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EXPLORING THE TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) LEVELS OF FUTURE TEACHERS IN PROFESSIONAL EDUCATION PROGRAMS

Sumardi, Marjono, and Ilmiyah, Kharisma Lutfiyatul
History Education Study Program, Faculty of Teacher Training and Education, University of Jember, Indonesia, Jl. Kalimantan 37, Jember 68121

Abstract

This study investigates the level of Technological Pedagogical Content Knowledge (TPACK) among Batch 1 Teacher Professional Education (PPG) students at the University of Jember who completed their programme in 2023. The research is motivated by ongoing challenges in Indonesian education, particularly the quality of teaching and the rapid technological transformation in learning environments. TPACK serves as a framework to bridge these gaps by equipping teachers and prospective teachers with the ability to integrate pedagogical, content, and technological skills into the instructional process. This study focuses on 25 prospective history teachers from the 2023 PPG cohort. A quantitative descriptive research design was employed, using questionnaires and interviews to collect data. Statistical analysis, conducted with SPSS version 23, revealed that the overall TPACK level of the participants was categorised as very high, with a mean score of 4.33 (> 4.21) and a standard deviation of 0.452. These findings indicate that the PPG students of the 2023 cohort at the University of Jember demonstrate a strong understanding of TPACK, reflecting their readiness to apply technology-enhanced pedagogical approaches in their future teaching practice.

Keywords: TPACK; Technology Integration; Teacher Education

Introduction

In recent years, education in Indonesia has undergone significant challenges and transformations, with a major emphasis on teaching quality and the integration of technology. These two factors directly influence the effectiveness of learning processes and the development of future generations, creating an urgent need for continuous research and reform to align the education system with contemporary demands. Teachers occupy a central role in achieving educational objectives, as outlined in Law No. 14 of 2005 of the Republic of Indonesia on Teachers and Lecturers. They function as learning agents, motivators, and inspirers, thus exerting a critical influence on the quality of national education. Consequently, teacher competence has become a key determinant of improving learning outcomes (Plungtana & Dwikumaningsih, 2020; Joseline & Rowell, 2021).

In the 21st century, teachers are expected not only to master subject content but also to develop strong skills in Information and Communication Technology (ICT) to enhance instructional delivery (Ambaryati, 2019; Rahmadi, 2019). Proficiency in digital technologies—including computers, the internet, mobile devices, and educational applications has transformed teaching and learning dynamics both inside and outside the classroom. Digital platforms and tools now form a vital component of modern learning, fostering richer experiences and greater collaboration between educators and learners (Gocen & Bucuk, 2020; Wang Wei et al., 2018).

To meet these evolving demands, 21st-century teachers must integrate pedagogical, technological, and professional knowledge in their teaching practices. The Technological Pedagogical Content Knowledge (TPACK) framework, proposed by Koehler and Mishra (2014), provides a critical model for combining these three domains to design and deliver effective technology-enhanced learning. Research confirms that mastery of TPACK improves teaching quality and supports adaptation to rapid technological change (Sintawati & Indriani, 2019; Rodriguez et al., 2019; Muhaimin et al., 2019). Shulman (2006) further highlights TPACK as an essential foundation for teaching in the digital era.

Despite these developments, the 2023 Programme for International Student Assessment (PISA) ranked Indonesia 68th among 79 participating countries, reflecting ongoing challenges in educational quality (Yetti et al., 2023). Several studies also indicate that teachers face difficulties in applying TPACK effectively in practice (Ratnawati et al., 2022; Ramdani et al., 2023). To address these issues, the Pre-Service Teacher Professional Education (PPG) Programme has been implemented as a strategic initiative to develop teacher competence in line with national standards. The programme equips prospective teachers with pedagogical, social, and professional skills required to meet classroom challenges (Permendikbud No. 37 Tahun 2017; GTK, 2020).

Within history education specifically, TPACK plays a pivotal role by supporting the development of historical thinking skills and enhancing students' comprehension (Doppen, 2004; Yi et al., 2019). For prospective history teachers, understanding TPACK is essential to preparing for the demands of digital-age instruction (Padila et al., 2024). Building on this context, the present study seeks to assess the "Level of Technological Pedagogical Content Knowledge (TPACK) of Teacher Professional Education (PPG) Students." Specifically, it examines the TPACK level of Batch 1 PPG students at the University of Jember who completed their programme in 2023.

2. Literature Review

2.1 Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPACK) is a framework that evolved from Pedagogical Content Knowledge (PCK), which was first introduced by Shulman in 1986. PCK encompasses teachers' knowledge of content and pedagogy, while TPACK, introduced by

Mishra & Koehler, adds a technological dimension to address modern educational challenges. TPACK integrates the understanding of pedagogy, content, and technology in the learning process to create effective teaching (Mishra & Koehler, 2008; Angeli et al, 2016).

TPACK is a new approach for teachers to apply technology in learning. It encompasses the knowledge and skills needed to use Information and Communication Technology (ICT) effectively in the classroom, helping students learn subjects and access learning resources (Irwanto, 2021).

TPACK consists of three basic knowledge: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). The combination of these three pieces of knowledge results in four new components: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). Each component influences each other and is important to be applied in a balanced way in learning.

Technological Knowledge (TK) is the knowledge of various types of technology to support learning, such as mobile phone or laptop-based applications. TK involves collaboration between teachers and students to integrate technology effectively in the learning process (Hanik et al, 2022). Pedagogical Knowledge (PK) covers theory and practice in the planning, process and evaluation of learning. It includes an understanding of how students learn and how theory can be applied in the learning process (Hanik et al, 2022). Content Knowledge (CK) is related to understanding the teaching material that will be delivered to students. CK includes the structure and components of the curriculum and the application of the material in everyday life (Hanik et al, 2022; Shulman, 2006).

From these three components, four new pieces of knowledge are formed. Pedagogical Content Knowledge (PCK) combines CK and PK to teach the material in a flexible way. Technological Content Knowledge (TCK) links CK and TK to select and assess appropriate technologies for teaching materials. Technological Pedagogical Knowledge (TPK) covers the use of technology in a pedagogical context. Finally, TPACK integrates the three components to teach content effectively using technology. The implementation of TPACK in learning requires continuous development to improve mastery of each component. This can be done through training related to educational technology and learning strategies (Hanik et al, 2022).

2.2 Components of Technological Pedagogical Content Knowledge (TPACK)

TPACK consists of three main bodies of knowledge: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK), which overlap to form seven components. Pedagogical Knowledge (PK) includes an understanding of learning processes, methods, classroom management, and planning and evaluation (Tian et al., 2014 in Farikah & Al Firdaus, 2020). Teachers with good PK can manage the classroom and understand the needs of learners, in accordance with the pedagogical competencies stipulated in Law No. 14 of 2005

concerning teachers and lecturers (Padmavathi, 2016). Content Knowledge (CK) is in-depth knowledge of subject matter that includes facts, concepts, theories, and procedures (Koehler & Mishra, 2014). CK is important to help educators understand and teach the material in an appropriate and interesting way. Shulman (1986) stated that CK is not only about factual information but also about understanding the relationship between concepts in a particular field of study.

Technology Knowledge (TK) includes knowledge about the use of technology, both digital and analog, in supporting the learning process (Koehler & Mishra, 2014). TK includes skills in using technological devices such as software and hardware, as well as the ability to adapt to changing technological advances (Fitrianingsih, 2020; Karamina, 2021). TK is important to help teachers utilize technology effectively in learning.

Pedagogical Content Knowledge (PCK) is a combination of PK and CK, focusing on how to integrate content understanding with the teaching process (Shulman, 1986). PCK helps teachers translate subject matter into appropriate teaching methods. Shulman (1986) identified seven categories of knowledge that teachers must possess to manage learning effectively, including knowledge of curriculum and assessment. Technological Pedagogical Knowledge (TPK) involves understanding how technology can be used in a learning context to enhance teaching effectiveness (Koehler & Mishra, 2014). TPK is important to ensure technology is used in a way that supports the learning process. TPACK is the integration of all these components, blending technology, pedagogy and content to teach knowledge constructively (Koehler & Mishra, 2014).

2.3 Digital Era History Learning

History learning aims to understand past events and relate them to present conditions and future prospects. A significant transformation in history learning occurred with the adoption of digital technology. The main aspects of this change include access to digital resources such as online archives and documentary videos, which expand history learning resources (Runtukahu & Ratri, 2020). The use of multimedia such as images, videos and animations allows for better visualization of historical events, as well as creating a more interactive and engaging approach to learning (Rusidiyah, 2022). In addition, the development of educational games and historical simulations allows learners to "feel" historical events directly, which can increase their engagement and understanding (Fitriani, 2019).

The digital age affects all aspects of life, including education. Teachers must master technology to overcome challenges in teaching and ensure a deep understanding of the subject matter. History learning design is currently shifting from the Epistemology model, which focuses on "What knowledge is," to the Ontology model that emphasizes "How do you know it" (Umamah, 2017; Koehler & Mishra, 2009). This shows the importance of a paradigm shift in history learning design that emphasizes the process of understanding and applying knowledge.

Technology in education offers a variety of benefits, including as educational technology tools, multimedia production organizers, and social media for educational communication (Rusidiyah, 2022). Technology also improves the effectiveness and efficiency of teaching and learning processes, as well as the overall quality of education (Mishra & Koehler, 2006). Technology integration can help learners develop the competencies needed to adapt to their environment, as well as increase their motivation and engagement in the learning process (Amalia, 2023).

Teachers remain essential in supporting effective learning, especially in achieving the Sustainable Development Goals target 4, quality education (UNESCO, 2019). With technology, teachers have the potential to change the way they teach and facilitate more efficient and relevant learning for learners (Harris, Mishra, & Koehler, 2009). Technology is not just a tool, but also an integral part of a broader learning strategy to achieve the goal of quality education.

3. Research Method

3.1 Population and Sample

Population is a group of people, objects, or things that are the source of sampling that meet certain criteria in accordance with research objectives (Griffee, 2012: 66). Thus, the population includes all individuals or objects that have characteristics relevant to the research problem, and the results of research on the sample can be generalized to the population (Sugiyono, 2013: 81).

The sample is part of the population chosen to represent the whole group (Abdullah, 2015: 230). If the population is too large to be studied thoroughly, then a representative sample is used so that the conclusions drawn can be applied to the population as a whole (Syahrum & Salim, 2012: 113-114). The sample must include units from the strata present in the population and be carefully selected to ensure its representativeness.

In this study, the population studied was PPG History Students of Jember University class of 2023, totaling 25 students. The sample was taken using non-probability sampling method with purposive sampling technique, in which the sample was selected based on certain criteria relevant to the research objectives (Sugiyono, 2013: 85). The respondents selected were PPG History students in batch 2023 Wave 1 who had completed field study practices in five different schools: SMAN 1 Jember, SMAN 2 Jember, SMAN 3 Jember, SMAN Arjasa Jember, and MAN 1 Jember.

3.2 Research Design

This research uses a quantitative descriptive research design, which aims to describe phenomena objectively using numbers, starting from collecting, interpreting, and processing data (Arikunto, 2006). Quantitative descriptive research, also known as descriptive statistics, involves descriptive data analysis techniques such as tables, curves, histograms, and data centering measures such as mean and median (Lother & McTravish in Alfatih, 2016: 2). This method prioritizes objective measurement of the phenomenon under study with numerical data to obtain a clear picture (Sugiyono, 2013: 7). Data were obtained through questionnaires, questionnaires, and field observations, which were then analyzed to provide an in-depth understanding of the conditions under study.

3.3 Research Instruments

The data collection method in this study used a questionnaire distributed via google form and in-depth interviews with respondents. Researchers tested the validity of the questionnaire instrument using the SPSS system through the calculated R test, provided that the minimum r value is 0.05 in order to be considered valid.

3.4 Data Analysis

This study tested the validity of the questionnaire instrument using SPSS with the R test, with a minimum r value of 0.05 to be considered valid (Arikunto, 2006). If the r value is less than 0.05, the instrument is considered less valid and needs to be reviewed. The reliability of the instrument was tested using the product moment correlation formula between the first and second hemispheres (Sugiyono, 2013:147).

Data analysis uses descriptive statistics to describe data without generalization, which is presented in the form of tables, graphs, and measures of data concentration such as mean, median, and mode (Sugiyono, 2013: 148). Central tendency technique (Abdullah, 2015: 284), including the calculation of the mean with the formula (Husnul, et al., 2019).

4. Results of Research

4.1 Instrument Test Result

This research uses instruments that have been tested for validity and reliability with data from PPG Pre-History students batch 2023 Wave 1, University of Jember. The data was used to test the initial prospective teacher instrument, and the trial results are presented as follows.

a. Results of the Validity Test of the Questionnaire Instrument

The validity test of this study uses a two-tailed test with a significance of 5% and a sample (N = 25), where the r table value is 0.396. The instrument is considered valid if the calculated r value exceeds the r table. SPSS analysis shows that all items of the technological pedagogical content knowledge questionnaire have a calculated r value greater than 0.396, confirming the validity of the questionnaire is considered valid.

b. Results of the Questionnaire Instrument Reliability Test

The reliability test of this study used Cronbach's Alpha with SPSS version 24, resulting in a value of 0.933. According to Sujarweni & Utami (2014: 193), the instrument is considered reliable if the Cronbach's Alpha value is> 0.60. Because the reliability value of this instrument exceeds 0.60, the instrument is declared reliable.

4.2 TPACK Level Analysis Results

This study aims to measure the TPACK level of prospective teachers, especially Teacher Professional Education (PPG) students at Jember University. The questionnaire results showed that the TPACK level of students reached 4.33, which was categorized as very high (> 4.21).

5. Discussion

Based on the results of data analysis, the average value of the TPACK level of PPG Prajab 2023 Wave 1 students shows a very high category. Students have shown good understanding and application of TPACK in the learning process.

In the Content Knowledge (CK) component, students understand the importance of preparing effective teaching materials, including how to present and learning resources (Sugiyono, 2013). In terms of Pedagogical Knowledge (PK), students are able to evaluate learning outcomes, apply learning strategies, and manage the classroom well (Moidunny, 2009).

The results of the analysis on Technological Knowledge (TK) show that PPG Prajab students are very familiar with various relevant technologies, in line with Mirsha's statement regarding the role of technology in developing skills in the digital era (Mirsha, 2020). Students have also shown high ability in Pedagogical Content Knowledge (PCK), combining learning strategies with teaching materials to facilitate student understanding (Abdullah, 2015).

In the Technological Content Knowledge (TCK) component, students are able to apply technology in accordance with teaching materials to improve student understanding, supporting the theory that the suitability of technology and material is the key to successful learning. (Husnul et al., 2020).

Technological Pedagogical Knowledge (TPK) shows that students have a high ability to choose technology that improves learning outcomes (Sugiyono, 2013). Finally, Technological Pedagogical Content Knowledge (TPACK) shows that students can choose technologies that support teaching and student learning outcomes, in accordance with Moidunny's (2009) guidelines regarding the integration of technology in the learning process.

6. Conclusions

Based on the results of data processing on the mean value of each TPACK component, the following conclusions can be drawn:

a. The overall level of Pedagogical Knowledge (PK) obtained a mean of 4.30 > 4.21 with a standard deviation of .452, so it can be concluded that the level of Pedagogical Knowledge of PPG Pre-History students from the sample tested is very high.

b. The overall level of Content Knowledge (CK) obtained a mean of 4.16> 3.21 with a standard deviation of .746, so it can be concluded that the level of Content Knowledge of PPG Pre-History students from the sample tested is high.

c. The level of Technological Knowledge (TK) as a whole obtained a mean of 4.39> 4.21 with a standard deviation of .553, so it can be concluded that the level of Technology Knowledge of PPG Pre-History students from the sample tested is very high.

d. The overall Pedagogical Content Knowledge (PCK) level obtained a mean of 4.26 > 4.21 with a standard deviation of .431, so it can be concluded that the level of Pedagogical Content Knowledge of PPG Prajab History students from the sample tested is very high.

e. The overall Technological Content Knowledge (TCK) level obtained a mean of 4.41> 4.21 with a standard deviation of .640, so it can be concluded that the level of Technological Content Knowledge of PPG Prajab

History students from the sample tested is very high.

f. The overall Technological Pedagogical Knowledge (TPK) level obtained a mean of 4.46> 4.21 with a standard deviation of .443, so it can be concluded that the Technological Pedagogical Knowledge level of PPG Prajab History students from the sample tested is very high.

g. The overall level of Technological Pedagogical Content Knowledge (TPACK) obtained a mean of 4.20> 3.21 with a standard deviation of .601, so it can be concluded that the level of Technological Pedagogical Content Knowledge of PPG Prajab History students from the sample tested is high. g. The level of Technological Pedagogical Content Knowledge of PPG Prajab History students from the sample tested is high.

Based on the results of data analysis, it shows that the level of Technological Pedagogical Content Knowledge (TPACK) of Pre-service Teacher Professional Education (PPG) students is at a good level with the “High” category. So that prospective history teachers need to maintain the use of technology in the teaching and learning process to maintain or improve the quality of history learning for the better.

Based on the results and discussion in the research, the suggestions that the researchers will give are described as follows:

a. Prospective history teachers are expected to improve their skills in collaborating technology with learning materials and pedagogy.

b. For schools, it is expected to further facilitate renewable technology in order to help the teaching and learning process of knowledge and be open to new knowledge.

c. For other researchers, it is hoped that they can develop research related to Technological Pedagogical Content Knowledge (TPACK) in education.

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