Language Related Research
E-ISSN: 2383-0816
https://lrr.modares.ac.ir
https://doi.org/10.29252/LRR.15.5.6

Tarbiat Modares University

Vol. 15, No. 5
pp. 145-171
November & December 2024

Received: 27 October 2023
Received in revised form: 9 December 2023
Accepted: 27 December 2023

TPACK, English Proficiency, and Technology Applications in Pre-service English Teacher Professional Development Teaching Practice

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Abstract

English proficiency as the content knowledge for English as a Foreign Language (EFL) teachers determines their instructional quality. However, previous studies have not focused on the significance of this knowledge in support of Teachers' Technological Pedagogical Content Knowledge (TPACK) on technology adoption in teaching. Therefore, this study aims at finding out the correlation between TPACK and technology applications, and how technology applications link to teachers' English proficiency levels. The study adopted a quantitative method, and the data were collected using two questionnaires in Likert scale, one for TPACK and another for technology application. Teachers' English proficiency levels are determined using the content knowledge dimension of TPACK. The questionnaires were completed online by 74 English pre-service teacher graduates who had participated in a national teacher certification program involving real teaching practice. The data were analyzed using the Spearman correlation coefficient to determine the correlation between TPACK dimensions and technology adoption and ordinal logistic regression analysis to find out the effect of teachers' English proficiency levels on technology applications. The results show that most TPACK dimensions correlate to technology applications with the level of

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[DOI: 10.29252/LRR.15.5.6]

correlations between 0.26 (weak) and 0.47 (moderate). English proficiency has been found to affect technology applications only among teachers who regularly used technology in teaching. Teachers with high English proficiency used technology in teaching 3.06 times more frequently than those whose English proficiency was low. Therefore, it is recommended that English proficiency development be inscluded in teacher professional development to ensure that teachers use technology in teaching.

Keywords: English proficiency, English teacher, professional development, technology, TPACK

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1. Introduction

Technology integration should now be treated as a standard, no longer an exception, in English language teaching due to its benefits for language acquisition. Language acquisition requires language exposure (Bahrani et al., 2014; Derakhshan et al., 2024; Khazaei & Derakhshan, 2024), and technology has been found to facilitate it (Sigurjónsdóttir & Nowenstein, 2021). However, technology application in English language classrooms is often unachievable. According to Moldavan et al. (2022) and Amelia et al. (2021), the primary problems hindering technology integration are the digital divide and teachers' Technological Pedagogical Content Knowledge (TPACK). While the digital divide requires external solutions such as government interventions and non-governmental financial support (Que, 2021), teachers' TPACK depends on teachers, professional development, and teacher training institutions. Therefore, the solutions for the problems related to TPACK levels can be sought through research. Much research recommends that a comprehensive professional development that covers all TPACK aspects be conducted to improve teachers' knowledge of using technology in teaching (Lisa et al., 2021). It has been found that TPACK professional development links to improved knowledge of using technology in teaching (Aniq et al., 2022). However, one of the problems reported in previous studies is that TPACK knowledge does not warrant TPACK application (Nawab & Bissaker, 2021; Syawallina & Suganda, 2023). Research shows that there are other factors which contribute to technology application in teaching, such as school context (Vaughn & de Beer, 2020), student internet access (Mustafa et al., 2022), and teacher attitude (Molise & Dube, 2020). In this case, we propose English proficiency level as the factor to investigate in the present study.

In a general context, previous studies have described the significance of English proficiency levels on English teachers' teaching practice. For example, Tseng et al. (2023) found that low English proficiency teachers faced many challenges in teaching. In addition, teachers with higher English proficiency believed they could teach more successfully than those with lower English proficiency (Wang, 2021). Furthermore, Richards (2017) stated that teachers need to reach the C1 level based on CEFR to teach English effectively. These previous studies show the significance of English proficiency for English teachers. However, it is unclear how English proficiency level impacts teachers' use of

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technology in teaching. Is it only TPACK that matters? There is a dearth of research focusing on TPACK and English proficiency levels in investigating the use of technology in teaching. Therefore, the present study aims to find out the correlation between TPACK, English proficiency, and technology use in teaching English among new English teachers. The results of this study can contribute to innovation in teacher training and teacher professional development to improve the use of technology in EFL classrooms.

2. Literature Review

This section reviews publications related to this research topic to reveal the current knowledge in the literature to show the gaps addressed in the present study. It begins with introducing TPACK and the role of professional development in developing this knowledge. We also show how TPACK translates to the actual use of technology among teachers and where teachers' English proficiency stands in this role. The section concludes with a summary of the literature review to confirm the gap that exists between TPACK, English proficiency, and technology applications in teaching.

2.1. Technological Pedagogical Content Knowledge (TPACK)

This knowledge, i.e., TPACK, is built on three primary types of knowledge, i.e., content knowledge, pedagogical knowledge, and technological knowledge (Koehler & Mishra, 2008). Content knowledge is the teacher's knowledge of the subject matter, i.e., they know what they are teaching (Shulman, 1986), which is English in this case. In the language teaching context, content knowledge refers to English proficiency. Meanwhile, pedagogical knowledge (PK) refers to knowledge of pedagogy, which includes curriculum, teaching, and assessment (Koehler & Mishra, 2008). Finally, technological knowledge (TK) is the knowledge of how to use technology and learn using new technology (Ratminingsih et al., 2018). The intersections of these three types of knowledge develop other four types of knowledge, as visualized in Figure 1.

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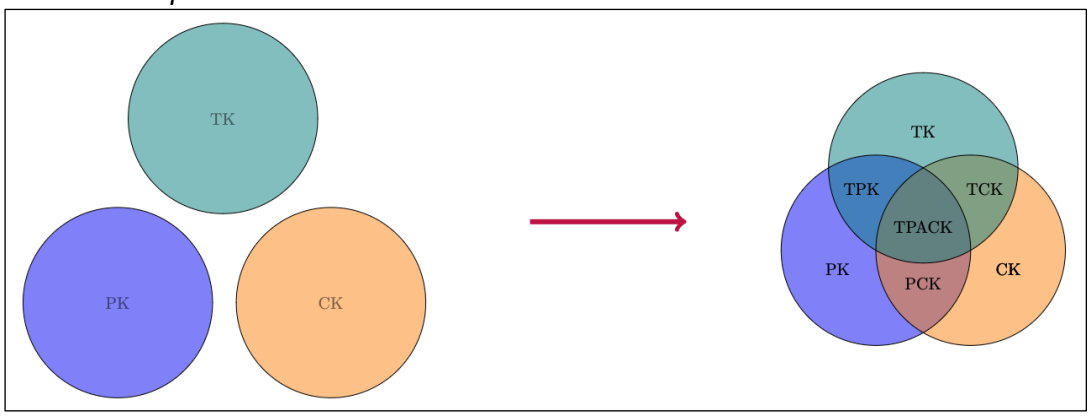
Figure 1.
Illustration of TPACK Framework



The three types of knowledge are the basic knowledge required to build up TPACK. In Figure 1, content knowledge and pedagogical knowledge enable teachers to master how to teach the content knowledge, known as 'Pedagogical Content Knowledge' (PCK), and this newly-generated knowledge has been confirmed by Shulman (1986). According to Koehler and Mishra (2008), PCK is the basis for TPACK after adding technological knowledge (TK). When technological knowledge interacts with content knowledge, teachers can understand how topics in language skills can be best represented with technology (Technological Content Knowledge or TCK) (Koh et al., 2014). For example, listening to the main idea can be taught using a digitally recorded lecture. In addition, the interaction between technological knowledge and pedagogical knowledge leads to teachers knowing how to collaborate the use of appropriate teaching methods with technology for teaching in a general sense (Technological Pedagogical Knowledge or TPK) (Bagheri, 2020). Finally, the interaction of the CK, PK, and TK enables teachers to understand how to select relevant teaching methods when teaching specific content and use appropriate technology to facilitate it (TPACK) (Angeli et al., 2015).

These types of knowledge, i.e., CK, PK, and TK, need to be connected to one another through personal experience or professional development (Krause & Lynch, 2018; Kristiawan et al., 2022). When these three types of knowledge exist in isolation, teachers might not be aware that technology can and should not be used in teaching. With a professional development program, teachers can learn the benefits of technology when it is brought to classrooms (Polly & Orrill, 2012).

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Therefore, they become more motivated to use technology in teaching. In addition, the professional development program improves teachers' skills on how to effectively select technology tools (Zengin, 2023). In addition, using technology for teaching comes with many challenges, and teachers can anticipate these problems by learning from other teacher experiences (Lisa et al., 2021). Finally, professional development improves teachers' self-efficacy in using technology for teaching (Gümüş & Bellibaş, 2023), which strongly links to classroom practice (Calleja, 2022), the actual use of technology for teaching. When teachers start using technology in classrooms, the three types of knowledge will make more sense for teachers and enable them to innovate beyond what they have learned in the professional development program (Schmid & Hegelheimer, 2014). Research also confirms that teachers' ability in using technology improves after teachers experiment with the use of technology in teaching their classes (Skevi et al., 2023).

2.2. TPACK and Technology Applications

There is a consensus that classroom practice is associated with teaching knowledge. In the context of the pedagogical use of technology, research found that teachers with knowledge of the pedagogical use of technology are more likely to use technology in teaching. Therefore, technology-related professional development programs are recommended as an effort to increase technology integration in classrooms (Aniq et al., 2022). These programs have been delivered in the forms of workshop (Kristiawan et al., 2022), classroom action research (Taşdemir & Karaman, 2022), and TPACK professional development (Chatmaneerungcharoen, 2019). Among these types of professional development, TPACK professional development is the most comprehensive because it includes all components of knowledge required to use technology in teaching. In some countries such as Indonesia, this professional development is carefully designed to include self-study, lectures, workshops, peer teaching practice, actual teaching practice, and assessment (Gozali et al., 2023). An evaluation of a TPACK-based professional development program conducted by Alemdag et al. (2020) revealed that English teachers could use technology based on their lesson plans prepared during professional development. In addition, Landry et al. (2009) also found that comprehensive professional development is the most impactful type of professional development to increase the use of technology in classroom

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instruction. Based on these precious studies, we can conclude that TPACK improves technology applications in teaching. However, while TPACK development through professional development is warranted, it does not always translate into classroom practice (Syawallina & Suganda, 2023). Previous studies proposed that there are other factors which mediate technology applications in teaching, such as school infratructure (Arreerard, 2022), student readiness (Mustafa et al., 2022), and teacher attitude (Molise & Dube, 2020). In this research, we propose that one of the TPACK dimensions, i.e., content knowledge, in this case, teachers' English proficiency, is more significant than other dimensions for technology application.

2.3. The Significance of English Proficiency Level

English proficiency level is one of the components of TPACK, which represents content knowledge for English teachers. This knowledge is fundamental for an English teacher (Sibomana, 2017). In fact, this knowledge was the only knowledge included in teacher admission tests prior to the 1980s in the U.S. before pedagogical knowledge was also considered significant (Shulman, 1986). The TPACK framework in the EFL context was built on teachers' knowledge of using various teaching methods and strategies to teach English (Koehler & Mishra, 2008). Therefore, teachers must have adequate knowledge of English linguistics, such as phonology, morphology, syntax, semantics, and pragmatics, in order that they can teach the language effectively (Vaisman & Kahn-Horwitz, 2020). These types of knowledge are what constitutes English proficiency in a practical context. In the pedagogy context, research has confirmed that teachers with low English proficiency experience many challenges in teaching (Tseng et al., 2023). Due to the significance of English proficiency, we can assume that it also influences their intention to innovate in teaching, including the application of technology. It is expected that teachers with low English proficiency do not have access to self-directed professional development, such as technology tutorials and webinars on technology applications. In addition, teachers experience many challenges in using technology for teaching (Fikuree et al., 2021). It is challenging for low English proficiency teachers to seek support to solve their problems because many teachers share their experience in English (Mukminin et al., 2023). Unfortunately, in-service teachers rarely attempt to improve their English proficiency without structured professional development (Tseng et al., 2023).

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Therefore, specific professional development needs to be offered to teachers with low English proficiency to improve their English level, as suggested by Yasin and Mustafa (2022). Experienced English teachers valued English proficiency improvement from any professional development they participated in during their career as teachers (Dávila & Jarquín, 2020).

2.4. Summary, Research Gap, and Research Questions

The literature has shown the significance of TPACK and English proficiency for English teachers to teach English effectively. Therefore, professional development is required to help teachers with low English proficiency reach the required English level, which is C1 according to the literature. Because English proficiency is a reflection of content knowledge, which is a dimension of TPACK, English proficiency level might have particular impacts on teachers' use of technology in teaching. However, topics related to TPACK and English proficiency were rarely researched in the context of professional development. Therefore, the present study investigated the impacts of teachers' TPACK and English proficiency on technology application in professional development teaching practice, with the following research questions.

1. Is there any significant correlation between TPACK and the use of technology in teaching among pre-service teachers in the professional development teaching practice?

2. Is there a significant effect of English proficiency level on the use of technology among pre-service teachers in the professional development teaching practice?

3. Methodology

This study adopted a quantitative method using a survey design. This method utilizes ordinal and categorical data. Therefore, the researchers used statistical analyses which reflect these data types.

3.1. Context and Participants

This research involves pre-service teachers who were participating in pre-service

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teacher professional development. The participants had completed their undergraduate programs in English language teaching. This teacher development program was conducted by the universities approved by the Indonesian Ministry of Education, Culture, Research, and Technology (hereinafter referred to as "Ministry of Education"). The program curriculum and the "student" admission were determined by the Ministry of Education. The program was completed in two semesters, and it consisted of 32 credits of core courses and six credits of elective courses. The courses offered are presented in Table 1.

Table 1.
Core and Elective Courses in Teacher Professional Development

No	Core Courses	Credits	No	Elective Courses	Credits
1	Philosophy of Education in Indonesia	2	1	Literacy across Disciplines	2
2	Learners and Teaching	3	2	New Technology in Teaching and Learning	2
3	Principles of Teaching and Assessments	6	3	Introduction to Special Education	2
4	Social Emotional Learning	3	4	Curriculum Design and Development	2
5	Seminar on Teacher Professional Development	2	5	Differentiated Instruction	2
6	Leadership Project	2	6	Online and Blended Teaching and Learning	2
7	Teaching Practice	14	7	Design Thinking	2
			8	Computational Thinking	2
			9	Teaching in Rural Areas	2
			10	Sociocultural Perspective of Education in Indonesia	2

The materials for these courses were provided by the Ministry of Education, and students and lecturers access the materials through Moodle Learning Management System. At the end of the program, students needed to pass an examination, known as the 'competence test' conducted online by the Ministry of Education. Students who have completed this professional development have more opportunities to be appointed state school teachers in Indonesia.

In this research, the questionnaires were distributed online to pre-service

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teachers who completed professional development in two universities in Indonesia in late 2022 and early 2023. In both universities, the elective course "New Technology in Teaching and Learning" was made mandatory due to its significance for the present circumstance. Of the 111 preservice teachers who completed this program, 74 of them completed the questionnaires. The participants consisted of 11 males and 63 females. This disparity in the number of male and female participants is expected because more females than males participated in the pre-service teacher professional development. In terms of ages, 31 of them were between 21 and 25, 23 between 26 and 30, and 20 between 31 and 42.

3.2. Instrument and Data Collection

The research used two questionnaires to collect the data. The first questionnaire was intended to measure teachers' Technological Pedagogical Content Knowledge (TPACK), which is the knowledge of using technology in teaching English. The questionnaire was adapted and translated from the English version developed by Bostancıoğlu and Handley (2018) into pre-service teachers' first language – Bahasa Indonesia. The questionnaire comprises 45 items, with four to eight items in each TPACK dimension. The internal consistency of this questionnaire is 0.964, suggesting high consistency. Meanwhile, the actual use of technology in the professional development teaching practice was measured using a questionnaire designed by Korur et al. (2021) and Avidov-Ungar and Amir (2018), with an internal consistency of 0.945 (high consistency). This questionnaire consists of 16 items covering the use of technology for teaching (10 items) and assessment (six items). Finally, English proficiency levels were measured with five items in the TPACK content knowledge dimension, backed up with another item where the participants rated their levels of English proficiency. Regardless of over-reporting, as revealed in previous studies, the nature of analyses in this research allows accurate research results because the analyses relied on trends in language level instead of the exact level.

The instruments were validated using Confirmatory Factor Anaysis to find out whether the items in the questionnaire represented the dimensions of the questionnaire. The items with a factor loading less than 0.30 were dropped from the questionnaire. As a result, one item in technological knowledge of TPACK and two in pedagogical use of technology questionnaires were dropped, resulting

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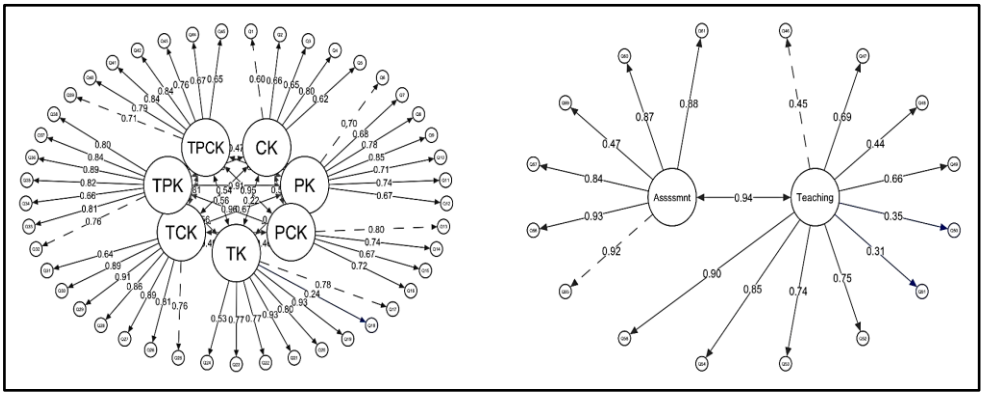
in 44 items for the TPACK questionnaire and 14 items for the questionnaire of technology applications in teaching. The detailed factor loadings are visualized in Figure 2.

Figure 2.
Factor Loadings of TPACK (Left) and Pedagogical Use of Technology (Right) Questionnaires



The invitation to complete the survey questionnaire was distributed online to the target participants through the professional development program coordinator and instructor in the target universities. The coordinator and instructor did not know who completed the questionnaires because the invitation contained a link to the online questionnaires. The pre-service teachers who completed the questionnaires had an opportunity to be randomly selected to receive eight vouchers equivalent to IDR 200,000 or approximately USD 13. According to Shiyab et al. (2023), this type of incentive increases the response rate in online surveys. A reminder was also sent two weeks after the questionnaire distribution.

3.3. Data Analyses

The data in this research was analyzed using correlation analysis to answer the first research question and ordinal logistic regression to deal with the second research question. For the first analysis, a Spearman's rank-order correlation coefficient (or Spearman correlation coefficient) was used because the data was ordinal data. This correlation is derived from the Pearson correlation to measure the relationship between two ranked factors on an ordinal scale of measurement (Privitera, 2018). Furthermore, the second analysis involved ordinal logistic

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regression to measure the effect on English proficiency levels and the use of technology in the classrooms. This regression analysis model was used because the variables are ordinal variable (technology application) and categorical variable (English proficiency), as suggested by Khonglumtan and Srisattayakul (2023). The null hypotheses for both analyses were rejected at the significance level of 0.05. The effect size for the regression analysis was calculated using the odds ratio, as suggested by Bilder and Loughin (2015). It refers to the probability of success for one group (teachers with high English proficiency) compared to the other (teachers with low English proficiency).

4. Results

The data was analyzed using inferential statistics, including correlation analysis and ordinal logistic regression analysis. In this section, these analyses are presented separately for simplicity. In addition, descriptive statistics of the data are included to show the shape of the data.

4.1. Data Preparation

The analyses in this research involved complex statistical calculations which required certain types of data. Therefore, the raw data needed to be converted accordingly. First, the Likert scale responses were coded into 1 for ‘completely disagree’ and ‘never’ to 5 for ‘strongly agree’ and ‘always.’ The coded questionnaire could be used to perform correlation analyses to show the correlation between TPACK and the pedagogical use of technology.

Furthermore, the ordinal logistic regression analysis for the effect of English proficiency levels requires that the data be presented as an ordinal variable (y or response variable) and categorical data (x or explanatory variable). Therefore, the self-reported English proficiency levels and pedagogical use of technology were converted to levels using agglomerative hierarchical clustering, which is a clustering technique based on a hierarchy of clusters that are built on the smallest to largest units of data and contain data with similar characteristics in each cluster (Pasupathi et al., 2021). The results of the data conversion are presented in Table 2.

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Table 2.
The Level of Pedagogical Use of Technology and English Proficiency

Mean of TECH	Levels	N	Mean of ENG	Levels	N
2.225	Level 1	11	3.825	Low	55
3.354	Level 2	21	4.653	High	19
3.988	Level 3	27			
4.739	Level 4	15			

Note. TECH = Pedagogical use of technology in teaching (response variable), ENG = English proficiency level (explanatory variable)

4.2. Descriptive Statistics

Further analyses were conducted for each dimension of TPACK. Therefore, the aggregate of each dimension is calculated separately. The summary of variables involved in the analyses is presented in Table 3.

Table 3.
Summary of Pre-service TPACK and Pedagogical Use of Technology in Teaching

Variables	Min	Q1	Median	Q3	Max	Mean	SD
Content knowledge (CK)	3.200	3.800	4.000	4.350	5.000	4.040	0.447
Pedagogical knowledge (PK)	3.430	4.000	4.210	4.710	5.000	4.310	0.464
Pedagogical content knowledge (PCK)	3.000	3.750	4.000	4.500	5.000	4.150	0.514
Technological knowledge (TK)	3.570	4.570	4.860	5.000	5.000	4.690	0.412
Technological content knowledge (TCK)	3.290	4.000	4.430	5.000	5.000	4.420	0.492
Technological pedagogical knowledge (TPK)	3.290	4.000	4.430	5.000	5.000	4.420	0.501
Technological Pedagogical Content Knowledge (TPCK)	3.000	4.000	4.290	4.860	5.000	4.360	0.488
All knowledge of technology use in teaching English (TPACK)	3.530	4.000	4.380	4.750	5.000	4.360	0.401
Pedagogical use of technology in teaching	1.360	3.230	3.790	4.210	5.000	3.670	0.871

Table 3 shows that the minimum values for all TPACK dimensions are relatively high, suggesting that the participants tended to over-report their knowledge of technology applications in teaching English. From all dimensions, technological knowledge received the highest mean, which translates to high technology literacy among the pre-service teachers. However, the actual use of technology in teaching was reported to be low, with a standard deviation of 0.871. This figure means that some pre-service teachers used technology very frequently while others used it very rarely. Further analysis shows how the actual use of technology links to their knowledge.

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4.3. Correlation Analyses

Correlation analyses were conducted to answer the first research question, aimed at finding out how each dimension of TPACK links to teacher-reported use of technology in teaching. For simplicity, the results of all correlations are summarized in Table 4.

Table 4.
Correlations between TPACK and Technology Applications

Pairs	rho	p-value	Level
CK - Technology applications	0.250	0.032	Weak
PK - Technology applications	0.387	0.001	Weak
PCK - Technology applications	0.370	0.001	Weak
TK - Technology applications	0.496	0.000	Moderate
TCK - Technology applications	0.266	0.163	-
TPK - Technology applications	0.398	0.000	Moderate
TPCK - Technology applications	0.409	0.000	Moderate
TPACK - Technology applications	0.470	0.000	Moderate

Table 4 shows that correlations exist between technology applications and almost all TPACK dimensions, except technological content knowledge, and the levels of correlation range from weak to moderate. The result shows the strongest correlation between technological knowledge and technology applications. In addition, the combined TPACK dimension moderately correlates with the use of technology in teaching. Another interesting finding is that content knowledge correlates with technology applications only at a weak level. Further analysis determines to what extent this knowledge, when interpreted as English proficiency level, affects the pedagogical use of technology in classrooms.

4.4. Ordinal Logistic Regression

For this analysis, the explanatory variable is English proficiency level, which has been coded into high and low, and thus it is considered a categorical variable. The response variable is the use of technology in teaching, presented in four levels – Level 1 as low and Level 4 as high. The result of the calculation is shown in Table 5.

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Table 5.
The Effect of English Proficiency on Technology Applications

	Value	Std. Error	t-value	p-value
English proficiency: High	1.119	0.501	2.234	0.025
Level 1|Level 2	-1.324	0.320	-4.133	0.000
Level 2|Level 3	0.102	0.264	0.387	0.699
Level 3|Level 4	1.545	0.324	4.761	0.000

Note. Odds ratio = 3.061

Interpreting Table 5 is relatively challenging. In general, English proficiency level is a significant predictor of technology applications in teaching (p-value = 0.025). However, the effect was reversed or nonexistent among teachers who rarely used technology in teaching (Level 1 and Level 2). Meanwhile, for teachers whose English proficiency level is high, the odds of increasing the use of technology from Level 3 to Level 4 is 3.06 times higher than for teachers whose English proficiency is low. This result is elaborated further in the discussion section.

5. Discussion

The first objective of this study is to determine the correlation between TPACK dimensions and the use of technology among pre-service English teachers when they teach classes as a part of their teaching practice in a teacher professional development program. The research results show that a correlation exists between technology applications and almost all TPACK dimensions at weak and moderate levels.

In general, knowledge of technology applications in teaching, translated into TPACK, correlated to how much English teachers used technology in teaching English. This result is expected because knowledge should determine practice. Previous studies also found that knowledge of using technology is a strong predictor of technology use (Pozas & Letzel, 2023). However, Pozas and Letzel's (2023) research measured technology application in the context of learning among pre-service teachers, instead of teaching. Regardless of the context, the research confirms that knowledge determines practice. Therefore, it is significant that professional development programs be provided to teachers to improve their knowledge of technology applications for pedagogical purposes. A study by Chen and Jiang (2023) shows that novice teachers gradually improved their TPACK when they were supported with relevant professional development.

Mode detailed analyses show that the TPACK dimensions without the component

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of technology, i.e., CK, PK, and PCK, correlate only weakly with the use of technology in teaching. These results suggest that technological knowledge is significant for technology applications in teaching. Teachers who are not technology literate are not ready to include technology in their lessons, although they have adequate knowledge of the subject matter and how to teach it. Previous studies have found that a lack of technology literacy is one of the most often reported challenges which prevent teachers from using technology in the classrooms (e.g., Arreerard, 2022; Jerry & Yunus, 2021; Molise & Dube, 2020; Owen et al., 2020). Therefore, we cannot expect teachers with high English proficiency and good pedagogical knowledge to utilize technology in innovating their instruction. And when they did, their students complained that they had problems in learning and suggested that their lecturers taught them using different approaches (Chau & Hieu, 2023).

Furthermore, technology literacy or technological knowledge (TK) has a higher correlation with the use of technology in classrooms. This result confirms our previous argument on the significance of this knowledge. This also applies to other TPACK dimensions with the component of technology, i.e., TPK and TPCK. Research outside the EFL context also found that TPK and TPCK are two dominant factors that influence technology adoption in classrooms (Pozas & Letzel, 2023). However, technological content knowledge (TCK) is not significantly correlated to the pedagogical use of technology in teaching. This result is unexpected because knowing what technology can be used to teach English language skills should determine the use of this technology. The questionnaire items for this TPACK dimension ask teachers whether they know specific technology tools to use in teaching listening (item 1), reading (item 2), writing (item 3), grammar (item 4), vocabulary (item 5), pronunciation (item 6), and culture differences (item 7). In this case, we suspect that pre-service teachers might have a distorted understanding of their knowledge of technology tools for each language skill. In addition, the curriculum for the English subject in Indonesia emphasizes teaching English ‘integratedly’ (Intansari, 2013). Therefore, they might be unable to accurately report their knowledge of the technological content knowledge dimension. Surprisingly, a previous study involving Indonesian pre-service teachers also found TPK, not TCK, had the highest level of importance for the pedagogical use of technology after TPACK (Sofwan et al., 2023). However, the authors could not explain this unexpected result.

The second objective of this study is to determine the effect of English proficiency on the use of technology in teaching. The result shows that the effect

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only exists among teachers who frequently use technology. For teachers who rarely used technology in teaching, their English proficiency level did not determine how much they used technology in teaching. This result emphasizes the significance of experience teaching with technology for technology applications in teaching, as found in some previous studies (e.g., Farjon et al., 2019; McCoy & Lynam, 2022; Paetsch et al., 2023). Our research result implies that teachers with more experience would be more likely to use more technology in teaching when their English proficiency is higher than when their English proficiency is low. This result indicates that the low English proficiency levels of experienced teachers need to be upgraded in order that they become more confident in using technology for teaching. In fact, there is a growing recommendation in the literature of the need to improve English pre-service English proficiency (e.g., Howlett & Penner-Williams, 2020; Mukminin et al., 2023; Yasin & Mustafa, 2022).

The results of this study provide significant pedagogical implications for teacher training institutions and teacher professional development programs. One of the most significant findings in this study is that technological knowledge is significant for technology applications in teaching. Therefore, a separate course learning related technology needs to be offered in pre-service teacher training and professional development, the idea of which is backed up by Paetsch et al.'s (2023) findings. In the current practice, most universities offering pre-service English teacher training and professional development have a "Technology in Language Learning" course where students learn some theory and have some hands-on experience. However, this course is limited to only technology tools used in language learning. Technological knowledge is more general knowledge on using technology and solving problems when it happens (Bagheri, 2020). Therefore, a course which develops students' knowledge of using technology fluently is necessary before students take the Technology in Language Learning course.

Second, the absence of a correlation between technological content knowledge raises concerns for professional development programs. It was assumed that pre-service teachers lacked knowledge of selecting technology tools to teach specific language skills. Therefore, the professional development program must include a technology application course for each language skill. Although the language is taught integratedly, the nature of teaching remains scaffolded, i.e., each language skill is presented in isolation at some points (Bazhutina, 2023). Therefore, pre-service teachers need to know how to select appropriate technology to teach each

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topic in each language skill. With this knowledge at hand, teachers will be able to alternate technology tools in teaching, depending on language skills, topics, student language level, and school infrastructure.

Third, that English proficiency levels only play a significant role among teachers with better experience in technology applications for teaching presents an opportunity to modify the format of teaching practice in pre-service teacher training and professional development. In Indonesia, the use of technology is not obligatory in teaching practice. Student teachers only need to use technology if their mentor teachers request it. Therefore, there is not much opportunity for student teachers to have experience in using technology for teaching or observing others. A previous study confirms that observing the success of other teachers using technology in teaching motivates teachers to use technology in their own classrooms (Nelson & Hawk, 2020). Therefore, the use of technology can be made mandatory by pre-service teacher training institutions and professional development programs, and they can be required to design their lesson plans by integrating technology into teaching scenarios and include technology applications in the teaching practice report. This practice can give students an opportunity to experiment with technology adoption and learn how to seek support for the problems that they might encounter during this practice.

Finally, this research has some limitations which need to be addressed in further studies. First, English proficiency level was measured using a self-reported questionnaire. There is a high possibility that the participants overreported their proficiency levels. Although the analysis in the present study is not compromisable with overreporting, having English proficiency scores measured using a standardized English language test will enable more detailed analyses. In this study, we could not provide a language test because the participants had just completed the program; therefore, future studies can collect the data earlier in the program. Second, the participants in this study were pre-service English teachers. Therefore, the results of the study might not be generalizable to the context of in-service teachers. Future studies need to investigate teachers participating in in-service teacher professional development programs because they may receive the training differently from pre-service teachers who do not have much experience with classroom situations. Finally, this study failed to record the participants' teaching experience and whether or not they used technology in their previous teaching job. These two factors might influence their TPACK and technology applications in teaching, and thus, these

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variables can be used as mediating variables. Therefore, it is recommended that future studies include potential mediating variables based on the literature in order that the use of technology in teaching can be studied more comprehensively.

6. Conclusion

The present study attempted to determine the significance of TPACK and its dimensions on technology applications among pre-service English teachers who just completed teaching practice as a part of their pre-service professional development. This professional development was conducted after the pre-service teachers completed their English language teaching program several years previously. In addition, the study explored the effect of English proficiency level on technology applications. The research results show that TPACK, along with most of its dimensions, correlated positively with the use of technology in the classroom. Content knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK) correlated to technology applications at a weak level; meanwhile, Technological Pedagogical knowledge (TPK) and Technological Pedagogical Content Knowledge (TPCK) were associated moderately with the use of technology for teaching among these new English teachers. In addition, the research result shows that English proficiency level affected technology applications in classrooms among teachers who were experienced in using technology for teaching. Therefore, it is recommended that future professional development for pre-service and in-service teachers include technology literacy and English proficiency development before TPACK training is started to maximize the impacts of the training on teachers' classroom practice. After or during TPACK training, teachers should be required to use technology in teaching practice or peer teaching to provide them with real experience in using technology for teaching. In addition, future studies are recommended to measure English proficiency using a standardized English test and include more potential mediating factors in data collection.

Acknowledgments

This work was financially supported by *Lembaga Penelitian dan Pengabdian kepada Masyarakat Universitas Syiah Kuala* [grant number 16/UN11.2.1/PT.01.03/PNBP/2023]. We are also grateful to the coordinators of the teacher professional development program at the universities where we collected the data for this research.

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