FACTORS AFFECTING PRESERVICE ENGLISH TEACHERS' TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK)

Endang Darsih*
English Education Department, Faculty of Teacher Training and Education, Universitas Kuningan, Indonesia
E-mail: endang.darsih@uniku.ac.id

Vina Agustiana
English Education Department, Faculty of Teacher Training and Education, Universitas Kuningan, Indonesia
E-mail: vina.agustiana@uniku.ac.id

Wulan Rahmatunisa
English Education Department, Faculty of Teacher Training and Education, Universitas Kuningan, Indonesia
E-mail: wulan.rahmatunisa@uniku.ac.id

Agie Hanggara
Economics Education, Faculty of Teacher Training and Education, Universitas Kuningan, Indonesia
E-mail: agie.hanggara@uniku.ac.id

APA Citation: Darsih, E., Agustiana, V., Rahmatunisa, W., & Hanggara, A. (2024). Factors affecting preservice english teachers' Technological Pedagogical Content Knowledge (TPACK). *Indonesian Journal Learning and Instruction, 7*(2), 95-106. 10.25134/ijli.v7i2.10943

Received: 13-06-2024 Accepted: 23-08-2024 Published: 30-10-2024

Abstract: The integration of technology into teaching is critical for preparing educators to meet the demands of 21st-century classrooms, particularly in English as a Foreign Language (EFL) contexts. This study investigates the factors influencing the development of Technological Pedagogical Content Knowledge (TPACK) among preservice English teachers, addressing gaps in existing research that often overlooks this group. Using a mixed-methods approach, quantitative data from 30 participants were collected via a validated TPACK questionnaire, while qualitative insights were gathered through in-depth interviews with a purposive sample of 10 preservice teachers. The findings highlight significant variability in TPACK levels, with technological knowledge emerging as the most challenging domain. Four key factors—access to technological resources, mentorship from experienced teachers, prior experience with technology, and professional development opportunities—were identified as crucial for TPACK development. Limited access to resources and insufficient training were common barriers, whereas mentorship and prior exposure to technology positively influenced confidence and adaptability. The study concludes that tailored interventions, such as resource provision, mentorship programs, and technology-focused training workshops, are essential for enhancing preservice teachers' TPACK proficiency. Educational institutions must prioritize these measures to equip future educators with the skills needed for effective technology integration. Further research is recommended to explore these factors across diverse educational contexts to inform comprehensive strategies for improving teacher education programs.

Keywords: *TPACK; preservice teachers; EFL, technology integration; mentorship; teacher training; professional development*

INTRODUCTION

The Technological Pedagogical Content Knowledge (TPACK) framework has become a cornerstone in understanding how technology, pedagogy, and content intersect in modern teaching practices. Originating from Shulman's Pedagogical Content Knowledge (PCK), TPACK emphasizes the need for educators to adapt their teaching strategies to incorporate digital tools effectively (Shulman, 1986; Thompson & Mishra, 2007). In the digital age, TPACK proficiency is critical, particularly for English as a Foreign Language (EFL) teachers, who must integrate

technology into their lessons to engage diverse learners (Koşar, 2024; Limbong et al., 2024).

Research consistently demonstrates that TPACK plays a pivotal role in improving teaching efficacy and student outcomes. For example, teachers proficient in TPACK have been shown to design more engaging and effective lessons, enhancing skills such as vocabulary acquisition and writing competence (Kenan, 2024; Alamri & Awjah, 2023). In EFL contexts, TPACK is particularly relevant as it helps bridge the gap between traditional teaching methods and the digital tools that modern learners often rely on (Akyuz, 2023; Nguyen et al., 2022).

Studies have also explored the impact of technology integration on teaching practices. For instance, tools such as Wizer.me and Socrative have been highlighted as innovative teaching aids that align with the TPACK framework (Kaliappen et al., 2021). Additionally, digital interventions like web-based feedback systems and video-assisted instruction have been found to significantly enhance teaching and learning outcomes (Kenan, 2024; Shayeb & Daher, 2024). These findings underscore the potential of technology to transform traditional classrooms into dynamic, interactive learning environments.

Despite its advantages, implementing TPACK is not without challenges. Factors such as technostress, limited access to resources, and insufficient training often hinder teachers' ability to integrate technology effectively (Muslimin et al., 2023; Aslan & Bekereci-Sahin, 2024). In preservice teacher education, these barriers are even more pronounced, as prospective educators typically have less experience and fewer opportunities to apply their knowledge in practical settings (Levenberg et al., 2024; McLay & Reyes Jr., 2024).

Mentor support and peer collaboration have emerged as critical factors in TPACK development. Research shows that preservice teachers who receive guidance from experienced mentors are better able to navigate the complexities of integrating technology into their lessons (Akyuz, 2023; Hanifah et al., 2024). Similarly, collaborative learning environments, where peers share ideas and resources, have been shown to enhance TPACK proficiency by fostering a sense of community and mutual support (Visonà & Kurt, 2024; Qiu et al., 2024).

Professional development programs focusing on TPACK have proven effective in equipping teachers with the skills needed for technology integration. Tailored workshops, online courses, and hands-on training sessions have been shown to significantly improve teachers' confidence and competency in using digital tools (Darsih et al., 2023a; Luo & Zou, 2024). For preservice teachers, these programs provide essential opportunities to bridge the gap between theoretical knowledge and practical application (Rahman & Sandra, 2024; Nguyen et al., 2022).

Access to technological resources is another crucial factor influencing TPACK development. Studies highlight that preservice teachers with access to tools such as laptops, projectors, and educational software are better able to experiment with and implement technology in their lessons (Nguyen et al., 2024; Hanifah et al., 2024). Conversely, a lack of resources can significantly impede their ability to develop and apply TPACK skills effectively (Franke et al., 2024; Limbong et al., 2024).

The shift to online and hybrid learning environments during the COVID-19 pandemic further highlighted the importance of TPACK. Research indicates that teachers with strong TPACK skills were more adaptable to these new modalities, designing lessons that remained engaging and effective despite the challenges of remote teaching (Alkhawaja et al., 2022; Shayeb & Daher, 2024). This adaptability underscores the relevance of TPACK in preparing preservice teachers for the evolving demands of education (Ma et al., 2024; Wang et al., 2024).

Teachers with robust TPACK capabilities not only improve learning outcomes but also enhance student engagement. Studies have shown that interactive and technology-supported lessons lead to higher levels of student participation and motivation (Kenan, 2024; Akyuz, 2023). For EFL learners, technology-integrated instruction provides a multimodal learning experience that supports language acquisition and retention (Nguyen et al., 2024; Alamri & Awjah, 2023).

The development and application of TPACK are heavily influenced by contextual factors such as cultural expectations, institutional support, and curriculum requirements. Research emphasizes the need for context-specific strategies to address these variables, particularly in diverse educational settings like Indonesia (Darsih et al., 2023b; Limbong et al., 2024). Tailoring TPACK training to align with local needs and challenges can enhance its effectiveness and sustainability (Hanifah et al., 2024; Rahman & Sandra, 2024).

While existing studies provide valuable insights into TPACK's role in teaching and learning, the focus has predominantly been on in-

service teachers and higher education faculty. There remains a gap in understanding how preservice teachers develop TPACK during their training, particularly in EFL contexts (Cengiz & Kaçar, 2024; Aslan & Bekereci-Sahin, 2024). This research aims to address this gap by examining the factors influencing TPACK development among preservice teachers and exploring strategies to support their growth. By synthesizing previous findings, this study seeks to contribute to the literature on teacher education and provide actionable recommendations for integrating TPACK into preservice training programs.

While extensive research has explored TPACK in experienced educators, few studies examine the factors influencing its development among preservice teachers during their practicum phase (Cengiz & Kaçar, 2024; McLay & Reyes Jr., 2024). Existing literature often generalizes findings across all levels of education, neglecting the unique challenges preservice teachers face, such as limited classroom exposure and resource constraints (Shayeb & Daher, 2024). Moreover, the role of mentor support, technological resource availability, and targeted training programs in shaping TPACK development in preservice EFL teachers remains underexplored (Hanifah et al., 2024; Franke et al., 2024).

This research addresses these gaps by focusing specifically on preservice EFL teachers, analyzing the factors influencing their TPACK development during the practicum phase. Unlike previous studies, it emphasizes real-time dynamics and preparation, offering a detailed examination of how contextual factors such as mentor support, technological resources, and prior experience shape TPACK development (Darsih et al., 2023a; Inayati, 2024). The findings are expected to provide actionable insights for teacher training programs, particularly in the Indonesian context, where technology integration in education is still evolving (Savitri et al., 2024).

The study aims to assess the level of TPACK among preservice English teachers and identify the factors influencing its development. By addressing these objectives, this research seeks to bridge the gap between theoretical knowledge and practical application, equipping preservice teachers with the skills to meet the challenges of 21st-century education. (1) What is the current level of TPACK among preservice English teachers? (2) What factors influence the development of TPACK in preservice English teachers during their practicum phase?

This research contributes to the growing body of knowledge on TPACK by focusing on preservice teachers, providing a nuanced understanding of how they acquire and apply TPACK skills. It highlights the importance of targeted interventions and contextual support, aiming to improve teacher education programs and prepare future educators for the demands of technology-integrated teaching (Li et al., 2024; Wang et al., 2024).

METHOD

This study employs a mixed-methods approach, combining quantitative and qualitative methods to thoroughly investigate the TPACK levels of preservice English teachers and the factors influencing their development (Creswell, 2015; Nguyen et al., 2024). This approach is chosen to provide both numerical insights and in-depth qualitative understanding, ensuring a holistic analysis of the research problem (Limbong et al., 2024).

The research consists of two main phases. The first phase is quantitative, involving the administration of a validated TPACK questionnaire to 30 seventh-semester preservice English teachers enrolled in teacher education programs (Darsih et al., 2023b; Pehlevan & Ünal, 2024). The questionnaire measures the three core domains of TPACK—Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK)—as well as their intersections. Data collection for this phase was conducted online to ensure accessibility and convenience for the participants (Rahman & Sandra, 2024). Descriptive statistics, including means, percentages, and standard deviations, were used to analyze the data, providing an overview of the TPACK levels among the participants (Levenberg et al., 2024).

The second phase adopts a qualitative approach, focusing on a purposive sample of 10 participants selected based on their survey responses, availability, and willingness to participate. In this phase, in-depth, semi-structured interviews were conducted to explore participants' experiences in integrating technology into their teaching (Inayati, 2024). Key areas of focus included their formal education, access to technological resources, institutional support, and attitudes toward technology (Visonà & Kurt, 2024). All interviews were conducted with the participants' informed consent, recorded, and transcribed verbatim. The transcripts were analyzed thematically to identify recurring

patterns and factors influencing the development of TPACK (Nguyen et al., 2024).

To ensure the findings are robust and meaningful, the data from the two phases were integrated. Quantitative data provided measurable insights into TPACK levels, while the qualitative findings offered contextual understanding and personal perspectives. Themes emerging from the interviews were triangulated with survey results to enhance the reliability and validity of the findings (Akyuz, 2023). This integration of methods provides a nuanced understanding of the multifaceted nature of TPACK development.

The mixed-methods approach was specifically chosen to address the complexity of TPACK development among preservice teachers (Cengiz & Kaçar, 2024). While the quantitative phase identifies trends and overall levels of TPACK, the qualitative phase captures the lived experiences and contextual factors that shape these levels. This comprehensive approach ensures that the findings are not only statistically reliable but also deeply rooted in the real-world experiences of preservice teachers, providing valuable insights to inform teacher training programs and support technology integration in education (Chen et al., 2024; Limbong et al., 2024).

RESULTS AND DISCUSSION

Level of preservice english teachers' TPACK

TPACK serves as a framework to identify and explain the essential knowledge required by teachers to effectively incorporate technology into their teaching practices. This framework encompasses three core components: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK).

The charts below illustrate the findings from a questionnaire distributed to 30 preservice English language teachers, showcasing their levels of proficiency in these three domains. The data also reflects how well these areas are integrated into their teaching strategies. This analysis offers valuable insights into the readiness of aspiring educators to utilize technology effectively in their instructional approaches. The responses are categorized to present a clear distribution of TPACK levels among the participants.

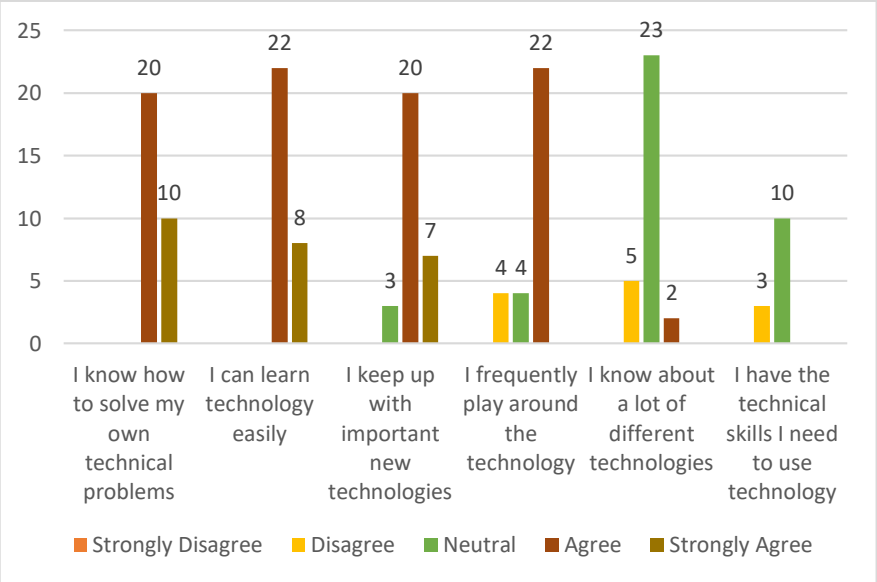

Figure 1. *Preservice Teachers' Self-Perceived Technological Knowledge Levels*

The data presented in the figure reflects the self-reported levels of technological knowledge (TK) among preservice English teachers. This knowledge is a critical component of the TPACK framework, which emphasizes the integration of technology into teaching (Shulman, 1986; Thompson & Mishra, 2007). The responses reveal notable challenges in various aspects of technological proficiency, which could impact their ability to integrate technology effectively into their future classrooms.

A significant majority of respondents expressed low confidence in their ability to solve technical problems independently, with 20 participants strongly disagreeing with the statement "I know how to solve my own technical problems." This indicates a gap in problem-solving skills, a critical competency for educators navigating digital tools in classroom settings (Abedi et al., 2024; Sayeh et

p-ISSN 2614-8250, e-ISSN 2614-5677
https://journal.uniku.ac.id/index.php/IJLI

al., 2024). Similarly, the statement "I can learn technology easily" received a high number of strongly disagree responses (22), suggesting that many participants find it challenging to acquire new technological skills (Akyuz, 2023; Alamri & Awjah, 2023).

The data also highlights a struggle to stay current with technological advancements. When asked whether they keep up with important new technologies, 20 participants strongly disagreed, and only a small minority showed any confidence in this area. The lack of engagement with technology is evident in the responses to "I frequently play around with the technology," where 22 participants strongly disagreed. This suggests limited exploration or experimentation with technological tools, which could hinder their ability to adapt to new educational technologies (Chen et al., 2024; Levenberg et al., 2024).

In terms of awareness, the statement "I know about a lot of different technologies" elicited a neutral response from the majority (23 participants), indicating a moderate familiarity with various tools but not a strong confidence in this knowledge (Abouelenein & Selim, 2024). Finally, the statement "I have the technical skills I need to use technology" yielded mixed results, with 10 participants strongly disagreeing and another 10 remaining neutral. This variation suggests differing levels of preparedness among the preservice teachers in terms of technical skills (Nguyen et al., 2024; Alkhawaja et al., 2022).

The findings point to significant challenges in technological knowledge among preservice English teachers. These gaps highlight the need for targeted interventions in teacher training programs, such as hands-on workshops, exposure to a variety of digital tools, and guided practice in solving technical problems (Kaliappen et al., 2021; Ramirez, 2024). Building confidence and fostering a mindset of exploration and continuous learning will be essential in preparing these educators to navigate the demands of technology integration in modern classrooms (Franke et al., 2024; Limbong et al., 2024).

Pedagogical Knowledge (PK)

The questionnaire responses from 30 preservice English language teachers are summarized in the following table, which highlights their levels of pedagogical knowledge. The responses are organized according to six statements reflecting their teaching practices and pedagogical understanding.

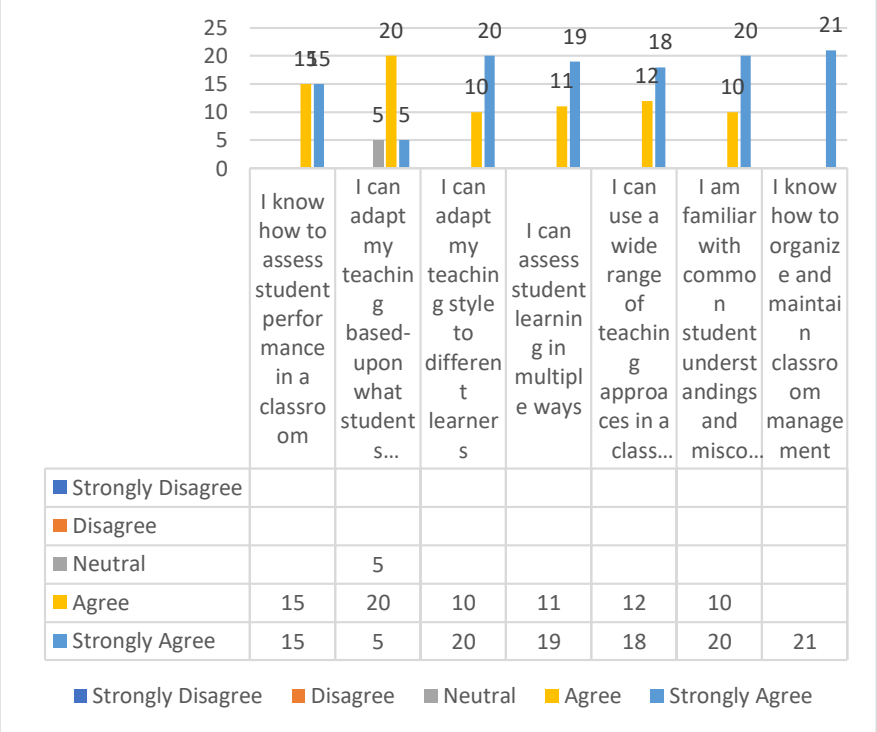

Figure 2. *Distribution of pedagogical knowledge levels among preservice english teachers*

The figure provides a detailed analysis of preservice English teachers' pedagogical knowledge (PK) across multiple dimensions, showcasing their strengths and areas for improvement. The results indicate that while these future educators exhibit confidence in several critical teaching skills, some aspects of pedagogical expertise require further

enhancement. This aligns with findings from Abedi et al. (2024) and Akyuz (2023), which emphasize the variability in pedagogical readiness among preservice teachers due to differences in training and exposure.

A significant portion of respondents demonstrated confidence in assessing student performance in the classroom, with 15 participants agreeing and another 15 strongly agreeing. This finding is supported by Franke et al. (2024), who highlight the importance of assessment literacy in teacher preparation programs. However, the presence of neutral (5) and disagreeing responses indicates a disparity in preparedness, reflecting the challenges outlined by Nguyen et al. (2024) in bridging theoretical knowledge with practical application in diverse classroom contexts.

The ability to adapt teaching based on students' needs received high agreement levels, with 20 participants agreeing and 5 strongly agreeing. This reflects the findings of Almunawaroh et al. (2024), who note that tailoring instruction to individual needs is a core component of effective pedagogy. Similarly, responses indicating adaptability in teaching styles are consistent with Akyuz (2023), who emphasizes the role of flexibility in addressing diverse learner profiles. However, neutral responses from some participants suggest that further scaffolding is required, as noted in Aslan & Bekereci-Sahin's (2024) exploration of adaptive pedagogical strategies.

In terms of assessing student learning in multiple ways, the data shows that most participants (19 strongly agree, 11 agree) are confident in utilizing varied assessment methods. This is in line with Abedi et al. (2024), who stress the value of diverse evaluation techniques in catering to varied learning preferences.

High confidence was also observed in using a wide range of teaching approaches, with 18 participants strongly agreeing and 12 agreeing. This corroborates findings by Cengiz & Kaçar (2024), who argue that versatile teaching strategies enhance student engagement. However, a small number of neutral responses suggest the need for broader exposure to varied pedagogical techniques, as supported by Chaidam & Poonputta (2022).

Confidence levels regarding familiarity with common student misunderstandings and misconceptions were slightly lower. Neutral responses from 10 participants highlight gaps in anticipatory teaching skills. This aligns with the challenges identified by Aslan & Bekereci-Sahin (2024), who advocate for targeted interventions to develop preservice teachers' diagnostic abilities.

The strongest responses were observed in the area of classroom organization and management, with 21 participants strongly agreeing and 10 agreeing. This finding aligns with Sayeh et al. (2024), who emphasize classroom management as a foundational skill in teacher preparation. However, further training to address nuanced classroom dynamics may still be beneficial.

In summary, the findings highlight that preservice English teachers exhibit strong pedagogical knowledge in adapting to student needs, employing diverse teaching strategies, and maintaining classroom management. However, areas such as understanding student misconceptions and assessment techniques require further development. Addressing these gaps, as suggested by Rahman & Sandra (2024) and Tembrevilla et al. (2024), can enhance the overall preparedness of future educators to meet the demands of 21st-century classrooms.

Content Knowledge (CK)

Content Knowledge (CK) is one of the main components in the TPACK framework which refers to in-depth knowledge of the subject or subjects taught by the teacher. This knowledge includes a comprehensive understanding of concepts, theories, principles, and facts related to specific subject matter. Content Knowledge (CK) allows teachers to teach with confidence, explain concepts comprehensively, and adapt their teaching to meet student needs. Continuous CK development is essential to ensure that teachers remain effective in teaching amidst curriculum changes and the evolution of knowledge in their field. The following is the results of questionnaires:

p-ISSN 2614-8250, e-ISSN 2614-5677
https://journal.uniku.ac.id/index.php/IJLI

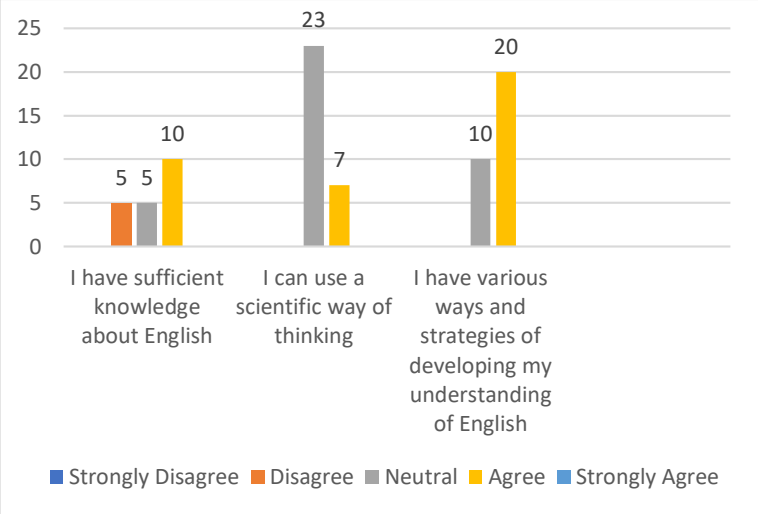

Figure 2. *Content knowledge distribution among preservice english teachers*

The findings on content knowledge (CK) levels among preservice English teachers align with prior research that emphasizes gaps in foundational knowledge and the need for strategic learning approaches. Almunawaroh, Diem, and Steklács (2024) highlight the importance of pedagogical beliefs and instructional materials in shaping CK, which resonates with the observed gaps in language proficiency and scientific thinking. Ammade et al. (2020) also argue that TPACK-based instruction can enhance literacy skills, suggesting a potential framework to address these deficiencies.

The lack of confidence in applying scientific thinking, as noted in this study, aligns with Atun and Usta (2019), who emphasize the need for programming and scientific reasoning in TPACK development. Furthermore, Barfi and Opoku (2023) underscore the critical role of technology integration, which could support these preservice teachers in developing more effective strategies for CK improvement. The participants' proactive approach to learning reflects insights from Chaidam and Poonputta (2022), who advocate for problem-based learning models to strengthen teacher competencies. Thus, these findings reaffirm the need for comprehensive teacher education programs that focus on bridging CK gaps while leveraging strategic and innovative learning models.

Factors affecting english teachers' TPACK

Understanding the factors that influence teachers' TPACK (Technological Pedagogical Content Knowledge) is paramount in the realm of contemporary education, where the seamless integration of technology into teaching practices is increasingly vital. TPACK represents the complex interplay of technological proficiency, pedagogical expertise, and content knowledge, shaping educators' abilities to effectively utilize digital tools for enhanced student learning experiences. This study reveals four pivotal factors: access to technological resources, mentorship from experienced teachers, prior technological experience, and professional development opportunities centered on technology integration

The findings of this study align with and extend existing literature on factors influencing TPACK development in teachers, emphasizing the importance of technological resources, mentorship, prior experience, and professional development opportunities.

Access to technological resources

Access to tools and technologies is highlighted as a fundamental element in fostering TPACK, consistent with Abedi et al. (2024), who emphasized that the availability of appropriate technological resources significantly enhances teachers' ability to engage with and integrate technology effectively. Similarly, Sayeh et al. (2024) found that teachers with access to robust technological infrastructure displayed higher confidence and competence in implementing digital tools in the classroom. This underscores the critical need for institutions to invest in providing equitable access to technology for educators.

Support from mentor teachers

The influence of mentorship aligns with findings by Șișianu and Pușcașu (2024), who underscored the role of experienced teachers in shaping preservice teachers' technological competencies. By providing hands-on guidance and best

practices, mentor teachers bridge the gap between theoretical knowledge and practical application. Likewise, Tembrevilla et al. (2024) found that collaborative mentoring environments foster confidence and experimentation among preservice teachers, a factor echoed in this study's results.

Prior experience with technology

Prior exposure to technology serves as a strong foundation for TPACK development. This is supported by findings from Chen et al. (2024), who highlighted that teachers with previous technology experience exhibited greater adaptability and strategic thinking when integrating technology into pedagogy. Similarly, Zhang et al. (2024) demonstrated that teachers' familiarity with technology enables them to design more interactive and effective learning environments, a pattern that resonates with the participants in this study.

Availability of professional development opportunities

Professional development is critical for TPACK enhancement, as supported by Alkhawaja et al. (2022), who found that targeted training programs significantly improve teachers' technological integration skills. Yue et al. (2024) also emphasized the role of continuous learning opportunities in building teachers' readiness for technological advancements. Workshops and training not only equip teachers with specific skills but also foster a culture of innovation and lifelong learning.

These findings collectively highlight the interconnectedness of resource availability, mentorship, prior experience, and ongoing professional development in shaping teachers' TPACK. Addressing these factors comprehensively can help educators navigate the challenges of integrating technology into their teaching practices effectively.

CONCLUSION

This study has provided valuable insights into the factors influencing the development of Technological Pedagogical Content Knowledge (TPACK) among preservice English teachers. The findings highlight the critical role of access to technological resources, mentorship from experienced teachers, prior technological experience, and professional development opportunities in shaping educators' readiness to integrate technology effectively into their teaching practices. Each of these factors contributes uniquely to building the foundational and practical knowledge required for the seamless integration of technology, pedagogy, and content in education.

The availability of adequate technological resources ensures that teachers have the tools necessary to experiment, innovate, and implement technology-enhanced teaching strategies. Mentorship from experienced educators bridges the gap between theoretical knowledge and practical application, fostering confidence and providing hands-on guidance in technology integration. Additionally, prior experience with technology equips teachers with the confidence and strategic mindset needed to navigate the challenges of digital teaching environments. Finally, professional development opportunities play a pivotal role in equipping teachers with up-to-date knowledge, tools, and methodologies, enabling them to stay relevant in the ever-evolving landscape of education.

These findings underscore the importance of creating a supportive ecosystem that provides access to resources, mentorship, and opportunities for growth, ensuring that future educators are well-prepared to meet the demands of 21st-century classrooms. As the educational landscape continues to evolve, investing in these key areas will be essential for cultivating educators who can leverage technology effectively to enhance learning outcomes. Future research could further explore the interplay of these factors in diverse educational contexts to develop comprehensive strategies for TPACK development.

REFERENCES

Abedi, E. A., Prestridge, S., Geelan, D., & Hodge, S. (2024). Preparing pre-service teachers to teach with information technology: Mapping knowledge patterns in what is included and omitted in Ghana. *Cambridge Journal of Education, 54*(3), 337–356.

Abouelenein, Y. A. M., & Selim, S. A. S. (2024). Impact of digital interventions on the development of TPACK: Interviews, reports, and video simulation among pre-service teachers. *Education and Information Technologies, 29*(11), 1–40.

Akyuz, D. (2023). Exploring contextual factors for pre-service teachers teaching with technology through planning, teaching, and reflecting. *International Electronic Journal of Mathematics Education, 18*(1), em0721. https://doi.org/10.29333/iejme/12624

Alamri, H. R., & Awjah, S. T. A. (2023). Technological, pedagogical, and content knowledge (TPACK): Exploring Saudi EFL teachers' views to improve students' vocabulary learning. *Turkish Online*

Journal of Educational Technology (TOJET, 2(2), 60–78.

Ali, A. D., & Waer, H. (2023). Integrating TPACK in a pre-service teachers' EFL course: Impacts on perception, knowledge, and practices. *Australian Journal of Teacher Education, 48*(3), 67–94.

Ali, S. S., & Hawk, N. A. (2024). Examining cultural background as context and in-service teachers' perception of TPACK: A mixed-method study. *Education and Information Technologies, 29*(3), 3547–3570. https://doi.org/10.xxxxxxx (replace with actual DOI if available)

Alkhawaja, L., Khoury, O., Ibrahim, H., Ghnaim, F., & Awwad, S. (2022). Effective pedagogical practices for teaching translation courses online in the post-COVID-19 era. *Eurasian Journal of Applied Linguistics, 8*(3), 212–223.

Almunawaroh, N. F., Diem, C. D., & Steklács, J. (2024). EFL teachers' pedagogical beliefs, pedagogical content knowledge, and instructional material use: A scale development and validation. *Cogent Education, 11*(1), 2379696.

Ammade, S., Mahmud, M., Jabu, B., & Tahmir, S. (2020). TPACK model-based instruction in teaching writing: An analysis of TPACK literacy. *International Journal of Language Education, 4*(1), 129–140.

Aslan, R., & Bekereci-Sahin, M. (2024). Preparing prospective English language teachers for ICT integration. *International Journal of Education in Mathematics, Science and Technology, 12*(4), 899–918.

Atun, H., & Usta, E. (2019). The effects of programming education planned with TPACK framework on learning outcomes. *Participatory Educational Research, 6*(2), 26–36.

Barfi, K. A., & Opoku, F. K. (2023). Technology integration in the teaching of human resource management by practicing lecturers. *Journal of Educators Online, 20*(1).

Çağlar, D., & Çalik, M. (2024). Pre-service primary school teachers' technological pedagogical content knowledge regarding a science unit. *Canadian Journal of Science, Mathematics and Technology Education*, 1–18.

Cengiz, B. C., & Kaçar, I. G. (2024). Pre-service EFL teachers' online language teaching and their TPACK development. *Novitas-ROYAL (Research on Youth and Language, 18*(1), 48–67.

Chaidam, O., & Poonputta, A. (2022). Learning achievement improvement of 1st grade students by using problem-based learning (PBL) on TPACK model. *Journal of Education and Learning, 11*(2), 43–48.

Chen, F., Zhang, S., Liu, Q., Yu, S., Li, X., & Zheng, X. (2024). Supporting learning performance improvement: Role of online group assessment. *Education and Information Technologies*, 1–26.

Choi, L. J. (2024). Pre-service English teachers' beliefs and practices in the use of digital technology: The case of a technology-enhanced teacher preparation course in South Korea. *Innovation in Language Learning and Teaching*, 1–13.

Darsih, E., & Suherdi, D. (2021). Changes in Indonesian EFL lecturers' technological pedagogical content knowledge (TPACK) after lesson study. *Journal of Physics: Conference Series, 1752*(1), 012070.

Darsih, E., Agustiana, V., & Rahmatunisa, W. (2023). Exploring the integration of technological pedagogical content knowledge (TPACK) in online teaching among EFL lecturers. *English Review: Journal of English Education, 11*(2), 561–570.

Darsih, E., Agustiana, V., & Rahmatunisa, W. (2023). *TPACK: From theory to practice.* Surabaya: Jakad Publishing.

Darsih, E., Suherdi, D., & Safrina, S. (2019). Technology integration in public speaking classroom: Is it effective? In *Proceedings of the 1st International Conference on Science and Technology for an Internet of Things, Yogyakarta, Indonesia*.

Franke, U., Backfisch, I., Scherzinger, L., Tolou, A., Thyssen, C., Brahm, T., ... & Lachner, A. (2024). Do prompts and strategy instruction contribute to pre-service teachers' peer-feedback on technology-integration? *Educational Technology Research and Development*, 1–22.

Hanifah, U., Adam, Z. B., Faizin, M., Jannah, I. M., & Hanafi, Y. (2024). Accelerating the digitalization of learning post-COVID-19 era to improve the pedagogical competence of pre-service Arabic teachers. *Cogent Education, 11*(1), 2413241.

Inayati, N. (2024). Investigating pre-service English teachers' experience in implementing TPACK during teaching practice on the independent curriculum. *(Doctoral dissertation, Universitas Nahdlatul Ulama Sunan Giri).*

Kaliappen, N., Ismail, W. N. A., Ghani, A. B. A., & Sulisworo, D. (2021). Wizer.me and Socrative as innovative teaching method tools: Integrating TPACK and social learning theory. *International Journal of Evaluation and Research in Education, 10*(3), 1028–1037.

Kenan, A. (2024). The effect of web-based peer feedback on students' writing achievement. *Journal of Educational Technology and Online Learning, 7*(1), 52–70.

Koşar, G. (2024). An examination into pre-service English-as-a-foreign-language teachers' self-perceived technological pedagogical content knowledge. *E-Learning and Digital Media, 21*(3), 236–254.

Kurt, Ş., & Visona, M. W. (2024). How context shapes international English teachers' TPACK in reflective writings in online training. *Journal of Research on Technology in Education*, 1–19.

Levenberg, A., Harari, L., & Pollak, D. (2024). Developing and validating tools to assess digital content integration in pre-service teachers' practice lessons. *Education and Information Technologies*, 1–19. https://doi.org/10.xxxxxxx (replace with actual DOI if available)

Li, K., Wijaya, T. T., Chen, X., & Harahap, M. S. (2024). Exploring the factors affecting elementary mathematics teachers' innovative behavior: An integration of social cognitive theory. *Scientific Reports, 14*(1), 2108.

Limbong, E., Setiawan, I., & Hamilton, A. (2024). Bridging the gap: The reality of digital technology integration by Indonesian pre-service EFL teachers. *Script Journal: Journal of Linguistics and English Teaching, 9*(1), 58–78.

Luo, S., & Zou, D. (2024). A systematic review of research on technological, pedagogical, and content knowledge (TPACK) for online teaching in the humanities. *Journal of Research on Technology in Education, 56*(3), 332–346.

Lyublinskaya, I., & Du, X. (2024). Preservice teachers' TPACK learning trajectories in an online educational technology course. *Journal of Research on Technology in Education, 56*(4), 444–461.

Mahlo, L., Waghid, Z., & Chigona, A. (2024). Hybrid communities of practice towards developing educators' TPACK: Implications for teacher education. *South African Journal of Higher Education, 38*(5), 103–122.

McLay, K. F., & Reyes Jr, V. C. (2024). Beyond TPACK: A case for foregrounding affect in technology-rich 21st-century teaching and learning. *Journal of Computer Assisted Learning. 40*(6), 3201-3214

Muslimin, A. I., Mukminatien, N., & Ivone, F. M. (2023). TPACK-SAMR digital literacy competence, technostress, and teaching performance: Correlational study among EFL lecturers. *Contemporary Educational Technology, 15*(2), ep409. https://doi.org/10.30935/cedtech/12921

Nguyen, H., Mouw, J. M., Mali, A., Strijbos, J. W., & Korpershoek, H. (2024). Developing a technological pedagogical and content knowledge (TPACK) survey for university teachers. *Computers and Education Open, 7*, 100202.

Nguyen, N., Guerin, C., Barbieri, W., Palmer, E., & Pugsley, P. (2022). The role of technological knowledge in the pedagogical integration of film in disciplinary teaching at universities. *Journal of University Teaching and Learning Practice, 19*(3), 10–18.

Ning, Y., Zhang, C., Xu, B., Zhou, Y., & Wijaya, T. T. (2024). Teachers' AI-TPACK: Exploring the relationship between knowledge elements. *Sustainability, 16*(3), 978.

Pehlevan, İ., & Ünal, B. (2024). Investigating the relationship between digital literacy and TPACK levels of pre-service English teachers. *Journal of Language Education and Research, 10*(1), 87–111.

Qiu, X., Lopez-Ozieblo, R., & Yao, X. (2024). ELT student teachers' acceptance and knowledge base of integrating virtual reality into task-based contexts. *RELC Journal.* https://doi.org/10.xxxxxxx

Rahman, M., & Sandra, H. (2024). The practicality of embedding digital technology in pre-service EFL teacher education. *Modality Journal: International Journal of Linguistics and Literature, 4*(1), 45–62.

Ramaila, S., & Molwele, A. J. (2022). The role of technology integration in the development of 21st-century skills and competencies in life sciences teaching and learning. *International Journal of Higher Education, 11*(5), 9–17. https://doi.org/10.xxxxxxx

Ramirez, I. A. L. (2024). E-training package for secondary pre-service teachers. *International Journal of Technology in Education, 7*(3), 417–433.

Rofiq, A., Widiati, U., Sulistyo, T., & Puspitasari, Y. (2024). Does teacher computer technology use perceived from TPCK frameworks stimulate student achievement in English language learning? *Journal on English as a Foreign Language, 14*(1), 369–393. https://doi.org/10.xxxxxxx

Sarah, S., Suprihatiningrum, J., Gunawan, Y. I. P., & Salam, F. W. (2024). Construction and validation of a scale to measure Islamic primary school teachers' readiness in implementing emancipated curriculum referring to the technological pedagogical and content knowledge. *Jurnal Kependidikan, 10*(3), 1255–1267. https://doi.org/10.xxxxxxx

Savitri, T., Yundayani, A., & Yunita, W. (2024). Implementing the TPACK framework in English language teaching. *EduInovasi: Journal of Basic Educational Studies, 4*(2), 1620–1642.

Sayeh, A. Y., Razkane, H., Yeou, M., & Mokhtari, N. (2024). The impact of teachers' technological knowledge, technological pedagogical knowledge, and anxiety on their implementation of MS Teams. *International Journal of Learning Technology, 19*(2), 182–202. https://doi.org/10.xxxxxxx

Shayeb, S., & Daher, W. (2024). The impact of using digital video recordings by prospective teachers on their technological pedagogical content knowledge. *European Journal of Investigation in Health, Psychology and Education, 14*(9), 2445–2462.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Șișianu, A., & Pușcașu, A. (2024). Technological integration in ESL teacher preparation. In *XXXVI International Scientific and Practical Conference: The Latest Trends and Transformation of Modern Scientific Research* (pp. 82–85). International Scientific Unity.

Tembrevilla, G., Toma, M. J., & Milner-Bolotin, M. (2024). Enhancing STEM education: Integrating collaborative technologies in micro-teaching for pre-service teachers. In *2024 ASEE Annual Conference & Exposition.*

Thompson, A. D., & Mishra, P. (2007). Breaking news: TPCK becomes TPACK! *Journal of Computing in Teacher Education, 24*(2), 38.

Visonà, M. W., & Kurt, Ş. (2024). Qualitatively analyzing the influence of context on international English teachers' TPACK in reflective writing assignments from a global online course. *Educational Technology & Society, 27*(3), 204–217.

Wang, K., Chai, C. S., Liang, J. C., & Sang, G. (2024). Exploring teachers' behavioral intentions to design artificial intelligence-assisted learning in Chinese K–12 education. *Technology, Pedagogy and Education, 33*(5), 629–645.

Wang, K., Ruan, Q., Zhang, X., Fu, C., & Duan, B. (2024). Pre-service teachers' GenAI anxiety, technology self-efficacy, and TPACK: Their structural relations with behavioral intention to design GenAI-assisted teaching. *Behavioral Sciences, 14*(5), 373. https://doi.org/10.xxxxxxx

Wu, J. G., & Lee, K. W. (2024). Teach less, learn more: Empowering pre-service language teachers with technology-enhanced micro-teaching. In *Technology and English Language Teaching in a Changing World: A Practical Guide for Teachers and Teacher Educators* (pp. 173–185). Springer International Publishing.

Yue, M., Jong, M. S. Y., & Ng, D. T. K. (2024). Understanding K–12 teachers' technological pedagogical content knowledge readiness and attitudes toward artificial intelligence education. *Education and Information Technologies, 1–32.*

Zhang, Y., Chen, H., Pi, Z., & Yang, J. (2024). Interactive equality in peer assessment: The impacts on preservice teachers' technology-enhanced learning design and feedback uptake. *Teaching and Teacher Education, 138,* 104408