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The Integration of Technology: The Role of Technological Pedagogical Content Knowledge and Self-Efficacy

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Abstract: Technology-mediated learning equips students with the skills to compete in the 21st century. Therefore, teachers as holders of an important role must have the ability to facilitate and create this learning environment. Higher education institutions have a role in providing various knowledge and abilities to students as prospective teachers to feel ready and able to integrate technology into learning effectively. This research aims to explore students' internal factors, especially TPACK and self-efficacy, which influence the integration of technology into learning. The research method uses an explanatory quantitative approach. The research sample was 132 accounting education students at the State University of Malang who took part in teaching assistance activities using proportional stratified random sampling. Data collection is distributed via G-Form and analyzed using multiple regression analysis. The results of the research show that technological pedagogical content knowledge and student self-efficacy have a positive and significant effect on the integration of technology into learning so that better TPACK and self-efficacy in students will make students more often integrate technology into learning in the future classroom. Therefore, this research is expected to provide material and insight for students regarding internal factors (TPACK and self-efficacy) related to the integration of technology into learning.

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INTRODUCTION

A learning environment mediated by technology provides space for students to search and analyze information, solve problems, communicate, and collaborate so that they have the competence to compete in the 21st century (Lim et al., 2013). Teachers as holders of an important role must be able to facilitate students and create a learning environment(Gil-Flores et al., 2013, 2014; Tarihoran, 2019). However, currently, education graduate students as prospective teachers with adequate technological backgrounds feel unprepared to use technology effectively in their learning (Gil-Flores et al., 2017; Tondeur, Pareja Roblin, et al., 2017). This is important to pay attention to because technology integration can support the learning process, improve the quality of education, increase the success of learning practices, and increase student learning achievement (Drossel et al., 2 017; Ghavifekr & Rosdy, 2015; Li et al., 2019; Pacurar & Abbas, 2015).

In implementing technology integration, teachers identify several internal factors such as attitudes, beliefs, knowledge, and skills as the strongest factors that can influence their decision to integrate technology (Ertmer et al., 2012). Previous research also states that the need for professional development in ICT (TPACK) and confidence (self-efficacy) are the most significant variables in explaining the use of ICT in the classroom (Fraillon et al., 2017). Meanwhile, research by Farjon et al.(2019) the WST (will, skill, tool) model explains that will (attitude and belief) is the strongest influence in the integration of technology into learning by prospective teachers. Therefore, this research will examine TPACK skills and self-efficacy of prospective teachers as factors that influence the integration of learning technology which is useful for preparing teachers in the future.

This research examines the factors of technology integration into learning, namely TPACK and self-efficacy based on Bandura's social learning theory (1986). Social learning theory assumes that human behavior arises as a result of the interaction of external factors (environment) and internal factors (intrapersonal). Intrapersonal factors have received much attention as an influence on teachers integrating technology into learning (Agyei et al., 2022). Supported by Saleh's statement (2018) which considers that apart from external factors a person's behavior is caused by internal factors. In this study, the variables TPACK and Self-efficacy are intrapersonal factors that play an important role in supporting teachers to integrate technology in their classrooms.

Teacher education institutions need to actively help develop the knowledge of prospective teachers to connect these components in all aspects of education and to support future learning by the concept of Technological Pedagogical Content Knowledge (TPACK) (Lachner et al., 2021; Tondeur, Pareja Roblin, et al., 2017). TPACK consists of 7 competencies including 3 main competencies technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) which intersect and form 4 other competencies namely technological pedagogical knowledge (TPK), technological content knowledge (TCK), pedagogical content knowledge (PCK), technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2006).

Previous research shows the importance of TPACK, which is very effective in determining the knowledge and skills of prospective teachers and the professional development of prospective teachers related to the integration of technology into education (Koh et al., 2018; Oakley, 2020; Philipsen et al., 2015; Raygan & Moradkhani, 2022; Voogt et al., 2013). However, research by Usman et al (2021) and Joo et al (2018) showed that teachers' TPACK did not affect their intention to use technology in learning. In addition, existing research related to TPACK still focuses on in-service teachers (Cheng & Xie, 2018; Dong et al., 2015, 2020).

Low use of educational technology in learning can also be caused by the teacher's assessment that the technology is difficult to use (Raphael & Mtebe, 2017). Koehler et al (2013) revealed prospective teachers do not seem confident in using ICT in education in combining their pedagogical knowledge with the availability of technology. This statement supports Giles and Kent's research (2016) that self-efficacy is an indicator that is believed to influence prospective teachers' decisions to use educational technology in the future. Siddiq et al (2016) explains that prospective teachers with higher ICT self-efficacy will use ICT more intensively.

Some empirical evidence shows that self-efficacy influences learning practices and the integration of technology into learning (Belbase, 2012; Han et al., 2017; Raphael & Mtebe, 2017). However, Teo's (2019) identifies self-efficacy as not affecting the integration of technology into learning. Most research focuses on teacher self-efficacy as an individual resource especially in primary and secondary school contexts (Menon & Sadler, 2016; Milner et al., 2012; Myers, 2019; O'Neal et al., 2017; Taştan et al., 2018) and still oriented towards science and mathematics subjects (Agyei et al., 2022; Bahçivan & Aydin, 2020; Belbase, 2015; Dignath et al., 2022; Kollar et al., 2022; Myers, 2019; Phelps-Gregory et al., 2020).

Based on the description above, shows that there is a lot of research and literature that focuses on factors that influence the integration of technology into learning by teachers or prospective teachers (Atman Uslu & Usluel, 2019; Bai et al., 2021; González-Sanmamed et al., 2017; Lawrence & Tar, 2018; Player-Koro, 2012). Teachers' TPACK knowledge and self-efficacy are the most significant factors in explaining the use of ICT in the classroom (Ertmer et al., 2012; Farjon et al., 2019; Fraillon et al., 2017). Meanwhile, Yeh et

al (2017) stated that the TPACK of teachers and prospective teachers is different because teaching experience and self-efficacy change from person to person who interacts with each other. This makes researchers want to examine TPACK and technology self-efficacy in teaching education students as prospective teachers.

This research aims to examine the influence of the TPACK and self-efficacy variables on the integration of technology into learning for Malang State University students. This research is also useful in providing new knowledge and expanding empirical explanations about the interrelationships of variables indicated by Social Learning Theory (Bandura, 1986). Apart from testing the applicability of the theory, this research is expected to contribute to the education of students as prospective teachers in knowing the intrapersonal matters that influence students to integrate technology into their future classes.

LITERATURE REVIEW AND HYPOTHESES

Social Learning Theory

This research is supported by Social Learning Theory by Albert Bandura (1986) considers that the components that form behavior that originate from the environment and the cognitive processes that take place within a person are closely related so that they can produce certain forms of behavior.

This theory not only emphasizes the importance of environmental preparation as a source of learning that can be imitated but also focuses on the cognitive processes used in making decisions. Research by Chen et al (2019) states that if teachers want to use technology effectively in the learning process, then teachers must have knowledge and understanding regarding the interaction of pedagogy, technology, and content which are incorporated in the concept of TPACK knowledge.

Social learning theory by Bandura (1986) starts from a view related to human agency where each person has control over their environment and decides their actions. Apart from the personal factors contained in human agency, each person has the self-efficacy to exercise control over their actions.

Research by Cox et al (2013) revealed that the factor that most influences teachers in integrating technology in their classrooms is the perceived success and failure (self-efficacy) when doing so. In line with Naz et al (2020) self-efficacy about the use of technology in the classroom influence teachers to create meaningful lessons and a conducive learning environment. This statement assumes that self-efficacy in prospective teachers can determine decisions in integrating technology into learning.

The Influence of Technological Pedagogical Content Knowledge on the Integration of Technology into Learning

In this research, as technology develops in educational institutions (environment), intrapersonal factors (cognitive/knowledge) receive attention because they influence efforts to incorporate technology into learning (behavior). This statement assumes that teachers' intrapersonal factors such as teachers' competence in the field of technology shape and determine decisions to use technology in the delivery of their learning (Fraillon et al., 2017). Mishra and Koehler (2006) explained that TPACK is a knowledge framework that educators need to combine pedagogical technology and content.

TPACK has three main competencies, namely (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), and four competencies that are integrated as a result of TK, PK, CK, namely Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK) and Technological Pedagogical Content Knowledge (TPACK) (Saengbanchong et al., 2014). These competencies have an important role for prospective teachers, so their development is a top priority for education in preparing prospective teachers who can integrate technology into learning (Jin & Schmidt-Crawford, 2022; Koh & Chai, 2014; Santos & Castro, 2021).

Research by Raygan and Moradkhani (2022) found TPACK to have a strong influence on teachers' technology integration behavior. Supported by Philipsen et al (2015) TPACK is a framework that can assist the process of developing teacher professionalism in implementing 21st century learning that is integrated with technology. These findings support research that states that the possession of TPACK knowledge in

prospective teachers can support the use of technology in creating effective learning (Reyes et al., 2017; Santos & Castro, 2021). Through mastery of TPACK prospective teachers understand the processes of technology, pedagogy, and content knowledge interacting, so they can create learning that is integrated with technology to be effective and efficient.

H1: TPACK prospective teachers have a positive effect on the integration of technology into learning.

The Influence of Self-Efficacy on the Integration of Technology into Learning

In this research, self-efficacy refers to an assessment of one's ability to do something with the skills using ICT that one has, because a lack of self-efficacy can lead to a decision not to use ICT in the classroom (Tarhini et al., 2015; Wambiri & Ndani, 2016). A teacher's self-efficacy is a form of teacher belief, personal knowledge, and judgment that can be seen as an implicit perspective on learning, student development, and technology-integrated subject matter (Fives & Buehl, 2012; Wambiri & Ndani, 2016).

Self-efficacy Every prospective teacher must have a high level of education to improve technology-integrated teaching or learning of students (Blackwell et al., 2013). So, prospective teachers need to explore self-efficacy from the beginning of the teacher preparation program to meet various demands in future learning activities (Caudle & Moran, 2012).

The above statement supports the results of several previous studies which state that self-efficacy is the core of integrating technology into learning (Belbase, 2012; Ertmer et al., 2012; Karaca et al., 2013; Petko, 2012; Petko et al., 2018; Sadaf et al., 2012). Previous research also shows that self-efficacy influences learning practices and the integration of technology into learning (Belbase, 2012; Han et al., 2017; Raphael & Mtebe, 2017; Zhang et al., 2023). Lailiyah and Cahyono (2017) show a positive influence between teacher self-efficacy and the integration of technology into learning. Based on several studies, prospective teachers who have high self-efficacy tend to actively participate in using technology and apply technology to their learning effectively and efficiently.

H2: The self-efficacy of prospective teachers has a positive effect on the integration of technology into learning.

METHODS

This research uses a quantitative approach and explanatory methods to test and explain the influence between variables. The population in this research is undergraduate students of Accounting Education at the State University of Malang (UM) class of 2019 and 2020 as prospective college graduates who are being prepared to become accounting teachers. The selection of the 2019 and 2020 class population was because they had and are currently carrying out teaching assistance activities which include technology-based learning academic activities (planning, implementation, evaluation) (Sobri et al., 2021). This research took samples using a proportional stratified random sampling technique because the TPACK and Self-efficacy characteristics of each student in the 2019 and 2020 classes are different. The sampling technique was carried out using the proportionate formula for a total of 132 students.

Measurement

The variables in this research are Technological Pedagogical Content Knowledge (X1), Self-efficacy (X2), as independent variables, and Technology Integration into In Learning (Y) as the dependent variable. Data collection was distributed via G-Form and used a questionnaire with a Likert scale assessment.

Technological pedagogical content knowledge (TPACK) skills and knowledge of prospective accounting teachers were measured using a questionnaire developed by Denise A. Schmidt, Evrim Baran, Ann D. Thompson, Punya Mishra, Matthew J. Koehler & Tae S. Shin (2009). This research will use four of the seven TPACK components (TK, TPK, TCK, and TPACK) because these indicators are considered to best demonstrate teacher knowledge about the use of technology in learning.

The self-efficacy of prospective teachers in this study was measured using the Technology Integration Confidence Scale (TICS) Version 3 developed by Gomez and Frank (2020) with indicators of technology usage, technology application, technology-infused learning, technology literacy & digital citizenship, and technology-supported assessment.

The integration of technology into learning by prospective teachers was measured by a questionnaire developed by Turel, Ozdemir, and Varol(2017) and Habibi, Yusop, and Razak (2020) with indicators for assessing learning preparation, learning processes, and technology-based learning evaluation.

Data analysis

In this research, the questionnaire was tested on an instrument consisting of a validity test and a reliability test on 30 Bachelor of Accounting Education students' class of 2019. The validity test was declared valid if r count > r table. Next, a reliability test was carried out and it was declared reliable with the condition that Cronbach's Alpha was > 0.7.

Then a classical assumption test was carried out which included a normality test using the One-Sample Kolmogorov Smirnov test, when the sig value was obtained. > 0.05 means the data is normally distributed. Multicollinearity test if the VIF is < 10 and the tolerance value is > 0.10, which means no multicollinearity is detected. The results of the heteroscedasticity test with the Glejser test if the sig value is obtained > 0.05 means no heteroscedasticity was detected.

After all the conditions are met, hypothesis testing is carried out using the t-test and F-test in multiple regression analysis to determine the influence between variables. The following regression analysis equation model is used:

$$\mathbf{Y = \alpha + L_n\beta 1X1 + L_n\beta 2X2 + \varepsilon}$$

RESULTS AND DISCUSSION

Descriptive Analysis

In this study, data was obtained through a questionnaire using respondents from Accounting Education students who took part in the Teaching Assistance Program. Respondents were categorized based on class year, namely the class of 2019 and the class of 2020 totaling 132 students. The following is a summary of the respondents' results based on class year which is presented in Table 1.

Table 1. Characteristics of Respondents Based on Class Year

Class Year	f	%
Class of 2019	72	54.5 %
Class of 2020	60	45.5 %
Total	**132**	**100%**

The research data that has been collected will then be analyzed descriptively to determine the distribution of data on each variable. The following are the results of the descriptive statistical analysis which are presented in Table 2.

Table2. Results of Descriptive Statistical Analysis

VARIABLES	MEANS	STDs. DEV.
TPACK	57,947	2.71078
Self-Efficacy	45.7197	2.30272
Integration of Technology into Learning	26.6439	1.63983

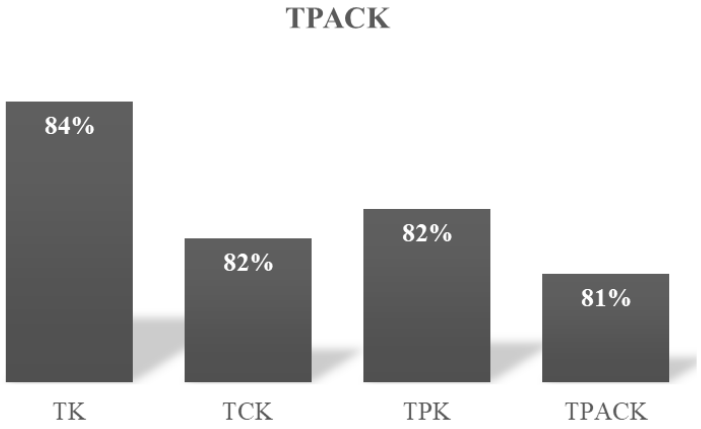

Figure 1. Score Chart Technological Pedagogical Content Knowledge

Based on Table 2, average– The average TPACK ability of students is 58%. Based on the results of the questionnaire in Figure 1, the indicator with the highest score is technological knowledge at 84.3%, this could be because students are accustomed to using technology. This means that the more students follow developments and master various uses of learning technology, the more opportunities they have to integrate technology into learning.

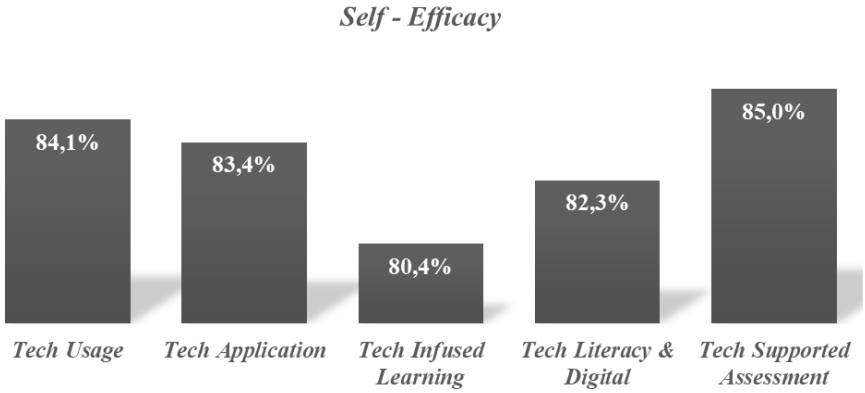

Figure 2. Score Chart Self-Efficacy

Based on Table 2, average– The average self-efficacy ability of students is 46%. This indicates that students have good self-efficacy seen from several indicators. Based on Figure 2, the self-efficacy indicator that has a high score is Technology–supported Assessment at 85%. This shows the confidence that students can use technology in evaluation so that students can design and implement various assessments using technological tools.

Based on Table 2, each variable in this study obtained a standard deviation value smaller than the mean. This study has data that is relatively homogeneous or not far from the average so the values in Table 2 can be interpreted positively as something that has the potential to support student success in integrating technology into learning.

Analysis Results

Instrument tests include validity tests and reliability tests carried out on 30 Bachelor of Accounting Education students' class of 2019. The validity test is declared valid if r count > r table = 0.361, in this study the TPACK test instruments were all declared valid (r count lowest = 0,508, sig = 0,0), self-efficacy (r count lowest = 0,673 sig = 0,0), and integration of technology into learning (r count lowest = 0,393, sig = 0,0).

Next, a reliability test was carried out and it was declared reliable with Cronbach's Alpha requirements. In this study, the results of the reliability test obtained Cronbach's Alpha for TPACK question items of 0,948, self-efficacy of 0,947, and integration of technology into learning of 0,829, so that all questions in the questionnaire were declared reliable.

The classical assumption test is carried out after all prerequisite tests are fulfilled using a multiple regression analysis equation model. The regression results turned out to violate a classic assumption, namely the heteroscedasticity test, so to treat this violation the regression model was changed to a semi-log model. In this study, the classical assumption test was met with the semi-log Lin-Log multiple regression model, which means that the independent variables were transformed into natural logarithms.

The normality test results using the One Sample Kolmogrov Smirnov test obtained a sig value. 0.200 > 0.05 which means the data is normally distributed. The results of the multicollinearity test for the TPACK and self-efficacy variables obtained a VIF value of 0.1340 < 10 and a tolerance value of 0.746 > 0.10, which means that no multicollinearity was detected. The results of the heteroscedasticity test for the TPACK variable obtained a sig value of 0.364 and self-efficacy obtained a ig. 0.05, meaning no heteroscedasticity was detected.

After all the conditions are met, hypothesis testing is carried out using multiple linear regression analysis. The results of the analysis are briefly presented in Table 3.

Table 3. Results of Multiple Linear Regression Analysis

Variable	Multiple Linear Regression Analysis		
	β	**t-count**	**Sig.**
Constant	-46,476	-3,877	0,000
LnTPACK	10,282	3,276	0.001
LnSelf-Efficacy	8,214	2,810	0.006
F-count	**18,698**	-	**0,000**
Adjusted R-Square	**0.213**	-	-

Table 3 produces the F test value sig. 0.000 < 0.05, which means that the semi-log Lin Log multiple linear regression analysis model can be used to explain the influence between variables. So, the regression equation is as follows:

$$\mathbf{Y = -46,476 + 10,282X1 + 8,214X2 + \varepsilon}$$

Based on Table 3, it is known that the variable value ($Ln\beta_1$=10.282, sig. 0.001 < 0.05) then it is accepted, meaning that the TPACK variable has a significant effect on the integration of technology into learning by 10.282. In Table 3, the values obtained for the self-efficacy variable are explained H_1($Ln\beta_2$=8.214 sig. 0.006 < 0.05), then it is accepted, meaning that the self-efficacy variable has a positive and significant influence on the integration of technology into learning of 8.214.H_2

Apart from that, it is known that the Adjusted R Square value is 0.213. This means that the variables TPACK and self-efficacy have an influence of 21.3% on the integration of technology into learning, the remaining 89.7% is influenced by other variables or factors not examined in this research.

Technological Pedagogical Content Knowledge on the Integration of Technology into Learning

In this research, the results of data analysis show that TPACK capabilities have a significant effect on the integration of technology into learning. This means that the better the students' TPACK skills, the more intensive the integration of technology into learning. This research supports Bandura's social learning theory (1986) that processes Students' cognitive abilities will form knowledge or abilities that can be used in making behavioral decisions. When studying at university, students gain knowledge, one of which is TPACK which is used to implement learning and teaching processes effectively using technology (Santos & Castro, 2021). When students want to integrate technology into their learning, they must understand that TPACK which includes technology, pedagogy, and content is the knowledge they must have (Cherner &

Smith, 2017). This means students have to have TPACK to better understand the effective use of technology to improve learning (Dong et al., 2015).

Based on Figure 1 as a whole shows that students master TPACK based on technology knowledge or technological knowledge of 84.3%. The results show that students carry out various technology-based activities in educational institutions or daily life, therefore they use technological devices in the classroom to increase student engagement. In this study, mastery of TPK and TCK was 82.5% and 82.0% respectively, indicating that students were able to recognize the need for appropriate technology in implementing learning by considering strategy and subject content. Meanwhile, student TPACK has the lowest level, namely 81.4%, this may be because students are not yet able to use the chosen technology to improve their learning process, but the level of TPACK knowledge among students is above 80%.

The results of this research are in line with previous research that TPACK has a positive influence on teachers' technology integration practices (Raygan & Moradkhani, 2022). In this research, teachers felt more prepared and confident in utilizing technology when they already had TPACK knowledge and skills. This attitude gives rise to the possibility of a higher sense of teacher satisfaction with the use of technology, thus making teachers give a positive response to the use of technology in their educational environment. Supported by Philipsen et al (2015) TPACK can develop teacher professionalism to implement technology-integrated learning. Apart from that, each student's mastery of TPACK can help them integrate technology into learning effectively (Reyes et al., 2017; Santos & Castro, 2021). Therefore, a high level of TPACK in students can influence their skills when integrating technology into their learning activities.

Based on Table 2, the TPACK level for students is 57%. This mastery shows that the majority of students have competence in combining pedagogy, content, and technology, so they can use technology in their learning. Therefore, students' mastery of TPACK creates a strong foundation of pedagogy, curriculum content, and application of technology in their future classes. This is in line with research by Lachner et al (2021) development of pre-service teachers' knowledge, content, pedagogical, and technology (TPACK) has become important in pre-service teacher education.

Self-Efficacy on the Integration of Technology into Learning

The results of the analysis show that self-efficacy has a significant influence on the integration of technology into learning. Students who have high self-efficacy will integrate technology into the classroom. This research supports Bandura's social learning theory (1986) that Everyone has self-efficacy that allows them to exercise control over their thoughts, feelings, and actions. Increasing self-efficacy in students has the potential to influence the decision to use technology in their teaching practice. When students have confidence in their knowledge and skills in using technology, they will create classes that are integrated with technology (Naz et al., 2020). Therefore, students also need to have self-efficacy or confidence to be able to apply the knowledge they have so they can integrate technology into learning.

In this research, the measurement indicators were adapted from Gomes and Frank (2020) with the Technology Integration Confidence Scale (TICS). Based on Figure 2, the results show that Technology-supported Assessment is at the highest level, namely 85%. This indicates that students have the self-efficacy to be able to use technology in evaluation so that students can design and implement various assessments using technological tools. Technology infused - learning has the lowest level at 80.4% because students are not yet able to use technology to create learning that suits the needs of each student. In addition, the indicator levels for technology literacy, technology application, and technology usage are 82.3%, 83.4%, and 84.1% respectively, indicating that students' confidence in using technology has reached 80%, this can be because students can facilitate and support innovative learning activities by applying learning design principles so that students can think critically and be responsible in the digital era.

The results in this study are consistent with previous research which states that self-efficacy has a positive influence on the integration of technology into learning (Lailiyah & Cahyono, 2017). In this research, teachers had a high level of self-efficacy because they felt comfortable using technology in learning and were familiar with technology and using technology during learning. In addition, previous research also states that self-efficacy is the core of integrating technology into learning (Belbase, 2012; Ertmer et al., 2012; Karaca et al., 2013; Petko, 2012; Petko et al., 2018; Sadaf et al., 2012). This research

shows that most students with self-efficacy can facilitate and support the use of technology in learning to maximize effective learning with technology.

The results of this research show that the average student has a self-efficacy level of 45%. Self-efficacy will provide positive support to prospective teachers to have the desire to create a learning process that involves technology positively (Siddiq et al., 2016). These results are supported by Njiku et al (2022) who reported that teachers have self-efficacy to teach with technology. These findings indicate that students have confidence in their ability to use learning technology tools to create effective and innovative learning activities. The majority of students will feel comfortable using technology in their teaching when they have confidence in technology. Thus, students who have a sense of self-efficacy will be able to create an effective learning environment that can encourage students to learn independently through technology.

CONCLUSION

The research results show that technological pedagogical content knowledge and self-efficacy have a positive and significant effect on the integration of technology into learning. This means that the better the TPACK and self-efficacy of students, the better the integration of technology into learning into their future classes will be. The results show that the majority of students already have competence in combining pedagogy, content, and technology so that they can integrate technology into learning in their future classes. Furthermore, students have self-efficacy regarding their ability to use learning technology tools to create effective and innovative learning activities.

This research uses a questionnaire that has been developed by several previous studies. However, this study did not include several items in the questionnaire to reveal the influence of the independent variable on the dependent variable because it was adapted to the situation and conditions of the research subjects. Apart from that, this study did not reveal the 3 factors that form TPACK, namely PK, CK, and PCK.

Based on the limitations of the research above, further research will be able to learn more about things that can make a significant contribution to the results of this research.

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