

Implementation of TPACK in Microteaching of Mathematics Education Students Based on Online Learning Platforms

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ABSTRACT

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The purpose of this study was to determine the effectiveness of the implementation of TPACK in microteaching mathematics education students in terms of differences in online learning platforms. The type of research used in this study is Mixed Method with a Sequential Explanatory design by starting with quantitative data collection and then continuing with qualitative data collection. The subjects in this study consisted of 12 mathematics students. Subjects were given a TPACK ability test and the opportunity to simulate learning using an online learning platform, then conducted in-depth interviews regarding the implementation results. The results showed that there were differences in the ability to implement student TPACK in microteaching consisting of PCK components including basic skills of explaining and asking, TPK components covering basic skills of explaining and providing reinforcement, TCK components covering basic skills of explaining and providing variations, and TPACK components covering basic skills of opening and closing as well as essential skills of managing small groups. Based on the two platforms used, Moodle is better when compared to Google Classroom in supporting and making it easier for students to implement TPACK when compared to using Google Classroom. Especially in terms of appearance, features, integration with other applications, and storage limits. It can be stated that Moodle is more effective when compared to Google Classroom in implementing TPACK in microteaching.



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A. INTRODUCTION

Teachers are an important component in determining the success of the learning process (Bostwick et al., 2020; Etim et al., 2020; Sims & Fletcher-Wood, 2021). Teachers are planners, facilitators, and assessors in the learning process (Gargalianos et al., 2021; Jayanthi & Manimozhi, 2020; Juhaevah et al., 2020). Thus, the success of learning is determined by the teacher's ability to manage to learn.

The form of learning carried out during the Covid-19 pandemic is distance learning (PJJ). PJJ forces teachers to be adaptive in using online learning platforms. Teacher must integrate technological use, pedagogic, and content skills in learning (Galanti et al., 2020; Khoza & Biyela, 2020). These components are integrated as *Technological, Pedagogical, and Content Knowledge* (TPACK). However, there are obstacles experienced by teachers when implementing learning with online platforms, including knowledge and skills related to information technology, which still needs to be improved (Azhari & Fajri, 2021; Mailizar et al.,

2021). In addition, teachers also experience problems in implementing TPACK in learning (Nursiah et al., 2021).

To support the results of the TPACK research, interviews were conducted with students of the IAIN Ambon mathematics education and IAIN Ternate Mathematics Tadris who had attended the microteaching course. Based on the results of the interview, information was obtained that students have never applied TPACK to microteaching, even though TPACK is very important to be mastered by prospective teacher students, especially the use of technology in supporting learning (Gutiérrez-Fallas & Henriques, 2021; Marbán & Sintema, 2021; Santos & Castro, 2021). Microteaching is widely used to train the teaching ability of prospective teacher students. Microteaching contributes greatly to the improvement of TPACK, which is characterized by changes in the ability to master technology in learning, the ability to manage classes, and the ability to present material that is easy for students to understand (Aktaş & Özmen, 2021; Grant & Ferguson, 2021). Microteaching is compulsory in all affairs in fakultas ilmu tarbiyah and keguruan (PTKIN).

PTKIN aims to produce teachers by the mandate of Law No. 12 of 2012 concerning Higher Education Articles 17 and 18, which states that universities prepare students to become scholars and develop themselves into professionals. However, the facts show different things. Based on the results of UKG in 2019 in Maluku and North Maluku, it shows that teachers' average achievement of pedagogic and professional abilities is still very low, namely 47.38% and 44.78% when compared to DKI Jakarta, DI Yogyakarta, or Papua (NPD, 2019). The educational qualifications of teachers who take part in UKG in Maluku and North Maluku have undergraduate qualifications above 90%, equivalent to the provinces of DKI Jakarta, DI Yogyakarta, or Papua. Hal pointed out that PTKIN in the two provinces could have been more optimal in producing professional teachers. Based on PMA No. 27 and No. 50 of 2015 outlines the objectives of IAIN Ambon and Ternate to produce professional scholars in science, Islam, and the use of technology. However, the facts show that integration is not optimal because technology has yet to be maximized to support students during PJJ, such as using online learning platforms.

There are several studies related to the implementation of TPACK in learning. The study was conducted by Nursiah et al. (2021) to describe the TPACK ability of teachers who follow PPG. The results showed that the teachers had good planning and understanding of concepts related to TPACK but needed help implementing it. In addition, there is research conducted by Turmuzi & Kurniawan (2021), which aims to find out the teaching ability of prospective mathematics teacher students in terms of TPACK. The results showed prospective teacher students have an average TPACK ability in the moderate category. The two studies above show that the TPACK ability of teachers and prospective teacher students still needs to be improved and has difficulties when asked to implement TPACK in learning simulations.

Several studies related to microteaching in the context of online learning. The research study was conducted by Roza (2021), aiming to test online platforms' effectiveness in microteaching lectures. The results showed that online platforms effectively carry out limited learning simulations (microteaching). In addition, the study conducted by Sarkar & Das (2021) aims to determine the effectiveness of online media in the microteaching transition. The results showed that Zoom meetings could be more effective in learning, but it will be more effective

when accompanied by supporting online media. Based on the two studies above, it is shown that the use of online platforms can help in increasing the effectiveness of microteaching.

Several studies related to online learning platforms in the context of PJJ. The study was conducted by Hamidy (2021) to determine the effectiveness of selecting the zoom and Google Classroom platforms. The results showed that the Google Classroom platform was more effective in the PJJ process. In addition, the study conducted by Pratama et al. (2021) aims to determine the influence of online platform selection in supporting learning. The results showed that the Moodle LMS platform has more exclusive features supporting online learning. The two studies above show that the choice of *the* online platform influences the success of learning with Moodle and Google Classroom.

The selection of online learning platforms contributes to the effectiveness of the learning used (Dhika et al., 2021; Hamidy, 2021; Ulfah et al., 2021). For this reason, researchers are interested in implementing TPACK in microteaching mathematics education students regarding differences in online learning platforms. So it is expected that by implementing TPACK in microteaching, researchers can get an overview of the effectiveness of online learning platforms used by mathematics education students.

Thus, researchers can describe the differences in online learning platforms between Moodle and Google Classroom when used by mathematics education students when implementing TPACK through the microteaching process. So that in the future, mathematics education students can compare the effectiveness and choose in using online learning platforms to support the online learning process.

B. METHODS

This research seeks to reveal the ability of mathematics education students to implement TPACK and the effectiveness of TPACK implementation in microteaching. The data used are quantitative and qualitative, and the type of research used is *mixed method* research (Timans et al., 2019). This research seeks to explore students' TPACK knowledge by using quantitative and qualitative descriptive to find out in-depth about the implementation and effectiveness of the TPACK application.

The design used in this study refers to *The Explanatory Sequential Design*. This design seeks to reveal initial data using quantitative data collection and then analysis (quantitative collection data and analysis). Then followed up with qualitative data collection and re-analyzed (qualitative data collection and analysis). Then an interpretation is carried out regarding the results obtained. The following presents the stages of research implementation, as shown in Figure 1.

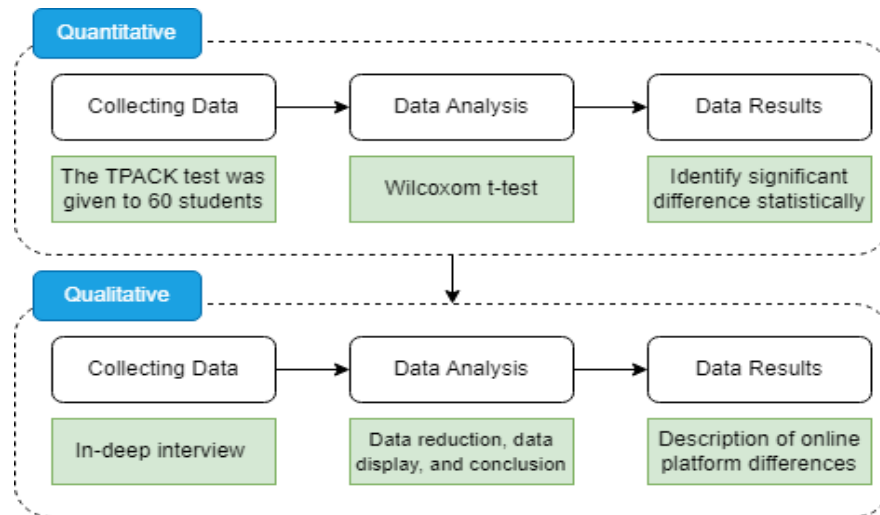


Figure 1. The Stages of Research

This research was carried out from June 9 to August 9, 2022, in the IAIN Ambon Mathematics Education study program and the IAIN Ternate Mathematics Tadris study program. Students of mathematics education/ tadris semester VI who are effective in microteaching courses at IAIN Ambon and IAIN Ternate. The subjects in this study were 12 consisting of 6 IAIN Ambon mathematics education students and 6 IAIN Ternate mathematics tadris students. Subjects are selected based on the TPACK knowledge obtained from the written test. The number of students who took the TPACK knowledge writing test was 60 students from the two campuses proportionally.

Data collection techniques in this study used observation, TPACK testing, and in-depth interviews. The research instrument consists of TPACK test questions and interview guidelines. The instruments used first go through a constructive validation process. The research data were analyzed with descriptive statistics and inferential statistics. Descriptive statistical data analysis is used to see the size of data centering. Meanwhile, inferential analysis is nonparametric because the data obtained by researchers is not normally distributed, although the data has similar characteristics (homogeneous). Inferential analysis was carried out to see if there were differences in the implementation of TPACK in students and if they were distinguished by campus or based on the online learning platform used. The test used was a Mann-Whitney test with a significance level of 0.05. Descriptive statistical analysis and inferential statistics using JASP application Version 0.12.2.

To find out the effectiveness of online learning platforms based on the interview results obtained after students implemented TPACK using two different platforms, namely Moodle and Google Classroom. The observation results are used as a reference to obtain interview data to reveal knowledge and implementation of TPACK in microteaching. Interview data were analyzed using the qualitative data analysis of Miles et al. (1994) consisting of a) data reduction, b) data presentation, and c) conclusion.

C. RESULT AND DISCUSSION

1. Students' TPACK Knowledge

Based on the data collection carried out, TPACK knowledge data is obtained in the following Table 1.

Table 1. Students' TPACK Knowledge

	PK	CK	TK	PCK	TCK	TPK	TPACK
Mean	63.06	66.50	68.33	66.39	68.67	66.33	70.00
Std. Deviation	9.67	8.72	11,06	14.43	9.91	11.83	10.99
Variance	93.44	76.08	122.22	208.26	98.22	139.89	120.83

Based on the data above, information was obtained that the ability of student TPACK is very low for the seven components of TPACK. If the data is classified into two groups of data based on the location of the study, the following data are obtained, as shown in Figure 2.

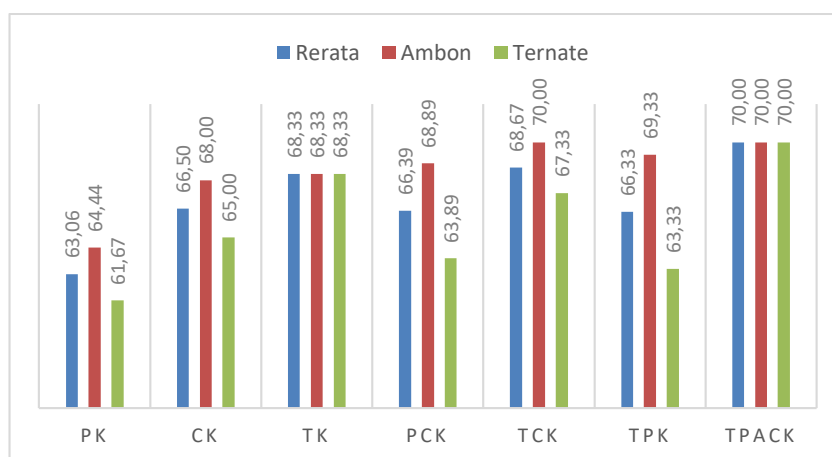


Figure 2. Students' TPACK Knowledge Diagram

Based on the data, information was obtained that most of the TPACK components differ between IAIN Ambon and IAIN Ternate students with better TPACK abilities of IAIN Ambon students when compared to IAIN Ternate students.

2. Students' TPACK Implementation

The implementation of TPACK in students is measured through a microteaching observation process with each consisting of six students at IAIN Ambon and IAIN Ternate who have the highest TPACK capabilities. Each campus is divided into two platforms, namely three students who use Moodle and three students who use Google Classroom.

a. Students' TPACK Implementation based on Campus

There are differences in the ability to implement student TPACK if they are distinguished by campus. The difference is presented in Figure 3.

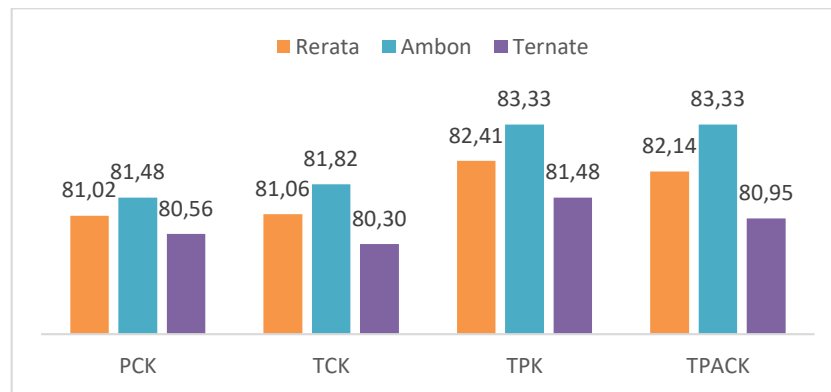


Figure 3. Students' TPACK Implementation based on Campus

In general, the ability to implement student TPACK on both campuses is above 80. The four components presented appear to have differences, however, the differences are not so significant. The TPACK implementation ability of IAIN Ambon students is higher when compared to the TPACK implementation ability of IAIN Ternate students.

b. Students' TPACK Implementation based on Platform

There are differences in the ability to implement student TPACK if they are distinguished by platform. The difference is presented in Figure 4.

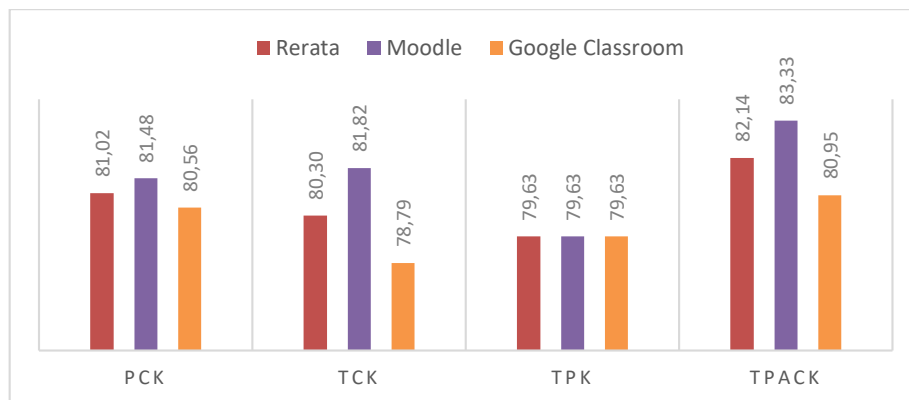


Figure 4. Students' TPACK Implementation based on Platform

In general, the ability to implement student TPACK if distinguished based on the platform used, is more diverse. It can be seen from the ability to implement TCK and TPK is still below 80 on the Google Classroom platform. Even so, on average, the four TPACK components are above 80. It indicates differences in the ability to implement student TPACK related to the use of the platform. The ability to implement TPACK in students who use Moodle is better when compared to using Google Classroom, although the differences between the two platforms are insignificant.

c. Implementation of Students' TPACK based on Basic Teaching Skills Using the Platform

Based on the results of quantitative data analysis of TPACK implementation observation sheets and interview transcripts obtained, the following are presented the results of the TPACK implementation of basic teaching skills students in terms of the use of online learning platforms, as shown in Table 2.

Table 2. Differences Implementation TPACK Based on Online Platform

Skill Differences	Platform		
	Moodle	Google	
PCK	Explain	S1 uses the class feature in Moodle to prepare and upload teaching materials for curved-sided space building, so that students can access the material to be taught such as modules, animations, and some stimulus questions so that it supports when explaining concepts according to student learning needs.	S54 cannot upload a large selection of materials due to the limited storage capacity of Google Classroom, so when explaining concepts it takes a long time because the teaching materials prepared are limited.
	Ask	S1 uses the forum and quiz features on Moodle to provide basic and advanced questions.	S54 uses the quiz feature but has to be integrated with google forms, which is not effective and efficient.
TPK	Explain	S1 integrates Zoom in Moodle so that when explaining it will show the two-way communication process synchronously.	S54 integrated Google Meet in Google Classroom so that when explaining there was two-way interaction even with a limited quota of students.
	Providing reinforcement	S1 provides reinforcement to students when they have completed the task by providing rewards through the your progress feature, so that students are more motivated when they get maximum progress.	S54 provides stimulus to students by rewarding students who can complete the assignments given although with limited features because it cannot display the progress that students have. It is only limited to the evaluation process.
TCK	Explain	S1 can integrate the use of GeoGebra on Moodle so that students can be active in constructing the concepts taught visually.	S54 explained the material using the power point file presented because Google Classroom cannot integrate third-party applications on the platform provided.
	Providing Variety	S1 can integrate various learning software on Moodle. In addition to using GeoGebra, S1 also uses Cabri 3D which can provide a variety of perspectives and options to students during the learning process.	S54 cannot integrate third-party applications in Google Classroom because it is limited by the platform. Thus, learning takes place in a monotonous manner.
TPACK	Opening and Closing	S1 can open learning by providing apperception through links to previous material, making it easier for students when recalling material on Moodle through material class. S1 also uses the question bank feature when evaluating student learning outcomes.	S54 provides apperception and motivation to students through the prepared class page. S54 does not have a wide selection of features when it comes to evaluating student learning outcomes as it is limited to assessment through Google Forms.
	Manage small groups	S1 can divide students into groups through the role feature in the participant section, making it effective and efficient when dividing groups proportionally.	S54 could not divide the groups through Google Classroom so had to divide the groups manually and took more time.

Implementation of PCK is related to knowledge in representing content knowledge and adopting pedagogical strategies to make specific content/topics more understandable to students.(Mishra, 2019; Zhang & Tang, 2021). Furthermore, when studied on microteaching using the online learning platforms Moodle and Google Classroom, most PCK implementations of the eight basic teaching skills are not significantly different. However nevertheless, there are two skills in PCK, namely the essential ability to explain and ask. The underlying difference is that Moodle's initial display has a large selection of features, especially in presenting information related to the material to be taught, so students can prepare themselves before learning. Therefore, learning Moodle can help teachers present more diverse and complete information. Similarly, Moodle has more exclusive features in presenting relevant tests or evaluation tools in presenting problems or questions. It is in line with Prasetya (2021), He states that Moodle is better than Google Classroom because Moodle has complete feature completeness, especially in presenting information and feedback.

Implementation of TPK carried out by students can be seen that students use various applications that support learning, namely using the Zoom application and Google Meet. However, students who use Moodle can directly integrate the applications used in a planned manner. In contrast, students who use Google Meet do not integrate directly, so it looks ineffective and efficient because the learning time is used to explain how to use it. In addition, using Zoom is more practical when compared to using Google Meet because it does not require authentication or logging into a Google account. It is in line with Mishra (2019); Zhang & Tang (2021)Which states that TPK is knowledge of the existence and specifications of various technologies to enable learning approaches and build new interactions in learning. Likewise, basic skills reinforce the use of the Moodle platform better when compared to Google Classroom because Moodle has a reward feature, so students do not need to give assessments manually because automatically, students who are active at the time of learning will get rewards that indirectly foster student interest in the learning process. It is in line with Hasan et al. (2019) who states that using the reward feature on Moodle can stimulate students to participate in the learning process.

Implementation of TCK is carried out by students when teaching uses applications to support the learning process, such as explaining and providing variations. Students who use Moodle present material assisted by the GeoGebra and Cabri 3D applications, while students who use Google Classroom only use PowerPoint Slides. This is in line with the view. Mishra (2019); Zhang & Tang (2021)they state that TCK is the knowledge of using technology to represent and create content in various ways. Moodle makes it easier for students to integrate more diverse applications because of the larger storage limit and open access to develop, when compared to Google Classroom, which is limited access especially when to integrate the third-party platform. So that the use of Moodle gives students flexibility in using various applications and learning resources to support the learning process. This is in line with the research conducted by Al-Hawari et al. (2021)who states that the advantage of Moodle, compared to other online learning platforms, is the ability to store more plugins than other learning platforms.

Implementation of TPACK is carried out by students when teaching using the evaluation feature on Moodle and Google Classroom. However, the difference is that the use of Moodle is more effective and efficient when there is a feature that allows evaluation to be carried out with various evaluation types. This is in line with Mishra (2019); Zhang & Tang (2021) implementation of TPACK is carried out by students when teaching using the evaluation feature on Moodle and Google Classroom. However, the difference is that the use of Moodle is more effective and efficient when there is a feature that allows evaluation to be carried out with various evaluation types. This is in line with Shofiyuddin et al. (2022) who states that using the Moodle platform is more accessible to integrate with Zoom than other online learning platforms.

Moodle can support PCK when accommodating the ability to explain and the ability to ask questions of teachers because it has more complete and unlimited features when compared to Google Classroom such as greater storage capacity and forum and quiz features. Moodle can support TPK when accommodating the ability to explain and provide reinforcement because it has features that can be integrated with other platforms and has a your progress feature. Moodle can support TCK when accommodating the ability to explain and provide variety because it can be integrated with various platforms simultaneously. Moodle can also support TPACK when accommodating the ability to open and close and manage small groups because it has a participant feature that can easily divide class participants into groups quickly.

D. CONCLUSION AND SUGGESTIONS

The selected online learning platform contributes to supporting the implementation of TPACK in microteaching. The use of Moodle in TPACK can accommodate several basic teaching skills such as basic skills of explaining and asking questions in PCK, basic skills of explaining and providing reinforcement in TPK, basic skills of explaining and providing variety in TCK, and basic skills of opening and closing and managing small groups in TPACK. This is based on storage capacity, supporting features, and multiplatform integration. Thus, it can be stated that the use of Moodle online learning platform is more effective when compared to Google Classroom. This study recommends that the use of Moodle online learning platform can support the implementation of TPACK in microteaching. However, this study is limited to two online learning platforms and mathematics education students. It should be continued with various other online learning platforms with students from other majors.

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