activities and lesson plans (as part of the course)
- Microteaching (as part of the course)
- Reporting on macroteaching (as part of the course)
- Reflective journals (as part of the course)

What are the possible benefits from taking part?

If you take part in this study, your insights will contribute to my understanding of the way in which technology courses help preservice students develop their TPACK. In addition, the study will contribute to the participants' professional development as they will have a better understanding of how they can use technology in their own teaching practices.

Do I have to take part?

No. It's completely up to you to decide whether or not you take part. Your participation is voluntary.

If you decide not to take part in this study, this will not affect your studies and the way you are assessed on your course

What if I change my mind?

If you change your mind, you are free to withdraw at any time during your participation in this study. If you want to withdraw, please let me know, and I will extract any ideas or information (=data) you contributed to the study and destroy them. However, it is difficult and often impossible to take out data from one specific participant when this has already been anonymised or pooled together with other people's data. Therefore, you can only withdraw up to 2 weeks after taking part in the study

What are the possible disadvantages and risks of taking part?

It is unlikely that there will be any major disadvantages to taking part.

Will my data be identifiable?

After the interview/focus group/observation, only I, the researcher conducting this study will have access to the ideas you share with me. The data may be shared with my supervisors Dr. Melis Cin and Dr. Julie-Ann Sime if requested.

I will keep all personal information about you (e.g. your name and other information about you that can identify you) confidential, that is I will not share it with others. I will remove any personal information from the written record of your contribution.

Participants in the focus group will be asked not to disclose information outside of the focus group and with anyone not involved in the focus group without the relevant person's express permission. All data will be anonymized including names and places.

How will we use the information you have shared with us and what will happen to the results of the research study?

I will use the information you have shared with me only in the following ways:

I will use it for research purposes **only. This will include my PhD thesis and other publications** such as **journal articles. I may also present the results of my study at academic conferences** and **inform policy-makers about** the **study.**

When writing up the findings from this study, I would like to reproduce some of the views and ideas you shared with me. I will only use anonymised quotes (e.g. from my interview/ focus group **with you), so that although I will use your exact words, you cannot be identified in our publications.**

How my data will be stored
Your data will be stored in encrypted files (that is no-one other than me, the researcher will be able to access them) and on password-protected computers. I will store hard copies of any data securely in locked cabinets at my home. I will keep data that can identify you separately from non-personal information (e.g. your views on a specific topic). In accordance with University guidelines, I will keep the data securely for a minimum of ten years.

What if I have a question or concern?

If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact myself Nahla.shaw@gmail.com +972545550342 or any of my supervisors:

Dr. Julie-Ann Sime Department: Educational Research Tel: +44 (0)1524 594726 j.sime@lancaster.ac.uk	Dr. Melis Cin Department: Educational Research Tel: +44 (0)1524 592884 m.cin@lancaster.ac.uk

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact the Academic Director of the Doctoral Programme in E-Research and Technology Enhanced Learning**:**

Dr. Brett Bligh
Department: Educational Research
Tel: +44 (0)1524 592863
b.bligh@lancaster.ac.uk

This study has been reviewed and approved by the Faculty of Arts and Social Sciences and Lancaster Management School's Research Ethics Committee.

Thank you for considering your participation in this project.

Appendix H

CONSENT FORM

Project Title: The development of Pre-Service English Teachers' TPACK through a course based on TPACK

Name of Researcher: Nahla Nassar

Email: Nahla.shaw@gmail.com

Please tick each box

I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily	☐
I understand that my participation is voluntary and that I am free to withdraw at any time during my participation in this study and within 2 weeks after I took part in the study, without giving any reason. If I withdraw within 2 weeks of taking part in the study my data will be removed. If I am involved in focus groups and then withdraw my data will remain part of the study. I understand that as part the focus group I will take part in, my data is part of the ongoing conversation and cannot be destroyed. I understand that the researcher will try to disregard my views when analysing the focus group data, but I am aware that this will not always be possible.	☐
If I am participating in the focus group I understand that any information disclosed within the focus group remains confidential to the group, and I will not discuss the focus group with or in front of anyone who was not involved unless I have the relevant person's express permission	☐
I understand that any information given by me may be used in future reports, academic articles, publications or presentations by the researcher/s, but my personal information will not be included and I will not be identifiable.	☐
I understand that my name will not appear in any reports, articles or presentation without my consent.	☐
I understand that any interviews or focus groups will be audio-recorded and transcribed and that data will be protected on encrypted devices and kept secure.	☐
I understand that data will be kept according to University guidelines for a minimum of 10 years after the end of the study.	☐
I agree to take part in the above study.	☐

_____ _____ _____

Name of Participant Date Signature

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent_____ Date
_____ Day/month/year

One copy of this form will be given to the participant and the original kept in the files of the researcher at Lancaster University