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Factors Affecting Preservice English Teachers' Technological Pedagogical Content Knowledge (TPACK)

Endang Darsih[1], Vina Agustiana[2], Wulan Rahmatunisa[3], Agie Hanggara[4]*

English Education Department, Faculty of Teacher Training and Education,
Universitas Kuningan, Indonesia
*Correspondence: E-mail: agie.hanggara@uniku.ac.id

ABSTRACT

This research aims to identify factors influencing the development of Technological Pedagogical Content Knowledge (TPACK) of preservice English teachers, specifically those who are currently undertaking teaching practicum. The study employs a mixed-methods approach by distributing questionnaires, conducting in-depth interviews, and observing teaching practices to obtain comprehensive data. The study highlights the diverse levels of TPACK among prospective English teachers, with significant variations in technological, pedagogical, and content knowledge. The results also reveal several key elements that influence TPACK development. These include access to technological resources, support from mentor teachers, prior experience with technology, and the availability of professional development opportunities focused on technology integration.

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1. INTRODUCTION

The rapid digital transformation has significantly changed the educational landscape, demanding educators to master new skills in integrating technology into the teaching process. One highly relevant model in this context is Technological Pedagogical Content Knowledge (TPACK), introduced by Mishra and Koehler in 2006. TPACK offers a comprehensive and integrative framework for understanding how technology can be effectively combined with pedagogy and learning content. The TPACK concept was first introduced by Koehler & Mishra in (Thompson, A. D., Mishra., 2007), which is a new structure from Shulman's PCK or Pedagogical Content Knowledge (Shulman, L., 1986; Shulman, L., 1987.)

In the context of teacher education, a deep understanding of TPACK and its application in classroom practice becomes very important. Prospective teachers, as the new generation of educators, need to be equipped with TPACK skills to prepare them to face educational challenges in the digital era. English teacher candidates, or preservice teachers, are faced with the challenge of developing their TPACK during their education and training period. This process does not occur automatically and is influenced by various factors.

In recent years, research on the application of TPACK (Technological Pedagogical Content Knowledge) has demonstrated the importance of integrating technology, pedagogy, and content in education (Barfi et al, 2023; Gaxhiqi, Behxhet, 2021; Hero, Jesson L, 2019) as well as for the effectiveness of learning (Ramaila et al, 2022). Many studies have explored how teachers at various educational levels implement TPACK to enhance their teaching effectiveness. Some studies have examined the TPACK status of lecturers and how they integrate it into their teaching (Mutanga, 2018; Ammade et al, 2020; Alkhawaja et al, 2022; Nguyen et al, 2022; Kaliappen et al, 2021). Several findings indicate that teachers who have a strong understanding and skills in TPACK tend to be more successful in designing and implementing innovative and engaging lessons (Ibtihal & Behrang, 2024; Amira & Hanan, 2023; Akyuz, Didem, 2023; Muslimin, Afif, 2024), which in turn can improve student learning outcomes (Atun, Handan, 2019; Chaidam et al, 2022), such as improving writing skills (Kenan Acarol, 2024) and increasing student vocabulary (Alamri et al, 2023).

However, although the existing literature has provided important insights into the application of TPACK by practicing teachers and lecturers (Darsih et al, 2023a; Darsih, E & Suherdi, 2021; Darsih et al, 2019; Darsih et al, 2023b) there remains a gap in research related to how preservice teachers, the next generation of educators, develop and apply TPACK during their preparation phase. Specifically, there is still very little research that delves into the specific factors influencing the TPACK of these preservice teachers.

This research aims to deeply examine the level of TPACK and the factors influencing the development of TPACK in prospective English teachers. By understanding these TPACK levels and factors, it is hoped that more effective training and professional development strategies can be developed, preparing prospective teachers to face the challenges and demands of teaching in the digital era. This research is also expected to make a significant contribution to the academic literature in the field of education, particularly in the context of developing technology competence among teachers in Indonesia.

The formulation of the problems in this research can be detailed as follows:

1. What is the level of TPACK among preservice English teachers?
2. What factors influence the development of TPACK in preservice English teachers?

This research offers several novel aspects that differentiate it from previous studies:

1. Focus on Preservice Teachers: Unlike previous TPACK research that primarily focused on practicing teachers and lecturers, this study specifically targets preservice teachers. This provides a new perspective on how the next generation of educators prepares themselves to integrate technology into teaching.

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2. In-depth Analysis of Factors Influencing TPACK Development: By conducting an in-depth analysis of factors influencing the development of TPACK among preservice teachers, this research contributes to the development of practical solutions that can support more effective integration of TPACK in the future.

2. METHODS

This research employs a mixed-methods approach, combining quantitative and qualitative methods (Creswell, 2015) to provide a comprehensive understanding of the TPACK levels among preservice English teachers and the factors influencing them. In the quantitative phase, a survey was administered to a random sample of 30 seventh-semester students in teacher education programs, using a validated questionnaire to measure TPACK levels comprehensively (Darsih et al, 2023b). Data collection was conducted online, with analysis utilizing descriptive statistics. In the qualitative phase, in-depth interviews were conducted with a selected subset of 10 participants, exploring their teaching experiences, formal education, access to technology, institutional support, and attitudes towards technology. These interviews, recorded and transcribed with consent, will undergo thematic analysis to uncover factors influencing TPACK development. This dual-method approach aims to offer a nuanced understanding that informs effective integration of technology in English language teaching preparation programs.

3. RESULTS AND DISCUSSION

3.1 Level of Preservice English Teachers' TPACK

TPACK, or Technological Pedagogical Content Knowledge, is a framework used to understand and describe the knowledge needed by teachers to effectively integrate technology into teaching. This framework combines three main types of knowledge namely Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content Knowledge (CK).

The following charts present the results of a questionnaire on the TPACK (Technological Pedagogical Content Knowledge) levels of 30 preservice English language teachers. The data highlights their proficiency in technological knowledge, pedagogical knowledge, and content knowledge, as well as their overall integration of these domains into their teaching practices. This analysis provides valuable insights into the preparedness of future educators in effectively leveraging technology in their instructional methods. The frequencies of the responses have been categorized to show the distribution of TPACK levels among the participants.

Technological Knowledge (TK)

Technological Knowledge (TK) is a vital component in the TPACK framework which refers to knowledge about how to use technology, including hardware and software, in educational contexts. Technological Knowledge (TK) includes an in-depth understanding of various technological tools and applications that can support the learning process, such as computers, tablets, interactive boards, and educational software. Additionally, Technological Knowledge (TK) involves knowledge of digital platforms and collaborative tools, such as Learning Management Systems (LMS), online learning applications, and social media used to increase student interaction and engagement. Teachers who have good Technological Knowledge (TK) are able to choose and use the right technological tools for various learning purposes, from delivering material, evaluating, to classroom management. Technological Knowledge (TK) also includes an understanding of technology-related issues such as digital safety, ethical use of technology, and equity of access, all of which are important for creating a safe and inclusive learning environment. Furthermore, Technological Knowledge (TK) allows teachers to stay up-to-date with the latest technological developments, adapt quickly to changes, and integrate

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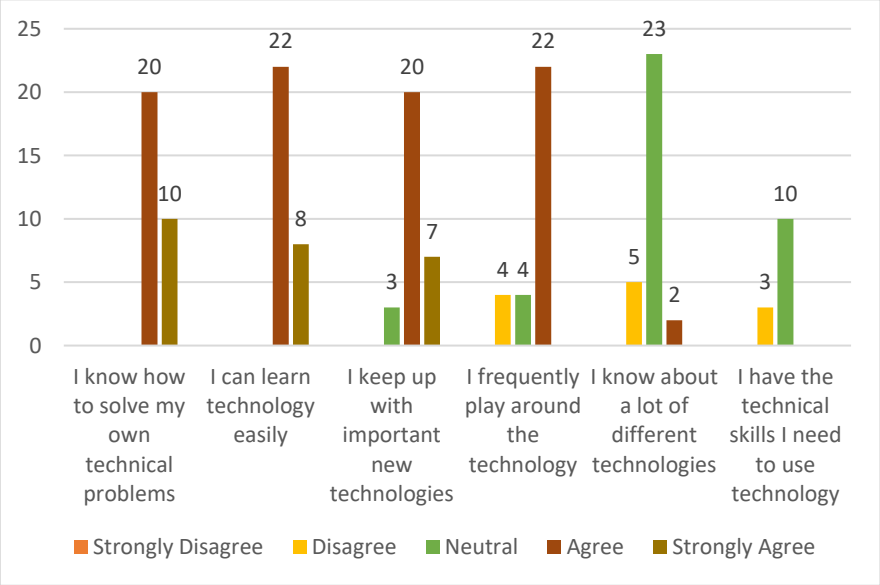
technological innovations effectively in their curriculum. Thus, this knowledge not only enriches teaching methods but also prepares students to face an increasingly digital world. Based on the questionnaire responses from 30 preservice English language teachers, the following table summarizes their levels of technological knowledge:



Based on the data provided by the questionnaire responses of 30 preservice English teachers, the results indicate varying levels of technological knowledge among the participants. Based on the questionnaire responses, the data reveals significant gaps in their technological knowledge and confidence. Most respondents (20 strongly disagree, 10 disagree) lack the ability to solve their own technical problems. Similarly, 22 strongly disagree and 8 disagree that they can learn technology easily. A majority also struggle to keep up with important new technologies, with 20 strongly disagreeing, 7 disagreeing, and only 3 remaining neutral. Additionally, 22 strongly disagree and 4 disagree that they frequently experiment with technology, suggesting limited hands-on experience. However, 23 respondents agree that they know about many different technologies, though this awareness does not necessarily translate into practical skills. Regarding technical skills, responses are mixed: 10 agree, 5 strongly agree, 10 are neutral, and 5 either disagree or strongly disagree. Overall, the findings indicate a broad awareness of technology but a lack of confidence and proficiency, highlighting the need for enhanced professional development in technological skills.

Pedagogical Knowledge (PK)

Pedagogical Knowledge (PK) is a key component in the TPACK framework which refers to knowledge about teaching and learning processes, practices and methods. PK includes an understanding of various learning theories such as constructivism, behaviorism, cognitivism, and social learning theory, which allows teachers to apply these principles to improve students' learning experiences. In addition, PK includes various teaching methods such as direct teaching, project-based learning, collaborative learning, problem-based learning, and differentiated learning, each of which can be applied according to context to maximize learning outcomes. Classroom management is also an important part of PK, including techniques for maintaining discipline, creating a conducive learning environment, and managing class dynamics. This knowledge allows teachers to adapt their approaches to individual students' needs, develop effective strategies for teaching, and create a classroom atmosphere that supports students' academic and social growth.

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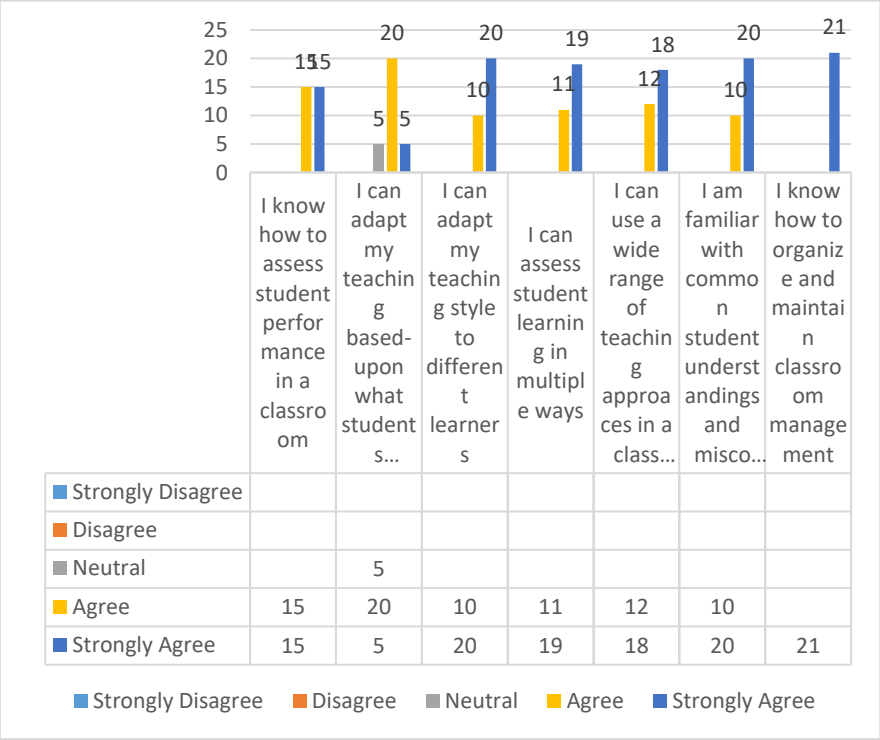
Based on the questionnaire responses from 30 preservice English language teachers, the following table summarizes their levels of pedagogical knowledge. The responses are categorized across six statements about their teaching practices and understanding.



	I know how to assess student performance in a classroom	I can adapt my teaching based-upon what students...	I can adapt my teaching style to different learners	I can assess student learning in multiple ways	I can use a wide range of teaching approaches in a class...	I am familiar with common student understandings and misco...	I know how to organize and maintain classroom management
Strongly Disagree							
Disagree							
Neutral		5					
Agree	15	20	10	11	12	10	
Strongly Agree	15	5	20	19	18	20	21

1. I know how to assess student performance in a classroom:
   Agree (15) and Strongly Agree (15):
   All respondents expressed confidence in their ability to assess student performance, with an even split between those who agree and those who strongly agree. This suggests that the prospective teachers feel well-prepared to evaluate student learning effectively.
2. I can adapt my teaching based upon what students currently understand or do not understand:
   Neutral (5), Agree (20), and Strongly Agree (5):
   Most respondents are confident in their ability to adjust their teaching based on student understanding, with a majority agreeing. However, a small number remain neutral, indicating some uncertainty in this area.
3. I can adapt my teaching style to different learners:
   Agree (10) and Strongly Agree (20):
   The majority of respondents strongly agree that they can adapt their teaching style to accommodate different learners, indicating a high level of confidence and flexibility in their teaching approaches.
4. I can assess student learning in multiple ways:
   Agree (11) and Strongly Agree (19):
   Most respondents feel capable of using multiple methods to assess student learning, with a significant number strongly agreeing. This shows a strong competency in varied assessment techniques.
5. I can use a wide range of teaching approaches in a class setting:
   Agree (12) and Strongly Agree (18):
   A high level of confidence is shown in the ability to use diverse teaching methods, with most respondents strongly agreeing. This indicates versatility in their teaching strategies.
6. I am familiar with common student understandings and misconceptions:

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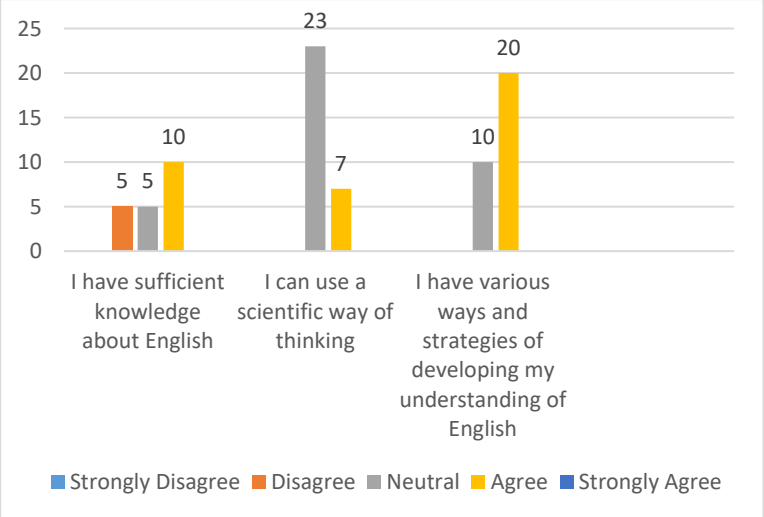
Agree (10) and Strongly Agree (20):
Respondents generally feel well-informed about common student misconceptions, which is critical for effective teaching and addressing learning gaps.

7. I know how to organize and maintain classroom management:
   Agree (9) and Strongly Agree (21):
   Classroom management skills are highly rated among respondents, with most strongly agreeing. This suggests a strong confidence in their ability to create and maintain an organized learning environment.

Based on the data, it reveals that preservice English language teachers have a high level of confidence in their pedagogical knowledge, particularly in adapting teaching styles, assessing student learning in various ways, using diverse teaching methods, understanding common student misconceptions, and managing classrooms effectively. However, there is a small degree of uncertainty in adapting teaching based on student understanding, which may require further development and support.

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:



The bar graph represents the responses of 30 preservice English language teachers regarding their content knowledge. The survey addressed three key statements about their understanding and strategies related to English. Here is a detailed interpretation:

1. I have sufficient knowledge about English:
   The responses are evenly distributed, indicating varied perceptions among the teachers about their knowledge of English. While a significant number feel confident (agree and strongly agree), there is also a notable portion that disagrees or remains neutral, suggesting room for improvement in their content knowledge.
2. I can use a scientific way of thinking:

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Neutral (23), Agree (7):
A majority of the respondents are neutral about their ability to use a scientific way of thinking, with only a few agreeing. This suggests a lack of confidence or clarity about applying scientific methodologies in their teaching practices.

3. I have various ways and strategies of developing my understanding of English:
   Neutral (10), Agree (20):
   Most respondents agree that they possess various strategies for enhancing their understanding of English. This indicates a proactive approach to improving their content knowledge, although some are still neutral, which points to potential areas for further development.

Overall, the prospective English language teachers display mixed levels of confidence in their content knowledge. While many feel equipped with strategies to develop their understanding of English, there is noticeable uncertainty about their current knowledge and their ability to apply scientific thinking. These insights highlight the need for targeted interventions to bolster their confidence and competence in these areas.

3.2 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

1. Access to Technological Resources

   Participants consistently highlighted the critical role of adequate access to technological resources in shaping their TPACK. Access to hardware and software was seen as fundamental in developing the necessary technological skills for integrating technology into teaching practices. They noted that without sufficient access to computers, tablets, interactive whiteboards, and various educational software and applications, it becomes challenging to explore and master relevant technological tools. Limited access often hinders their ability to design and implement technology-enhanced lessons effectively. Furthermore, consistent access to these resources allows educators to experiment with different technologies, understand their pedagogical implications, and find the best ways to incorporate them into their teaching strategies. Participants also emphasized that adequate access to technology facilitates ongoing professional development and helps them stay updated with the latest technological advancements. Overall, the availability of technological resources is seen as a foundational element in building robust TPACK, enabling teachers to enhance their instructional methods and improve student learning outcomes. One participant remarked, "*Having reliable access to technology means I can experiment more freely with different tools and methods in my lessons*."
2. Support from Mentor Teachers

   The support provided by mentor teachers emerged as a significant factor influencing TPACK development. Mentor teachers play a crucial role by offering direct guidance that helps novice teachers navigate the complexities of integrating technology into their teaching practices. This guidance often includes hands-on assistance with using specific technological tools, demonstrating how to incorporate these tools into lesson plans effectively, and addressing any technical issues that may arise. Mentors also provide

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constructive feedback, which is essential for the professional growth of new teachers. This feedback helps them understand what is working well and what needs improvement, allowing them to refine their technological, pedagogical, and content knowledge integration strategies. Additionally, mentors share best practices in technology use for educational purposes, drawing from their own experiences and successful implementations. This sharing of best practices includes practical examples and strategies that have been proven effective in enhancing student engagement and learning outcomes. The mentorship process also fosters a supportive learning environment where novice teachers feel encouraged to experiment with new technologies and pedagogical approaches without fear of failure. Overall, the influence of mentor teachers is profound, as they help to build the confidence and competence of new educators in using technology, ultimately contributing to the development of a robust and effective TPACK framework. As one interviewee explained, "*My mentor showed me practical ways to incorporate technology that I hadn't considered before. Their advice really helped me gain confidence*."

3. Prior Experience with Technology

   Previous experience with technology was cited as influential in participants' ability to develop TPACK. Those with prior experience demonstrated greater confidence and proficiency in integrating technology into their teaching. This prior experience provided them with a foundational understanding of various technological tools and platforms, enabling them to navigate and utilize these resources more effectively in an educational context. Participants with a background in using technology were more adept at troubleshooting technical issues, which minimized disruptions in their teaching and allowed for smoother integration of technology into their lessons.

   Furthermore, having prior experience meant that these participants were already familiar with the potential benefits and challenges of using technology in the classroom. This familiarity allowed them to approach technology integration with a more strategic mindset, selecting tools and applications that best supported their pedagogical goals and content delivery. Their confidence in using technology also translated into a willingness to experiment with new tools and innovative teaching methods, fostering a dynamic and interactive learning environment for their students.

   Moreover, experienced participants could better understand and implement the interconnectedness of technological, pedagogical, and content knowledge. They could more easily identify how specific technologies could enhance their teaching strategies and support student learning outcomes. This proficiency not only improved their effectiveness as educators but also set a positive example for their peers, potentially influencing a broader adoption of technology-enhanced teaching practices within their institutions.

   Overall, previous experience with technology significantly bolstered participants' ability to develop TPACK, equipping them with the skills, confidence, and insights necessary to integrate technology into their teaching effectively. This highlights the importance of providing opportunities for educators to engage with technology prior to and during their professional development to build a strong foundation for TPACK growth. One participant noted, "*Having used technology extensively in my previous role made it easier for me to adapt and innovate in using it for educational purposes."*

4. Availability of Professional Development Opportunities

   The availability of professional development opportunities focused on technology integration was also highlighted as crucial. Participants who engaged in targeted training reported significant improvements in their understanding of effective technology use for learning outcomes. "*Attending workshops on tech integration opened up new strategies and tools that I could immediately apply in my classroom*," remarked one educator.

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4. CONCLUSION

This study has highlighted varying levels of TPACK (Technological Pedagogical Content Knowledge) among educators, influenced significantly by access to technological resources, mentorship from experienced teachers, prior technological experience, and professional development opportunities focused on technology integration. Educators with stronger TPACK demonstrated adeptness in integrating technology effectively to enhance student learning outcomes. Addressing these factors through targeted support and professional development initiatives is crucial for fostering a digitally proficient teaching workforce capable of meeting the demands of modern education.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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