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Exploring TPACK on prospective English teachers: Synergy among technology, pedagogy, and content

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Abstract

Mastery of Technological Pedagogical Content Knowledge (TPACK) is a crucial aspect in improving the quality of learning for prospective English teachers in the digital era. TPACK is an integration of pedagogical, content and technology in the learning process. This study aims to analyze the level of mastery of TPACK in prospective English teachers at the Faculty of Teacher Training and Education, HKBP Nommensen University. The research method used was a descriptive qualitative approach with an instrument in the form of a questionnaire. The questionnaire consisted of 34 statement items related to TPACK. The participants in this study consisted of 18 prospective English teacher students at the Faculty of Teacher Training and Education, HKBP Nommensen University. The results showed that the mastery of Content Knowledge (CK) and Pedagogical Knowledge (PK) and Technological Knowledge (TK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), and Technological Content Knowledge (TCK) aspects were categorized as good. Furthermore, the overall mastery of TPACK on prospective English teachers is categorized as good. This finding indicates that prospective English teachers at the Faculty of Teacher Training and Education, HKBP Nommensen University have readiness to teach in a technology-based environment.

Keywords
Learning process, mastery, prospective teacher, technology-based environment

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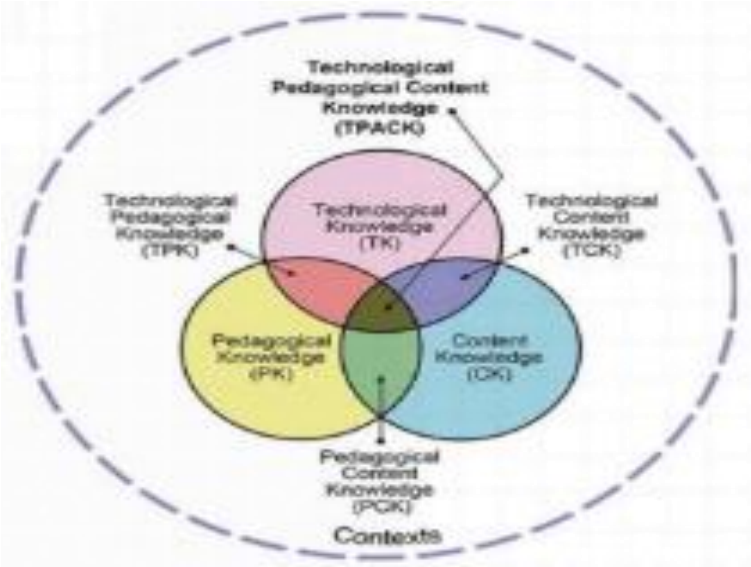
Introduction

In digital age, proficiency in TPACK (Technological Pedagogical Content Knowledge) is crucial, particularly for aspiring English teachers (pre-service English teachers). Teachers must be proficient in using technology as a teaching tool in the digital age (Damaiyanti, 2024; Hidayat et al., 2022; Maslikah et al., 2023). Teachers must become proficient in the new technology. Technology is not just a science but also a source of knowledge and learning that may help with the teaching and learning process (Costley, 2014; Hussain & Safdar, 2008; Sudarsana et al., 2019; Wulandari et al., 2023). Since the rise of information and communication technology has altered the nature of education, aspiring educators must not only be proficient in pedagogy and content but also be proficient in technology usage. It means that an effective teaching depends not only on the mastery of teaching materials, but also on the selection of appropriate teaching strategies and the utilization of relevant technology. According to Koehler and Mishra (2008), TPACK includes an comprehending of how technology, pedagogy, and content are connected to each other to support effectual learning. This concept helps educators use technology effectively to improve the teaching and learning process in today's digital era.

In TPACK, there are 3 main components namely pedagogical, content and technological knowledge. The three main components cannot stand alone, but they interact to create optimal learning, resulting in Pedagogical Content Knowledge (a combination of CK and PK), Technological Content Knowledge (a combination of CK and TK) and Technological Pedagogical Knowledge (a combination of TK and PK). Furthermore, the combination of pedagogical, content and technology is called TPACK (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna & Fitri, 2017). TPACK is new knowledge and has become a framework (Koehler & Mishra, 2008). It can be used to achieve educational goals. The TPACK framework can be seen below.

Figure 1. *Framework of TPACK* (Koehler & Mishra, 2008)



Incorporating technology into instruction can increase students' engagement and academic results (Ang et al. 2017; Aslan & Zhu, 2015). Technology can also make it easier for students to access information, making teaching and learning process be fun, effective, interactive, and can increase student learning motivation (Costley, 2014; David & Weinstein, 2023; Haleem et al., 2022). That means the need for digital skills in Education is very much needed. In addition to technology, pedagogical skills and mastery of the material are also important because they can also affect motivation, student learning achievement and the smoothness of learning (Hikmah, 2018; Kurniadi et al., 2020; Pujasari, 2017; Taqavi & Rezaei, 2021). However, most pre-service teachers do not possess enough comprehending to integrate TPACK into their instruction, which is a barrier to creating meaningful learning experiences.

Based on the observation result in the field that some of prospective English Teacher at Universitas HKBP Nommensen were not enough to integrate technology. It can be seen when they presented in the class. Sometimes they did master their topic. Of course, it will affect in creating an effective learning by and by when they will be a teacher next future. Be a professional teacher should be able to master material, has high insight, and master technology. So, it is necessary to conduct research to know the mastery of prospective English teacher in TPACK. In this case, the writers want to analyze the profile of prospective English teacher in mastering TPACK that consist of Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) and Integrating of PK, CK, and TK that called TPACK.

Besides that, research discusses TPACK already exists, but most of it focuses on experienced teachers. There are not many studies that specifically identify the level of TPACK mastery among pre-service English teachers. Research related to TPACK mastery among pre-service English teachers is still limited (Usta, Yilmaz, & Kadir, 2020; Vongkaron, 2019). In other hand, the previous research also suggested for the next research to conduct a research about TPACK for pre-service teacher for all institution (Rahmadi, 2019). It means that the research relates to TPACK should be applied and urgent to be conducted. Based on the explanation above, the writers want to know and explore the mastery of TPACK on prospective English teacher at Universitas HKBP Nommensen. By knowing it, Universitas HKBP Nommesen and prospective English Teacher know the readiness of prospective English Teacher in digital age.

Methodology

This study utilized descriptive qualitative research methods. Qualitative research is a method of inquiry that focuses on understanding human behavior, experiences, and social phenomena through the collection of non-numeric data. It seeks to provide insights into people's thoughts, feelings, and motivations, often emphasizing context and meaning (Creswell, 2016; Creswell, 2014, 2016). In this study, the writers want to describe the ability of prospective teachers to master TPACK. The participants of this study were fourth semester students of English Education. The number of participants is 18 learners. To get the data, the writers gave questionnaire to the participants. The number of the items were 44

items. The writers used this method because it is suitable for this research and this method is used for many researchers, especially in TPACK (Chai, et al., 2016; Mouza, 2016; Murtiyasa & Atikah, 2021). The questionnaire included items related to technological knowledge, pedagogical knowledge, content knowledge, Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and TPACK. Questionnaire were taken from the previous study and had been validated (Murtiyasa & Atikah, 2021). The questionnaire was given to the participants that consisted of 5 Likert scales in this research. In this case the participants were free to choose it. In the questionnaire, the writers put explanations about the scale so that the participants were easy to understand and choose the choice based on their ability. In addition, the writers also did not ask participants to include their identity. This is done to maintain the identity of the participants as a form of confidentiality of the participants so that they feel safe, free and honest in filling out the questionnaire so that the answers they give are in accordance with what is felt so that the data obtained also has validity and can be trusted. Data that has validity can ensure that the research conclusions reflect the true reality (Creswell, 2016).

Furthermore, after the data were obtained, then the author scores the answers to the questionnaires that have been filled in by the participants. The scores obtained were converted into presentation form using the following formula:

$$Score = \frac{score\ obtained}{maximum\ score}\ x\ 100$$

Then, the data obtained is grouped based on the following categories(Sugiyono, 2015):

Table 1. *Category group*

No.	Range	Categorie
1.	0 – 20	Very low
2.	21 – 40	Low
3.	41 – 60	Pretty good
4.	61 – 80	Good
5	81 – 100	Very good

Subsequently, the data analysis techniques in this study follow the Interactive Model proposed by Miles, Huberman, and Saldana (Miles & Saldana, 2014). The analysis involved three steps: 1) data condensation. This is the process of selecting, focusing, simplifying, abstracting, and transforming the data that appears in the original data into more understandable information.2) data display. This method presents the data in a format that allows the researcher to see existing patterns and relationships, usually done using a matrix or network. 3) and conclusion drawing (verification).

Findings

Based on the formulation of the problem and the research objectives, the author wants to explore the mastery of TPACK of prospective English teachers at HKBP Nommensen University. Therefore, the author will first describe the 3 main components in TPACK,

namely Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content Knowledge (CK). Furthermore, the author will analyze Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), and Technological Content Knowledge (TCK). This is done because the 3 (three) main components cannot stand alone as explained in the background. Therefore, it is necessary to know how the ability of prospective English teachers in TPK, PCK, and TCK, after that, the last step describes TPACK, which is the integration of the three main components. The results obtained from data analysis are as follows.

Technological knowledge (TK) analysis results

Technological Knowledge is an understanding skill related to various technological tools and media is used in an instruction process. This includes an understanding of hardware and software, as well as relevant technological applications for education (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna, 2017). The result of data analysis of the pre-service English teachers' technological knowledge can be found below.

Table 2. *The technological knowledge (tk) analysis results*

No.	Aspects	TK	
		Value	Category
1.	Following aspects of technological development	77,78	Good
2.	Proficient in using laptops, cameras, and projectors	74,44	Good
3.	Able to utilize existing technology creatively	73,33	Good
4.	Able to create technology in the form of visual aids (teaching aids)	72,22	Good
5.	Mastering the technology you have created well	74,44	Good
	Average	74,44	Good

Table 2 shows that all respondents have a good ability in technology. They were on the good category with an average scores of 74.44. A teacher or pre-service teacher who has technological skills will certainly make it easier for teachers or pre-service teachers to access more information or learning resources. In addition, it can also facilitate interactive and fun learning. This can be seen when prospective teachers use Canva as their presentation, learners are more motivated of learning. This is in line with the results of Pawlus, Kurniawan, and Caisar (2020) that the use of graphic design tools such as canva can make learning materials more interesting and easier to understand, so that students are more enthusiastic and make learners motivated to learn. In addition, pre-service teachers are also more confident in providing material with attractive slides. It is same with the research result conducted by Malichatin (2019) that the use of attractive PowerPoint with contrasting colors and slide sequences that match the material presented makes pre-service teachers more confident.

The analysis results of pedagogical knowledge (PK)

Pedagogical Knowledge (PK) includes teaching theories and practices, including an understanding of various learning methods, instructional strategies, and how to manage the classroom. This knowledge is essential for designing effective and student-centered learning experiences (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna, 2017). The result of data analysis regarding to Pedagogical Knowledge can be shown below.

Table 3. *The pedagogical knowledge (PK) analysis results*

No.	Aspects	PK	
		Values	**Category**
1	Knowing how to manage learning well	73,33	Good
2	Can use various learning strategies	75,56	Good
3	Able to get reflective action to enhance the quality of instruction	73,33	Good
4	Aware of possible misconceptions and students' difficulties in learning	75,56	Good
5	Able to create students' interest in an instruction process	75,56	Good
	Average	74,67	Good

Table 3 shows that the respondents' ability has a good category in pedagogical knowledge the average value was 74.67. The highest values of the fifth aspect are in the second, fourth and fifth aspects. This shows that this pedagogical knowledge is measured from the knowledge of prospective teachers in using learning strategies, misconceptions, and learning difficulties of students and the knowledge of respondents to make students interested in an instruction process. It has the same research result with Freeman (2014) that said teaching utilizes pedagogical knowledge to design active learning activities can improve learning outcomes and student interest in the material being studied.

The content knowledge analysis results

Content Knowledge is a deep comprehending of the material or content being taught (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna, 2017). The result of data analysis toward respondents' Content Knowledge can be described in table below.

Table 4. *The content knowledge (CK) analysis results*

No.	Aspects	CK	
		Value	**Category**
1.	Mastering the material to be delivered	80	Good
2.	Being able to explain the concept of a material to be delivered	77,78	Good
3.	Being able to provide relevant examples of questions	73,33	Good
4.	Delivering contents clearly and logically	72,22	Good
5.	Conducting a material analysis based on its difficulty	74,44	Good
	Average	75,55	Good

Table 4 shows that the pre-service English teachers' ability has a good category in content knowledge with an average value of 75.55. Among five aspects, the first aspect has a higher percentage. This means that content knowledge is measured from the knowledge of prospective teachers in mastering the material to be delivered. Based on the observations, it was discovered that pre-service teacher masters the content that can explain effectively and are capable to answer items related to content or material delivered and this has an impact on learning outcomes. The results of this study are same with Baumert (2010) that there is a positive correlation between teacher's content knowledge and students' achievement. Teachers with strong content knowledge tend to have students who show better learning outcomes.

The technological pedagogical knowledge (TPK) analysis results

Technological Pedagogical Knowledge (TPK) refers to the understanding of how technology could be applied effectively in learning process (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna, 2017). The result of data analysis toward respondents' Technological Pedagogical Knowledge can be described in table below.

Table 5. *Technological pedagogical knowledge (TPK) analysis results*

No.	Aspects	TPK	
		Value	Category
1.	Able to choose technology that is in accordance with the learning approach and strategy	78,89	Good
2.	Utilize available technologies as learning aids	74,44	Good
3.	Use technology to find more information independently	76,67	Good
4.	Able to manage learning using technology in the form of teaching aids that have been created	75,56	Good
	Average	76,39	Good

Table 5 shows that the pre-service English teachers' ability has a good category in Technological Pedagogical Knowledge (TPK) with an average value of 76.39. In table 5 above, it can be seen that the highest aspect is in the first aspect with a value of 78.89. It shows that the choice of suitable technology with learning approach and strategy by pre-service teachers measured their ability in technological pedagogical knowledge. The selection of the right technology with the strategy used greatly influences the design of effective learning, meeting student needs, student success and achieving the final goal in learning. It has same with previous research which states that pre-service teachers who are trained in choosing appropriate technology show an increase in their ability to design effective learning, meet student needs, and increase student learning satisfaction (Koehler & Mishra, 2017; Stürmer & Gunter, 2014; Uluğ & Kaya, 2020).

The pedagogical content knowledge (PCK) analysis results

Pedagogical Content Knowledge (PCK) is knowledge related to how to teach certain material, including strategies for explaining difficult concepts, how to adapt teaching to students' needs, and appropriate evaluation methods. It is a combination of pedagogical and content knowledge (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna., 2017). The result of data analysis toward respondents' Technological Pedagogical Knowledge can be described in table below.

Table 6. *The pedagogical content knowledge (PCK) analysis results*

No.	Aspects	PCK	
		Value	**Category**
1	Able to choose learning strategy according to the material to be delivered	76,67	Good
2.	Able to prepare presentation materials or lesson plans/modules with good understanding	73,33	Good
3.	Mastering the right presentation flow so that it is easy for participants to understand	74,44	Good
4.	Able to make participants actively solve a real problem in the material delivered even without using technology	76,67	Good
5	Able to provide solutions when participants or students experience difficulties with learning materials	76,67	Good
	Average	75,56	Good

Table 6 shows that the respondents have a good category in Pedagogical Content Knowledge with an average value of 75.56. In table 5 above, it can be seen that the highest aspects are in aspects 1, 2 and 4 with a value of 76.67. This shows the fespondents' ability in choosing learning strategies can create students active in instruction, easily understand the content or material provided and facilitate the provision of solutions. The results of this study are in line with the research of Eilam and Poyas. Eilam & Poyas (2020) found that teachers who have good Pedagogical Content Knowledge (PCK) allow them to design activities that encourage students' interaction or activeness and gain a more comprehensive and in-depth understanding of learning content.

The technological content knowledge (TCK) analysis results

Technological Content Knowledge (TCK) poitns to the understanding of how technology could support and enrich in delivering content. For example, using computer simulations to teach physics concepts or involving multimedia in History lessons (Koehler & Mishra, 2008; Lestari & Rahayu, 2023; Wiguna & Fitri, 2017). The result of data analysis toward respondents' Technological Content Knowledge can be described in table below.

Table 7. *The technological content knowledge (TPK) analysis results*

No.	Aspects	TPK	
		Value	**Category**
1	Using internet facilities to deepen mastery of the material to be delivered	78,89	Good
2	Able to master technology that is relevant to the material to be delivered	76,67	Good
3	Able to develop participant or student activities through teaching aids that have been made	75,56	Good
4	Able to improve students' understanding through the visual aids used	75,56	Good
5	Knowing and being able to integrate technology in learning	76,67	Good
	Average	76,67	Good

Table 7 shows that the pre-service English teachers' ability has a good category in Technological Content Knowledge with an average value of 76.67. In table 6 above, it can be seen that the highest aspect is in the first aspect. This shows that the Technological Content Knowledge's ability is measured from pre-service teachers' knowledge in using or utilizing internet facilities to deepen their mastery of the material. With sufficient information, prospective teachers will certainly be comprehending the material or content being taught better. In other hand, a technology integration such as digital presentation equipment makes the delivery of material more interesting. This is in line with Duffy (2011) who said that digital presentation tools allow teachers to deliver material in an interesting and interactive way. Features such as animation, images, and videos can help in understanding the content being taught.

The analysis results of technological pedagogical and content knowledge (TPACK)

Technological Pedagogical and Content Knowledge (TPACK) is a combination of three types of knowledge above, namely technology, pedagogy, and content. It describes teachers' ability to integrate technology effectively with teaching methods and content they teach, to create a holistic and relevant learning experience for students (Koehler & Mishra, 2008). The result of data analysis toward respondents' Technological Pedagogical and Content Knowledge (TPACK) can be described in table below.

Table 7. *The analysis results of technological pedagogical and content knowledge*

No.	Aspects	TPACK	
		Value	Category
1.	Able to choose learning strategies and technology or teaching aids that are appropriate to the material to be delivered	75,56	Good
2.	Expert in combining material knowledge, pedagogical knowledge and technological knowledge	73,33	Good
3.	Able to activate participants or students in constructing in-depth knowledge related to the material to be delivered using technology in the form of teaching aids that are made	72,22	Good
4.	Mastering how to integrate knowledge of English material, pedagogy and technology	76,67	Good
5.	Can help colleagues understand how to combine English knowledge, pedagogical knowledge and technological knowledge	75,56	Good
	Average	74,67	Good

Table 7 shows that respondents have a good category in Technological Pedagogical and Content Knowledge (TPACK) with an average value of 74.67. The aspect that has the highest percentage or value is the 4th aspect. It means that respondents have overlorded how to integrate knowledge of English material, Pedagogy and Technology in an instruction. This finding is different with Murtiyasa & Atikah's findings. Murtiyasa and Atikah (2021) which stated that the pre-service teacher also was in a good category and the ability of pre-service teachers in TPACK is measured from the teacher's learning strategies and the technology used in learning. It means that although they were on the same category but the level of pre-service teachers on TPACK were different.

Conclusion

The results showed that the mastery of Content Knowledge (CK) and Pedagogical Knowledge (PK) and Technological Knowledge (TK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), and Technological Content Knowledge (TCK) aspects were categorized as good. Furthermore, the overall mastery of TPACK on prospective English teachers is categorized as good. This finding indicates that prospective English teachers at the Faculty of Teacher Training and Education, HKBP Nommensen University have readiness to teach in a technology-based environment.

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