Pre-service Teachers and Teacher Educators Perceptions of Technological Pedagogical Knowledge and Professional Identity Development

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Abstract: This study intended to investigate pre-service teachers' and teacher educators' perceptions of technological pedagogical knowledge and professional identity development. The research was conducted with 152 English Language Teaching (ELT) pre-service teachers and 73 teacher educators from various universities in Iraqi Kurdistan. Using a mixed-method, the data for this study was collected through semi-structured interviews as well as a Technology, Pedagogy, and Content Knowledge survey questionnaire. Thematic analysis and SPSS 24 were employed for analyzing the interview responses and survey data, respectively. From this data, both pre-service teachers and teacher educators perceived a high rate of proficiency in their pedagogical content knowledge as well as familiarity with simple traditional technologies, while they lacked some knowledge of professional technologies. Participants also mostly agreed that pedagogical technologies are effective and affect their professional identity development. However, there were a few participants who believed these technologies were not more effective for their teaching practice and professional identity development. The implications of the study are stated, and some suggestions for further studies in this regard are provided.

Key words: Pre-service teachers, Teacher educators, Teachers` professional identity, Technology, Pedagogy, and Content Knowledge (TPACK)

Introduction

In today`s communities, technological instruments have been considered a medication for traditional issues in education (Mohammadkarimi & Amin, 2019). Based on this medical approach, proper integration of technologies in education involves students in a way that leads to creating knowledge, and consequently, the belief that students will acquire skills and knowledge to thrive in future workplaces and live in modern communities. Technological instruments are introduced to education through various approaches. Policy-makers (at the national or university level) and other relevant stakeholders within universities, including parents, have facilitated the implementation of these educational technologies in response to a growing demand for their integration within contemporary educational institutions. Various external entities, such as non-governmental organizations, with similar perspectives and approaches, have contributed to the

introduction of these technological instruments into the realm of education. With the aim of facilitating the availability of these technologies, it was expected that teachers would incorporate them more frequently into their teaching practices compared to traditional tools (Cornu, 2003).

With the growth of technology, the number of technological tools that are used for pedagogical purposes has increased. In Iraqi Kurdistan, like in other parts of the world, language teachers use at least some of these tools (such as laptops and projectors) in their teaching. Although utilizing different technologies for teaching purposes might influence the effectiveness of teaching and provide striking learning opportunities (Engeness, 2021), as well as an enjoyable environment for learners, it imposes more demands on teachers and could affect their professional identity (Lai & Jin, 2021). Therefore, technology can cause teachers to adapt their roles and practices, or alternatively, they may resist the technological change (Goos, 2014).

It is not clear to what extent teachers in Iraqi Kurdistan are familiar with and utilize technological pedagogical tools. Particularly, since the beginning of the Corona Virus period until now, some teachers have had to employ various tools for online lectures, depending on their institutes.

Some universities spend a considerable amount of money and effort on providing recent pedagogical technologies (such as smart boards), but it`s not clear where the required training for using them is provided for teachers and students. In addition, teachers` beliefs about the effectiveness of pedagogical tools are somehow ambiguous (Li et al., 2019; Van Twillert 2020).

Moreover, the stability of teachers` professional identities strongly affects the effectiveness of their teaching practices (Avidov-Ungar & Forkosh-Baruch, 2018; Richardson & Watt, 2018). This study aims to address a relatively unexplored area of research in Iraqi Kurdistan, focusing on the effects of technology on the technological pedagogical knowledge and professional identity development of pre-service teachers and teacher educators. The primary objective of this study is to investigate their perceptions regarding the impact of technology on language teaching. Specifically, the study examines the level of familiarity of English language teachers with different technological pedagogical tools in their teaching practices, their willingness to incorporate technology in their teaching, and the potential influence of technology on their professional identity development, as perceived by pre-service teachers and teacher educators. By exploring these aspects, this research seeks to contribute to a better understanding of the role of technology in language education in the context of Iraqi Kurdistan.

Literature Review

In contemporary times, technology has become deeply ingrained in the daily lives of a vast majority of students across various educational levels through the utilization of diverse devices and software applications. Although there is enough evidence from research over the last decades about the positive effects of technology on education (Higgins et al., 2012) and more emphasis on integrating technology into education (Falloon, 2020; Picciano, 2021), one question is to what extent technology has been used as a facilitator for students` improvement and how it can be used in education. Moreover, since some studies show low levels of improvement in the use of technology in some teaching contexts (Higgins, et al., 2012), another issue is the effective use of technology to make teaching and learning more effective.

A distinct perspective for understanding the association between pedagogical beliefs and technology could be observed in identifying Technology, Pedagogy, and Content Knowledge

(TPACK) (Baser et al., 2016). This notion developed from the Pedagogical Content Knowledge (PCK) concept of Shulman (1987). Mishra and Koehler (2006) defined the TPACK as interacting among three knowledge sections: knowledge of technology, knowledge of subject content, and knowledge of pedagogy. They also explained the TPACK as the basis of good teaching with technology, and the notion has been commonly utilized in the setting of schools and as a criteria for development of staff.

Before integrating technology into language learning and teaching, there are also other issues that require attention. The extent of integration of technology in education, processes of its implication, considering students` needs and levels, its effectiveness, and related challenges are some concerns of using technology in education (Reinders, 2006). One of these challenges is using technology in practice by teachers (Chun et al., 2016). In this regard, various issues may arise, such as the level of familiarity of teachers with technology, the beliefs, and attitudes of teachers about technology, and time constraints, which could affect teachers` identities. Therefore, investigating the potential impacts of technology on teachers and their identities, and students` perceptions in this regard is crucial.

According to Alsup (2005), only teachers who have established an identity as well-rounded, rich, or having a sense of self are genuinely effective in the classroom. This claim is supported by the results of large-scale longitudinal research done by Day et al. that found a link between fixed teaching identities and teacher performance (Day et al., 2006). This study was framed by these results, which show that in order to be a teacher, one should create a comprehensive teacher identity. Realizing this process and how to successfully scaffold it might help enhance the quality of teacher education programs, resulting in better instructors, higher professional satisfaction levels, and increased retention of teachers (Danielewizc, 2001).

As the role of technology may differ in the classroom, the role of teachers and their identity may also be negotiated in association with applying technology. Several studies (Eslamdoost et al., 2020; Sardabi et al., 2018; Vokatisa & Zhang, 2016) in various fields examined the negotiation of teachers` professional identities in using technology. Many factors may affect teachers` use of technology, such as their knowledge, motivation, self-efficacy, beliefs, community of practice, and availability of technology, and consequently, based on these factors, they may reconstruct their identities. In an attempt to explore three pre-service music teachers' identities during their practicum, Pike (2015) found that pre-service teachers promoted their teacher identity and pedagogical effectiveness. In another case study, Vokatisa and Zhang (2016), using interviews, reflection journals, and observations, explored the professional identities of three teachers who were teaching in an elementary school in relation to the use of technology. These teachers had the most extensive experience with knowledge-building pedagogy at their school. Their results showed that teachers in computer-assistant programs in classrooms negotiate their professional identities. Their new professional identities involve teachers as innovative collaborators with colleagues, co-learners with students, problem-solvers to address contextual challenges, and vision-driven professional knowledge builders.

In another paper on 30 schools in Kurdistan, Taha (2019) employed a mixed-method approach for gathering and analyzing data from 30 instructors and 30 students in order to assess the influence of technology on their learning and teaching. It also inquires about the degree to which instructors and students employ technological tools for learning and teaching. Based on Taha`s interviews with both instructors and students, there is strong and convincing evidence to suggest that technology has a significant beneficial influence on both the processes of teaching

and learning. Moreover, according to this study's findings, students, rather than instructors, employ electronic tools for educational purposes.

Moreover, Ismail, Abdulsalam, and Abdulrahman (2018), in their study, looked at the current state of educational technology in Kurdistan to get insight into potential growth opportunities. They investigated relevant scientific publications and other resources, as well as the development of educational technology in some universities in Kurdistan. Based on the results, they concluded that higher education teachers should be aware of and take advantage of emerging technological trends, including cloud services, virtual reality, and adaptive learning. University professors in Kurdistan should use more sophisticated technology in their classes. Universities should have specialized professional IT teams to assist professors and students in applying current educational tools.

Utilizing ICT in English language teaching and learning in Iraqi Kurdistan schools is explored by Kareem (2017). Teachers believed that applying ICT positively impacted their teaching efficiency. However, there were some challenges, including a lack of training, a lack of ICT equipment, the inappropriate culture of the school, internet connection issues, and an electricity shortage.

Finally, Azeez and Al Bajalani (2018) investigated the impacts of using mobile phone on improving the listening skills of EFL learners in Kurdistan. This study used pretest-experiment-post-test for collecting data. Their findings revealed that using mobile phones positively developed their listening skills.

In line with the objectives of the study, the following research questions were investigated:

RQ1: To what extent are English language pre-service teachers and teacher educators familiar with technological pedagogical tools?

RQ2: How do pre-service teachers perceive the importance of technological pedagogical knowledge for their teaching efficacy?

RQ3: How do pre-service teachers perceive the characteristics of the identity of language teachers who are involved in using technology?

RQ4: How do teacher educators perceive the importance of technological pedagogical knowledge for their teaching efficacy?

RQ5: How do teacher educators perceive the characteristics of the identity of language teachers who are involved in using technology?

RQ6: Are there any differences between pre-service teachers` and teacher educators' perceptions of the importance of technological pedagogical knowledge for their teaching efficacy?

RQ7: Are there any differences between pre-service teachers` and teacher educators' perceptions of the characteristics of the identity of language teachers who are involved in using technology?

Methodology
Participants

In order to investigate the perceptions of pre-service teachers and teacher educators towards technological pedagogical knowledge and professional identity development, a total of 152 students (pre-service teachers) enrolled in the English language teaching department, along

with 73 teachers from various universities (both private and public) in Iraqi Kurdistan, were selected for the study. The participants were chosen using availability sampling, a technique where individuals are selected according to their willingness and availability to participate in the research, as explained by Farhadi (2008). The students were in their final year of undergraduate studies, encompassing both male and female students. The teachers, who held different scientific titles, were also a mix of genders. For detailed demographic information, please refer to Table 1 for teachers and Table 2 for students.

Number	Gender	Age (year)	Years of teaching	Field of study	Position
	F: 39	≤30: 29	≤5: 26	ELT:28	A. Lec: 31
73				TS: 9	Lec: 34
	M: 34	30-40: 27	5-15: 34		
				LL: 32	A. Pro: 7
		≥40: 17	≥15: 13	AL: 4	Pro: 1

Note: F= Female, M= Male, ELT= English language teaching, TS= Translation studies, LL= Language and literature, AL= Applied linguistics, A. Lec= Assistant Lecturer, Lec= lecturer, A. Pro= Assistant Professor, Pro= Professor

Table 1: Demographic Information of Teacher Educators

Number	Gender	Year of study
	F: 83	
152	M: 69	Last year (Senior)

Note: F= Female, M= Male

Table 2: *Demographic information of Pre-service Teachers*

Design of the Study

The design of this study is descriptive and exploratory, employing a triangulation approach in data collection. Triangulation involves utilizing multiple methods of data collection to study various aspects of human behavior (Cohen et al., 2007). This approach enhances the validity of the data by providing a comprehensive understanding of the research topic (Briggs et al., 2012).

Instruments
Questionnaire

The TPACK survey questionnaire employed in this research was adapted from Baser et al.'s (2016) research, which aimed to evaluate the technological pedagogical content knowledge of teachers. The survey comprised eight sections, consisting of a total of 39 questions. These sections encompassed demographic information, content knowledge, technological knowledge, pedagogical knowledge, technological content knowledge, pedagogical content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge. To ensure the questionnaire's effectiveness, a pilot test was conducted with five pre-service teachers

and five teacher educators who were part of the main participants in the study. Based on the feedback received, some modifications were made to the questions. The reliability of the final questionnaires was evaluated using the Cronbach's alpha coefficient.

Interview

Semi-structured interviews were employed as another method of data collection for this study. Interviews are widely recognized as a legitimate research method (Kvale & Brinkmann, 2009) and are known for their versatility in generating in-depth insights from participants on the intended topic (Rubin & Rubin, 1995). Prior to conducting the final interviews, a pilot study was conducted with five students who were part of the main participants. According to their valuable feedback, the predetermined interview questions were revised accordingly. The final interviews were conducted with a total of 36 pre-service students and 24 teacher educators, with each interview lasting approximately 20 to 25 minutes. Before participating, all participants were required to sign consent forms and were thoroughly informed about the nature of the research and their rights as interview volunteers. They were assured that they had the freedom to withdraw from the interview at any point they felt comfortable doing so.

Procedure

To expedite the data collection process, the researcher made efforts to contact potential participants during the summer. Once five participants were identified, a pilot study was conducted utilizing both the survey and interview questions, and the predetermined questions were revised based on their feedback. It is worth mentioning that the study obtained ethical approval from the universities to ensure the proper conduct of the research. Subsequently, additional participants were recruited at the beginning of the first semester of the 2021-2022 academic year. Surveys and interviews were then administered to the participants, with the interviews being audio-recorded with the students' consent. Following the interviews, the audio-recorded were transcribed for further analysis.

Data Analysis

For the analysis of the questionnaires, SPSS 24 software was utilized. The results are presented in tables and accompanied by descriptive explanations. To analyze the transcribed data from the interviews, a thematic analysis approach was employed. Thematic analysis aims to provide a comprehensive understanding of the dataset or focus on specific aspects (Braun & Clarke, 2006). Following this analytical method, the researcher thoroughly reviewed and familiarized themselves with the transcribed data, identifying primary codes. These codes were then organized into potential themes. Through careful consideration, the themes were refined and given appropriate labels. Finally, an analysis report was compiled, incorporating pertinent quotes from the participants to support and illustrate the findings (Braun & Clarke, 2006).

Results
Questionnaire

As mentioned earlier, the questionnaire consisted of eight sections. The results are presented in tables, followed by a description of the corresponding statistics. The questionnaire utilized a five-point Likert scale. To enhance understanding and facilitate result summarization, the responses of "disagree" and "strongly disagree" were combined and classified as "disagree," while "agree" and "strongly agree" were grouped together as "agree."

Section 1: Demographic Information

A) Teachers
Demographic information comprised the first section of the questionnaire (see Table 1).
B) Pre-service Teachers
As observed in Table 2, there were a total of 152 pre-service teachers participating in the study. These students were senior students enrolled in various universities in Iraqi Kurdistan. The participants consisted of 55% female and 45% male students.

Section 2: Technological Knowledge

This section comprised of nine items that assessed the technological knowledge of both teachers and pre-service teachers regarding the use of various technologies.

Technological knowledge (TK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(1) I can use basic technological terms (e.g. operating system, wireless connection, virtual memory, etc.) appropriately.	95%	85%	0%	5%	5%	10%
(2) I can adjust computer settings such as installing software and establishing its connection.	100%	100%	0%	0%	0%	0%
(3) I can use computer peripherals such as a printer, a headphone, and a scanner.	95%	89%	0%	0%	5%	11%
(4) I can troubleshoot common computer problems (e.g. printer problems, Internet connection problems, etc.) independently.	90%	88%	0%	0%	10%	12%
(5) I can use digital classroom equipment such as projectors and smart boards.	61%	28%	5%	6%	34%	66%
(6) I can use Office programs (i.e. Word, PowerPoint, etc.) with a high level of proficiency.	100%	93%	0%	1%	0%	6%
(7) I can create multimedia (e.g. video, web pages, etc.) using text, pictures, sound, video, and animation.	78%	46%	1%%	7%	21%	47%
(8) I can use collaboration tools (wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives.	31%	2%	7 %	1%	62%	97%
(9) I can learn software that helps me complete a variety of tasks more efficiently.	82%	43%	8%	12%	10%	45%
Total	82%	63%	2%	4%	16%	33%

Note: T= Teacher educators, P= Pre-service teachers
Table 3: Technological Knowledge of Teachers and pre-service teachers

As shown in Table 3, the overall level of technological knowledge reported by teachers was relatively high. The items with the highest percentage of agreement were item number 2, "I can adjust computer settings such as installing software and establishing its connection," and item number 6, "I can use Office programs (i.e., Word, PowerPoint, etc.) with a high level of proficiency," both scoring 100% agreement. On the other hand, the lowest level of agreement was found in item 8, "I can use collaboration tools (wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives," with 31% agreement, and item 5, "I can use digital classroom equipment such as projectors and smart boards," with 61% agreement. In some items, such as 8 and 9, a small percentage of teachers (7% and 8%, respectively) were uncertain about their abilities and selected the Neutral option.

Table 3 also reveals that pre-service teachers had similar responses, but with a lower level of agreement. The item with the highest rate of disagreement among pre-service teachers was item 8, "I can use collaboration tools (wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives," with 97% disagreement, followed by item 5, "I can use digital classroom equipment such as projectors and smart boards," with 66% disagreement. Additionally, items 7 and 9 showed significant levels of disagreement, with 47% and 45% disagreement, respectively.

Section 3: Content Knowledge

This section focused on assessing teachers` and pre-service teachers' knowledge of the content they were teaching, specifically English as a second language. It included four items related to their content knowledge.

Content knowledge (CK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(10) I have sufficient knowledge about my teaching subject.	100%	92%	0%	0%	0%	8%
(11) I can use a subject-specific way of thinking in my teaching subject.	100%	85%	0%	0%	0%	15%
(12) I know the basic theories and concepts of my teaching subject.	100%	92%	0%	0%	0%	8%
(13) I know the history and development of important theories in my teaching subject	100%	88%	0%	3%	0%	9%
Total	100%	89%	0%	1%	0%	10%

Note: T= Teacher educators, P= Pre-service teachers
Table 4: Content Knowledge of Teachers and pre-service teachers

Notably, all teachers expressed a unanimous agreement regarding their sufficient knowledge of their respective subjects, including the history and development of relevant theories and concepts. Likewise, pre-service teachers exhibited a similarly high level of agreement in this section, with a negligible rate of disagreement.

Section 4: Pedagogical Knowledge

This section consisted of six items that aimed to assess participants' perceptions of their own pedagogical knowledge.

Pedagogical knowledge (PK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(14) I can use teaching methods and techniques that are appropriate for a learning environment.	100%	97%	0%	0%	0%	3%
(15) I can design a learning experience that is appropriate for the level of students.	97%	88%	0%	1%	3%	11%
(16) I can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences.	99%	95%	0%	0%	1%	5%
(17) I can collaborate with university stakeholders (students, parents, teachers, etc.) to support students' learning.	99%	96%	0%	0%	1%	4%
(18) I can reflect the experiences that I gain from professional development programs on my teaching process.	99%	92%	0%	0%	1%	8%
(19) I can support students' out-of-class work to facilitate their self-regulated learning.	97%	90%	0%	2%	3%	8%
Total	98.5%	93%	0%	1%	1.5%	6%

Note: T= Teacher educators, P= Pre-service teachers

Table 5: Pedagogical Knowledge of Teachers and pre-service teachers

According to Table 5, in this section, teachers demonstrated a high level of agreement in their responses, indicating that they believed they possessed sufficient pedagogical knowledge. The questions pertained to appropriate teaching techniques and methods, designing learning experiences, supporting students' learning, collaborating with stakeholders of the university, and reflecting on their professional development experiences. Similarly, pre-service teachers also mostly agreed with all items in the pedagogical knowledge section, and the levels of disagreement were not significant.

Section 5: Pedagogical Content Knowledge

This section comprised five items that inquired about respondents' pedagogical content knowledge.

Pedagogical content knowledge (PCK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(20) I can manage a classroom learning environment.	100%	100%	0%	0%	0%	0%
(21) I can evaluate students' learning processes.	100%	100%	0%	0%	0%	0%
(22) I can use appropriate teaching methods and techniques to support students in developing their language skills.	100%	97%	0%	0%	0%	3%
(23) I can prepare curricular activities that develop students' language skills.	100%	95%	0%	0%	0%	5%
(24) I can adapt a lesson plan in accordance with students' language skill levels.	100%	96%	0%	0%	1%	4%
Total	100%	98%	0%	0%	0 %	2%

Note: T= Teacher educators, P= Pre-service teachers

Table 6: Pedagogical Content Knowledge of Teachers and pre-service teachers

Similar to the previous sections of this survey, the teachers in this section expressed high levels of agreement across all items. They demonstrated satisfaction with their pedagogical content knowledge, specifically in areas such as classroom management, student evaluation, and supporting student development through the implementation of appropriate activities, lesson plans, and teaching methods. Similarly, the majority of pre-service teachers agreed with the items related to pedagogical content knowledge, with only a few exceptions.

Section 6: Technological Content Knowledge

There were only three items in this section, which aimed to explore the perceptions of pre-service teachers and teacher educators about their technological content knowledge.

Technological content knowledge (TCK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(25) I can take advantage of multimedia (e.g. video, slideshow, etc.) to express my ideas about various topics in English.	93%	89%	0%	0%	7%	11%
(26) I can benefit from using technology (e.g. web conferencing and discussion forums) to contribute at a distance to multilingual communities.	66%	55%	0%	5%	34%	40%
(27) I can use collaboration tools to work collaboratively with foreign people (e.g. Second Life, wiki, etc.).	33%	3%	5%	0%	62%	97%
Total	64%	49%	2%	2%	34%	49%

Note: T= Teacher educators, P= Pre-service teachers

Table 7: Technological Content Knowledge of Teachers and pre-service teachers

As shown in Table 7, this section exhibits the highest level of disagreement among teachers compared to the previous sections, with a rate of 34%. This discrepancy becomes particularly evident in item 27, where 62% of teachers disagreed with the statement "I can use collaboration tools to work collaboratively with foreign people (e.g., Second Life, wiki, etc.)". Additionally, 34% of teachers disagreed with item 26, which states "I can benefit from using technology (e.g., web conferencing and discussion forums) to contribute at a distance to multilingual communities". This indicates a relatively high percentage of disagreement. Among pre-service teachers, the overall disagreement was the highest in this section, particularly for item 27, where 97% of pre-service teachers disagreed. Furthermore, there was a significant level of disagreement in their responses to item 26, with 40% expressing disagreement.

Section 7: Technological Pedagogical Knowledge

This section of the questionnaire, consisting of seven items, aimed to explore teacher educators` and pre-service teachers` perceptions of their technological pedagogical knowledge.

Technological pedagogical knowledge (TPK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(28) I can meet students' individualized needs by using information technologies.	87%	76%	1%	7%	12%	17%
(29) I can lead students to use information technologies legally, ethically, safely, and with respect to copyrights.	63%	68%	5%	0%	32%	32%
(30) I can support students as they use technology such as virtual discussion platforms to develop their higher order thinking abilities.	88%	74%	1%	0%	11%	26%
(31) I can manage the classroom learning environment while using technology in the class.	95%	83%	0%	0%	5%	17%
(32) I can decide when technology would benefit my teaching of specific English curricular standards	96%	91%	0%	0%	4%	9%
(33) I can design learning materials by using technology that supports students' language learning.	85%	69%	0%	3%	15%	28%
(34) I can use multimedia such as videos and websites to support students' language learning.	100%	96%	0%	0%	0%	4%
Total	88%	80%	1%	1%	11%	19%

Note: T= Teacher educators, P= Pre-service teachers

Table 8: Technological Pedagogical Knowledge (TPK) of Teachers and pre-service teachers

Based on the data presented in Table 8, although there is a higher level of agreement compared to the previous section, there are a few items that show a relatively higher percentage of disagreement. For instance, item 29, which addresses the ability to guide students in using information technologies legally, ethically, safely, and respecting copyrights, has a disagreement rate of 32%. Similarly, item 33, which focuses on designing learning materials that incorporate technology to support students' language learning, has a disagreement rate of 15%. It is worth noting that pre-service teachers' responses align closely with those of teacher educators, and the disagreement levels for items 29, 33, and 30 are higher compared to other items (32%, 28%, and 26% respectively).

Section 8: Technological Pedagogical Content Knowledge

The final section of the questionnaire consisted of four general items that aimed to assess the technological pedagogical content knowledge (TPACK) of teachers and pre-service teachers.

Technological pedagogical content knowledge (TPACK)	Agree		Neutral		Disagree	
	T	P	T	P	T	P
(35) I can use collaboration tools (e.g. wiki, 3D virtual environments, etc.) to support students' language learning.	33%	12%	4%	9%	63%	79%
(36) I can support students as they use technology to support their development of language skills in an independent manner.	84%	73%	0%	3%	16%	24%
(37) I can use Web 2.0 tools (animation tools, digital story tools, etc.) to develop students' language skills.	37%	27%	5%	13%	58%	60%
(38) I can support students` professional development by using technological tools and resources to continuously improve the language teaching process.	70%	78%	0%	0	30%	22%
Total	56%	48%	2%	6%	42%	46%

Table 9: Technological Pedagogical Content Knowledge (TPACK) of Teachers and pre-service teachers

As illustrated in Table 9, among all seven sections of the questionnaire, this particular section received the lowest rate of agreement (56%). Respondents expressed the most disagreement with item 35, which focused on the use of collaboration tools (e.g., wiki and 3D virtual environments) to support students' language learning. Additionally, item 37, which pertained to the use of Web 2.0 tools (digital story tools and animation tools) for developing students' language skills, received a high rate of disagreement at 58%. Although the remaining two items had relatively lower rates of disagreement, their percentages were still noteworthy (30% and 16%, respectively). Similarly, pre-service teachers exhibited the lowest rate of agreement in this section. The most significant disagreements among them were observed in items 35 and 37, with disagreement rates of 79% and 60%, respectively.

Interview

In this section, interviews were conducted with 36 pre-service students and 24 teacher educators, with each interview lasting between 20 to 25 minutes. The interviews consisted of five predetermined open-ended questions, followed by additional probing questions for further clarification. Prior to the interviews, participants were informed about the audio-recording of the sessions, and the collected data were later transcribed and analyzed to identify common themes. In this part, the generated themes included the familiarity, knowledge, and skills of teachers in using technology, the extent of technology use by teachers, challenges related to technology, beliefs about technology, and the impact of technology on teachers' professional identity development. Each theme is accompanied by representative quotes from the participants to provide illustrative examples.

a)   Familiarity, knowledge, and skills of teacher in using technology

Both teacher educators and pre-service teachers generally express confidence in their familiarity with and knowledge of using technology. However, there are instances, particularly when it comes to utilizing professional technologies, where they faced challenges or harbored doubts. Additionally, some participants admitted to a lack of understanding on how to effectively integrate technology into their teaching practice.

> *Teacher educator 22:*
> *"I mostly use various technological tools in my classes, and I think I don`t have any special problem with using them."*
> *Pre-service teacher 8:*
> *"I can use all of the tools and technologies that my teachers use in the class. I also used some applications and software in my presentations."*
> *Pre-service 19:*
> *"Because we used only some software like Microsoft Word and PowerPoint, I just learned these programs, and I did not use other programs."*

b)   The extent of use of technology by teachers

While some teachers asserted that they incorporate more technology into their classes, others acknowledged that the extent of technology usage is contingent upon the availability of equipment in universities and the proficiency level of students. Pre-service teachers also noted that the use of technology varies among their instructors, with some relying more heavily on technology while others employ it to a lesser extent. The technologies commonly utilized include software such as Microsoft Word and PowerPoint, as well as presentation projectors. Notably,

the data indicates that the programs and software mentioned in the questionnaire are not frequently used by the participants.

> *Teacher educator 13:*
> *"I think it depends on some factors, including the equipment of universities. If there are not enough technological tools in the university, how we can use it."*
> *Pre-service teacher 31:*
> *"Some of our teachers use it more than others."*
> *Pre-service teacher 28:*
> *"Our teachers only use PowerPoint in the class. I did not see and hear the programs that were mentioned in the questionnaire; our teachers never used them in the classroom, and they did not talk about those programs."*

c)   Problems of teachers with technology

The majority of teachers stated that they typically do not encounter difficulties with commonly used technologies such as printers, internet access, and software like PowerPoint. However, they often face challenges when it comes to troubleshooting internet connections, printers, projectors, and scanners. These difficulties are primarily attributed to a lack of training, limited availability of technical support staff, and insufficient motivation among both teachers and students. Furthermore, in response to the question, many teachers admitted to lacking experience in using the specific programs mentioned in the questionnaire. Pre-service teachers expressed similar sentiments regarding their familiarity with technology.

> *Teacher educator 12:*
> *"I don`t have a problem with those programs that I use. But in professional programs, we have some issues. They are due to less training and motivation to use technologies."*
> *Teacher educator 17:*
> *"When using everyday software like PowerPoint and tools such as the internet, printer, and data show, I don`t have any problems, but if there is a problem with the internet connection or printer I cannot fix it. There are no experts to teach us such technologies."*
> *Pre-service teacher 5:*
> *"My teachers use PowerPoint for their lectures every day, and I haven`t seen any problems."*
> *Pre-service teacher 21:*
> *"I realized that sometimes that data show is not connecting some teachers cannot solve this problem."*

d)   Beliefs of the participant about technology

Almost all teacher educators and pre-service teachers are in agreement that pedagogical technologies and programs are effective. However, there are some individuals who hold the belief that not all technologies are useful and that learning how to use them is neither easy nor necessary.

> *Teacher educator 23:*
> *"I think that technology is important for students. It helps the students learn better and is a facilitator. All teachers and students should learn to use pedagogical technologies in their teaching and learning."*
> *Pre-service teacher 5:*

> *"Using every related technology has its benefits."*
> Pre-service teacher 21:
> *"It`s not easy to learn every program because there are several programs. We know only a few of them, and I think it is enough"*

e)   Effects of technology on teachers` professional identity development

Some participants, including both teacher educators and pre-service teachers, hold the belief that utilizing technology presents teachers as experts, enhances their prestige, professionalism, knowledgeability, and reliability, and that a lack of technological skills has a negative impact on their teaching. Conversely, there are others who believe that having knowledge of certain traditional software is sufficient for teaching purposes, and that a lack of technological knowledge does not significantly affect their teaching practice.

> *Teacher educator 16:*
> *"In this era students know and use more applications than teachers it`s why we as their teachers should be familiar at least with popular applications. It makes our teaching easier and more effective and then develops their professional identity."*
> *Teacher educator 7:*
> *"I believe that as far as teachers have sufficient content knowledge, it`s enough for them to know some programs, like PowerPoint. They don`t need more complicated programs and these technologies do not have more effects on their professional identities."*
> *Pre-service teacher 35:*
> *"Using different technologies, show them as an expert. If a teacher uses more and various technologies and programs, we consider him a professional teacher, and we know he is knowledgeable and we can rely on him more."*
> *Pre-service teacher 24:*
> *"We have some teachers who use only PowerPoint, and if there was a problem with the electricity or data show, they could not teach properly. Even some teachers say that they are not good at technology."*

Discussion

The results of the first section of the questionnaire revealed that most participants claimed to have sufficient knowledge of simple everyday technologies and programs such as Microsoft Word, PowerPoint, the internet, and printers. However, there was a critical lack of knowledge, particularly among pre-service teachers, regarding certain programs like Wiki, Edmodo, 3D virtual environments, and smart boards. These findings address the first research question and align with the study conducted by Golshan and Tafazoli (2014), which investigated the frequencies, attitudes, and challenges of using Technology-Enhanced Language Learning tools (TELL) in the Iranian EFL context. Their results showed that computers and video projectors were more frequently used as TELL tools, while technologies like Web 2.0 had the lowest frequency.

In the following three sections of the questionnaire, participants were asked about their content knowledge, pedagogical knowledge, and pedagogical content knowledge. In all of these sections, participants mostly expressed a relatively high level of knowledge. These findings are consistent with the research conducted by Archambault and Crippen (2009), who examined

teachers' Technological Pedagogical Content Knowledge (TPACK) and found that teachers demonstrated a considerable level of knowledge in these three domains.

In the last three sections of the questionnaire, participants reported lower rates of perceived Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK), with teacher educators scoring 64%, 88%, and 56%, respectively, and pre-service teachers scoring 49%, 80%, and 48%, respectively. This corresponds with the findings of Jang and Tsai (2013), who evaluated Taiwanese teachers' TPACK and concluded that participants rated these knowledge areas lower.

During the interviews, participants were asked about their familiarity with and knowledge of pedagogical technologies, their extent of use, and any challenges they faced when using such technologies. Many participants claimed to have basic knowledge of technologies and programs such as computers, printers, PowerPoint, and internet connections. However, they struggled with troubleshooting these technologies and programs due to a lack of training, expert support, and motivation from both teachers and students. Furthermore, most participants indicated that they were unaware of recent pedagogical programs such as Wiki, Edmodo, 3D virtual environments, and smart boards, or that they lacked the knowledge and skills to incorporate them into their teaching. These findings are supported by previous studies. For example, Abdulrahman (2019) found that teachers predominantly used basic technologies like projectors and email. Chere-Masopha (2018) concluded that teachers had limited use of digital technologies and lacked the necessary skills to adopt and integrate these technologies into their practice. Additionally, Li and Ni (2011) stated that EFL teachers in China primarily used technology for teacher-centered purposes rather than student-centered ones. The findings of this research align with the participants' statements that technology was primarily used for presentations rather than other activities. Similarly, Habibu et al. (2012) reported that while teachers in Uganda expressed a strong desire to integrate technology into their teaching, they faced various challenges such as a lack of administrative support, technical staff, equipment, training, and an inadequate course curriculum.

In the remaining part of the interview, participants were asked about their beliefs regarding the use of technology and its potential impacts on their teaching practices. Both groups of participants mostly agreed that utilizing pedagogical technologies has a significant influence on their teaching. However, they have not effectively utilized the useful technologies they are familiar with. Furthermore, some participants believe that not all technologies can be effective, and they believe the use of technology should be limited to conventional methods. These findings address questions 2, 4, and 6 of this study. The results of this section align with the research conducted by Taha (2019), who found that teachers believe educational technology has a strong and positive impact on education. Additionally, Azeez and Al Bajalani (2018) showed in their study that teachers perceived the mobile phone as a language-assisted technology with a beneficial effect on improving students' listening skills. Finally, Shifflet and Weilbacher (2015) revealed that although participants in their study believed in the effectiveness of technology in the process of teaching and learning, they did not always put their beliefs into practice.

In response to question 3, which explores pre-service teachers' perceptions of the characteristics of language teachers who use technology, they described these teachers as typically being perceived as experts, professionals, knowledgeable individuals, and sometimes as teachers who heavily rely on technology. Similarly, teacher educators perceived these teachers' identities as prestigious, knowledgeable, reliable, and continuously developing. These findings are relevant to question 5. It can be observed that the responses of pre-service teachers and

teacher educators are relatively similar, and there is not a significant difference between their perceptions. This answers question 7 of the study. These results align with a literature review conducted by Raporu (2015) on the pedagogical effects of technology, which suggests that technology usage leads to teachers being perceived as more effective. Moreover, Vokatis and Zhang (2016) mentioned some positive characteristics of teachers' identities resulting from the application of technology in their practice, such as being professional knowledge builders, co-learners, problem-solvers, and members of a professional community.

Interestingly, in contrast to many other studies (Long, 2005; McKenzie, 2007; Prensky, 2004), the teacher educators in this study rated their pedagogical technological knowledge higher than pre-service teachers. Additionally, during the interviews, they claimed that, in general, they possessed more pedagogical technological knowledge than their students. One possible interpretation, based on the researcher's experiences and observations, is that students in Iraqi Kurdistan typically use specific applications like Facebook, Instagram, etc., and they are not adequately trained or required to use pedagogical technologies.

Limitations and Recommendations

One limitation of this study was the relatively small number of teacher educators. To enhance future research, it is recommended to include a larger sample of teachers.

Incorporating case studies and classroom observations of teachers could contribute to obtaining more reliable results. Nevertheless, during the interviews, teachers were provided with ample opportunities to explain the dynamics in their classrooms and the reasons behind their utilization or non-utilization of technology in their teaching practices. However, researchers can explore additional data collection tools, such as observation and case studies, to observe teachers' use of technology.

The impact of technology on teaching practice and professional identity development might vary between female and male teachers. Therefore, further studies could be conducted to investigate the gender-specific use of technology by teachers.

Participants in this study were selected from both public and private universities; however, the study did not specifically analyze the results based on university type. Other researchers could explore the use of pedagogical technologies by teachers in private and public universities to determine if there are any differences in the outcomes between these two settings.

Future studies that examine the identities of novice and experienced teachers who have integrated technology into their classrooms would be of great interest. Such investigations could provide valuable insights into the role of technology in shaping the professional identities of teachers at various stages of their careers.

Conclusion and Implications

In conclusion, this study sheds light on the perceptions of pre-service teachers and teacher educators regarding technological pedagogical knowledge (TPK) and professional identity development. The findings indicate that both pre-service teachers and teacher educators possess a strong sense of proficiency in pedagogical content knowledge, along with familiarity

with basic traditional technologies. However, there is a need for further improvement in their understanding and utilization of professional technologies.

The participants expressed a generally positive outlook on the effectiveness of pedagogical technologies and their influence on professional identity development. They recognized the impact of these technologies on shaping their teaching practice and professional growth. Nevertheless, a small number of participants held contrasting views, suggesting that these technologies may not be as effective in their specific teaching contexts or for their professional identity development.

The study's implications underline the significance of incorporating technological pedagogical knowledge into teacher education programs, ensuring that future educators are equipped with the required skills to integrate technology effectively into their teaching practices. The findings also emphasize the need for ongoing professional development opportunities for both pre-service teachers and teacher educators to promote their knowledge and use of professional technologies.

Although there were limitations related to the number of participants, gender, data collection tools, and types of universities, it is important to note that participants were drawn from various cities and universities, representing a typical sample of Iraqi Kurdish pre-service teachers and teacher educators. Hence, the findings of this study hold potential benefits for various stakeholders, including pre-service teachers, teacher educators, university authorities, curriculum designers, and material developers.

Existing literature has consistently demonstrated the positive impacts and benefits of pedagogical technologies in diverse educational contexts. Therefore, it is imperative for pre-service teachers to strive to acquire comprehensive knowledge about these technologies and proactively plan for their integration into both their own learning and future teaching practices. Likewise, teachers should play a pivotal function in facilitating their students' learning and application of technology in their education and future careers. Teachers should be well-versed in popular pedagogical technologies, capable of effectively utilizing them in practice, and continuously develop and expand their pedagogical technological knowledge beyond basic tools such as projectors and emails (Abdulrahman, 2019).

According to the study's findings, it is recommended that curriculum designers and material developers design courses that not only focus on theoretical aspects but also incorporate more practical elements. Adequate time allocation should be provided to these courses to ensure comprehensive learning experiences for pre-service teachers and teacher educators.

University authorities have a crucial role to play in supporting pre-service teachers and teacher educators in their training and integration of technologies into their learning and teaching processes. It is essential for universities to provide the necessary technological resources and extend assistance to facilitate their effective utilization.

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