Analysis of Technological, Pedagogical and Content Knowledge (Tpack) of Economics Students as Economics Candidate Teachers

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Abstract

Technological Pedagogical and Content Knowledge (TPACK) was introduced to the field of educational research as a theoretical framework for understanding teacher knowledge required for effective integration of technology in learning. Technological Pedagogical and Content Knowledge (TPACK) is a framework for integrating technology in teaching. This study aims to analyze the effect of technological knowledge, pedagogic knowledge, and content knowledge of the field of economics as well as the ability to integrate TPACK. This study uses descriptive research methods using a quantitative research approach. The research respondents were 97 active students of Economics Education FKIP UNS who had carried out practical field teaching activities (PPL). Data collection was carried out using questionnaires distributed through electronic media to students directly. The results showed that the technological knowledge, pedagogic knowledge, content knowledge and the ability to integrate the three possessed or ability to integrate TPACK by economics education students as teacher candidates were in the good category, this was indicated by the acquisition of the highest score interval having the largest percentage.

Keywords— Technology Knowledge, Pedagogic Knowledge, Content Knowledge, TPACK

INTRODUCTION

Education is always developing. The development of education must be balanced with the ability to understand the science of education. In the 21st century, education will become increasingly important to make students have the skills to learn and innovate, skills to use technology and information media, and can work and survive using *life skills* (Trilling and Fadel, 2009: 48).

Based on the results of recent research, it is explained that the success of 21st century learning involves understanding material or *content*, teaching methods, and synergistic use of information technology (Rossenberg and Koehler, 2015). Various challenges arise for teachers or prospective teachers, to answer these challenges an important theoretical framework to have today to be able to measure the level of mastery of information and communication technology is through an assessment of *Technological Pedagogical and Content Knowledge* (TPACK).

Technological Pedagogical and Content Knowledge (TPACK) was introduced to the field of educational research as a theoretical framework for understanding teacher knowledge required for the effective integration of technology in learning. The ability of a teacher to integrate technology, pedagogics, knowledge of material content (content) greatly affects the way teachers teach in the classroom, therefore the importance of the TPACK ability to be possessed by a teacher (Koh & Chai, 2011).

The importance of preparing the TPACK abilities of prospective teachers in 21st century learning to be able to integrate technology in

the implementation of learning, is not only required to be able to master technology, a prospective teacher is also required to be able to master *content knowledge* and all of that can be seen through the TPACK abilities of prospective teachers. Learning that occurs in the digital environment of the 21st century such as independent learning and collaborative learning places students and the community at the center of the learning process who will recognize the differences in student characters (Eyel, 2012).

Based on the results of previous studies, it was shown that the TPACK ability of a prospective teacher was in a good category (Turmuzi and Kurniawan, 2021; Supriyadi, Bahri, and Warema, 2018; Arbiyanto, Widiyanti and Nurhadi, 2018). However, these results are different from research which shows that the TPACK ability of prospective teachers is in the low category (Irfan, Anzora, and Fuadi, 2018). The ability gap shows that there is still a need to improve the abilities of prospective teachers.

Learning activities given to students need a combination of technological knowledge, pedagogical knowledge, and content knowledge that complement each other in the process of teaching and learning activities (Koehler & Mishra, 2009). Along with the increasing needs of students, a teacher must have Pedagogical Content Knowledge (PCK) capabilities combined with technology in delivering learning materials. The relationship between Pedagogical Content Knowledge (PCK) and technology produces a new conceptual framework in the world of education, namely Technological pedagogical content knowledge (TPCK).ability that will help or prospective teachers to be able to carry out learning well and in accordance with the development of 21st century learning.

Research Method

Technological Pedagogical and Content Knowledge (TPACK) was introduced to the field of educational research as a theoretical framework for understanding teacher knowledge required for effective integration of technology in learning (Mishra and Koehler, 2006). Hurrell (2013) describes Pedagogical Content Knowledge (PCK) as the relationship between basic knowledge of content and pedagogy with the required field of context.

TPACK is formed from a combination of 3 (three) types of basic abilities, namely Technological, Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK) (Koehler et.al, 2013). Based on these 3 basic components, new knowledge is generated, namely Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content and Knowledge (TPACK). The relationship diagram for the components of TPACK is described as follows:
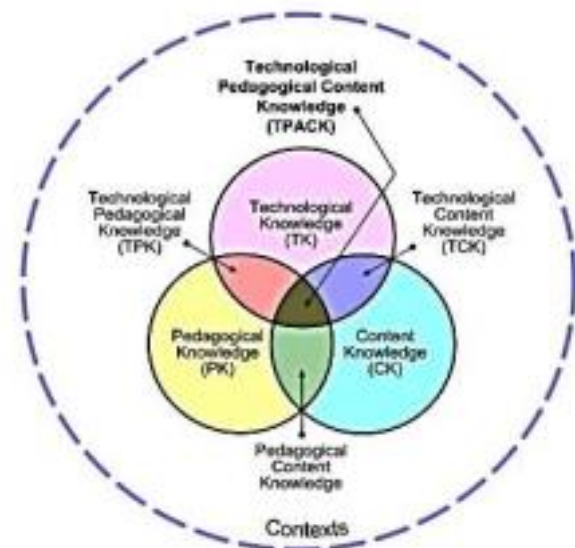

Figure 1.1 TPACK Framework, Koehler's (2013)

This study uses descriptive research methods using a quantitative research approach. This study aims to determine technological knowledge, pedagogical knowledge and content knowledge and the ability to integrate technology skills, pedagogic knowledge and content knowledge into technological pedagogical and content knowledge (TPACK). This research was conducted on 97 students of Economics Education FKIP UNS who have implemented Field Experience Practice (PPL). The data collection technique used in this study uses a questionnaire/questionnaire that will be

used to measure technological knowledge with indicators of mastery about technology, application of technology in learning, and following technological developments (Suryamto, et.al. 2020), pedagogic knowledge with indicators of ability to use models, media, evaluation and assessment (Ariyati, 2018), content knowledge with indicators of mastery, breadth and material development (Ariyati, 2018) as well as the ability to integrate TPACK with indicators of use and integration of materials, strategies, pedagogics and technology (Suryamto, et.al. 2020). In this research questionnaire using a positive statement using a Likert that has been tested for validity and reliability.

Result and Discussion
1. Description of Respondents

Based on the results of the questionnaire, data obtained that most of the samples were female students with a total of 78 students with a large presentation of 80.41% and male respondents with a total of 19 students with a large presentation of 19.59%.

2. Analysis the TPACK of Economics Students as Economics Teacher Candidates

Based on the results of the study, the following is an analysis of the Technological Pedagogical and Content Knowledge (TPACK) abilities of Economics Education students as prospective Economics teachers:

a. The Technological Knowledge of Economics Education Students as Economics Teacher Candidates

Variable of technological knowledge based on the results of the study showed the lowest score of 31 and the highest score of 52 with an average of 43.99. The following is a summary of the results of data processing on the technology knowledge variable which is presented in Table 1:

Table 1. Technology Knowledge Score Results

Classification	Interval Class	F	Percentage
Very low	31-36	5	5,1 %
Low	37-42	36	37,1 %
High	43 -47	12	36,7 %
Very High	48-52	44	44,9 %
Total		**97**	**100%**

Based on the results of descriptive analysis Table 1 shows that technological knowledge are in the very high category with a percentage of 44.9%. Meanwhile, in the high category, the students' technological ability was 36.7%, the low category was 37.1%, and the very low category was 5.1%.

Based on the results of data analysis, it is known that technological knowledge are in a good category, this can be a factor in the readiness of economics students to become economics teachers. These results can be interpreted that the better the technological ability of prospective teacher students, the better the readiness of students to become teachers. This study supports the theory of social *learning theory of career decision making* (SLTCDM) that career readiness is influenced by individual career decision choices where career decisions are influenced by learning experiences.

The results of the learning experience will shape the interests, abilities, beliefs, values, and qualities of individuals. Therefore, the results of the learning experience affect work or career readiness. While studying in higher education, prospective teachers acquire technological skills through experience using technology in learning. When prospective teachers decide to have a career as a teacher, it is necessary to know that the current era of learning requires high technological abilities for prospective teachers. This makes prospective teachers must have the readiness of knowledge and technological skills that are mastered to be taught to students later.

The results showed that most of the prospective teachers mastered technology skills based on their use of technology and knowledge of the development of online sites. In the current era

of learning technology has been used everywhere and is important for students. The high level of use of technology for prospective teachers can equip students with digital skills and prospective teachers who master the use of technology well according to existing conditions will make the continuity of the learning process with students run smoothly.

In addition, Santika et al. (2021) also revealed that prospective teachers need to have technological knowledge of the development of online sites. Prospective teachers who follow the development of online sites well will be able to take advantage of the functions of these online sites for learning. The use of online sites in learning is carried out by prospective teachers to improve the technological readiness of prospective teachers (Mutiani et al., 2021).

Technological knowledge that will affect readiness to become teacher candidates, this is indicated by the results of previous studies which explain that technological knowledge has a significant positive effect on student readiness to become teachers (Petko et al., 2018; Shinas et al., 2015; Susanti et al. , 2020; Tondelur et al., 2017). The results of this study indicate that the technological knowledge mastered by prospective teachers is very high. In contrast to the research of Shinas et al. (2015); Tondeur et al. (2017) where the mastery of technology for prospective teachers is still low. This difference in results is due to the fact that when this research took place, students took online or online learning which resulted in high technological knowledge mastered by students because they were accustomed to using technology (Scherer et al., 2021). Online learning encourages the digital competence of prospective teachers with the involvement of technology in learning (Damşa et al., 2021). The use of technology in learning will be successful when teachers master technological skills, for that prospective teachers are required to master technology well for success in learning (Szymkowiak et al., 2021). Supported by Susanti et al. (2020) that prospective teachers who master technology skills well will have readiness to work.

b. Pedagogic Knowledge of Economics Education Students as Economics Teacher Candidates

The pedagogical knowledge variable based on the results of the study showed the lowest score of 17 and the highest score of 32 with an average of 26.70. The following is a summary of the results of data processing on the pedagogical knowledge variable which is presented in Table 2:

Table 2 Pedagogic Knowledge Score Results

Classification	Interval Class	F	Percentage
Very low	17-20	4	4,1 %
Low	21-24	30	30,9 %
High	25-28	30	30,9 %
Very High	29-32	33	33,7 %
Total		97	100%

Based on the results of descriptive analysis Table 2 shows that the pedagogic knowledge of students are in the very high category with a percentage of 33.7%. Meanwhile, in the high category, the pedagogic ability of students was 30.9%, the low category was 30.9%, and the very low category was 4.1%.

The pedagogic knowledge of prospective teachers are obtained by the way they study it in theory and practice when taking teacher education in universities. By mastering high pedagogic knowledge, prospective teachers will make them have readiness in teaching (Sari, 2019). For this reason, the experience of teaching prospective teachers while in college affects the readiness of the pedagogical knowledge of prospective teachers (Long et al., 2020).

Developing the pedagogic knowledge of a prospective teacher must be able to adapt, structure, manage and motivate in the implementation of learning. A high learning structure has an impact on the success of learning activities. Some teacher education structures prepare more intensively than others for the readiness of future teacher candidates (König et al., 2017). Good pedagogic knowledge can be assessed from effective classroom management between teachers and students. Good classroom management shows

that prospective teachers are ready to learn (König & Pflanzl, 2016).

Based on the results of the analysis, it is known that pedagogic knowledge can have a positive influence on student readiness to become teachers. These results can be interpreted that the better the pedagogic knowledge of prospective teacher students, the better the readiness of students to become teachers. The results of this study are in accordance with previous research which showed that pedagogical knowledge has an influence on student readiness to become teachers (König & Pflanzl, 2016; Long et al., 2020; Sari, 2019). The results of this study indicate that the pedagogic knowledge mastered by the teacher is very high. Prospective teachers have high pedagogic knowledge because they are obtained from the practical experience of teaching taken (Long et al., 2020). Teaching experience has a significant correlation with teachers' pedagogic knowledge (Drits-Esser et al., 2017). Pedagogic competence is very important because it determines the success of learning from teacher readiness when teaching (Nurdianti, 2017). Supported by Arbiyanto et al. (2019) which shows that students have teaching readiness by mastering pedagogical knowledge well such as teaching methods, conditioning the class, understanding the characteristics of students, and being able to provide motivation.

The results of previous studies also show that the better the pedagogic knowledge of the teacher, the higher the learning achievement of students (Prasetyo & Kusumantoro, 2015). This means that prospective teachers must improve their pedagogic abilities to have a variety of teaching strategies that focus on students (Hudson, 2015). The pedagogic knowledge of prospective teacher students are very important in building and increasing student confidence (Richardson et al., 2018). Therefore, it takes the confidence of prospective teachers with the knowledge and skills they have to increase their readiness to become teachers later (Riahmatika & Widhiastuti, 2019).

c. Content Knowledge of Economics Education Students as Economics Teacher Candidates

Variable content knowledge based on research results shows the lowest score of 17 and the highest score of 32 with an average of 26.70. The following is a summary of the results of data processing for content knowledge variables which are presented in Table 3:

Table 3 Content Knowledge Score Results

Classification	Interval Class	F	Percentage
Very low	17-20	4	4,1 %
Low	21-24	30	30,9 %
High	25-28	30	30,9 %
Very High	29-32	33	33,7 %
Total		**97**	**100%**

Based on the results of descriptive analysis Table 3 shows that the content knowledge of students is in the very high category with a percentage of 33.7%. Meanwhile, in the high category, students' content knowledge was 30.9%, the low category was 33.7%, and the very low category was 4.1%.

Aspects of content knowledge (CK) or knowledge of the material to be taught. Knowledge of this content leads to knowledge or specificity of disciplines (Suyamto et al., 2020). A teacher or prospective teacher is expected to master this ability because the teacher is one of the sources of student learning. Content knowledge is an ability that will show the uniqueness in a discipline that will be studied in learning activities.

The results showed that the students' content knowledge were in the very high category with a percentage of 33.7%. Based on the results of data analysis that has been obtained, prospective teachers are able to prepare themselves before entering the classroom by understanding concepts, theories, examples of questions, and proof of the material to be taught so that students understand well the teaching material at each meeting. The results of this study are similar to the research of Suyamto, Masykuri, and Sarwanto (2020), namely the results of the CK ability of prospective teachers in the good category and taught well.

Prospective teachers should take advantage of various sources in the process of making teaching materials. If you only use handbooks as the only source in making material, students will be less able to describe the material and provide the latest information related to the material (Malichatin, 2019).

d. Ability to Integrate TPACK Economics Education Students as Economics Teacher Candidates

Variable of ability to integrate TPACK based on research results shows the lowest score of 14 and the highest score of 28 with an average of 23.56. The following is a summary of the results of data processing capability variables in TPACK integration which is presented in Table 4:

Table 4 Results of TPACK Integration Ability Value

Classification	Interval Class	F	Percentage
Very low	14-17	2	2,1 %
Low	18-20	36	36,7 %
High	21-23	19	19,4 %
Very High	24-28	40	40,8 %
Total		97	100%

Based on the results of descriptive analysis Table 4 shows that the ability to integrate student TPACK is in the very high category with a percentage of 40.8%. Meanwhile, in the high category, students' content ability was 19.4%, the low category was 36.7%, and the very low category was 4.1%.

The ability to integrate Technological Pedagogical and Content Knowledge (TPACK) is the ability to combine technological knowledge, pedagogical knowledge and content knowledge. According to Rusmiyati (2018), a teacher is a facilitator who manages the learning process in the classroom and also as a determinant in the quality of education, the teacher must be able to prepare everything as well as possible so that the learning process in the classroom runs effectively.

TPACK is knowledge of the complex interaction of domains of knowledge principles (content, pedagogy, technology). Learning in modern times demands teacher understanding

to be able to collaborate with technology. So not only pedagogical aspects but content and technology aspects are also a consideration in terms of implementing modern and innovative classroom learning. Teachers must have an understanding of the complex interactions between 3 basic components, namely PK, CK, and TK by teaching the material using appropriate pedagogic methods and technology (Mishra & Koehler, 2006).

Research on Technological Pedagogical and Content Knowledge (TPACK) has been widely carried out, such as research conducted by Chai, Koh, & Tsai (2013) with the results of research indirectly stating that teachers need TPACK for effective learning in the classroom although more in-depth research on TPACK is still ongoing. necessary. The TPACK framework has had a significant impact on teachers and teacher educators. The TPACK framework describes the various types of knowledge that teachers need to teach effectively with the help of technology and the complex procedures in the area of knowledge interaction.

Based on the results of the analysis, it is known that the ability to integrate TPACK has a positive influence on student readiness to become a teacher. Being a teacher, the ability of TPACK is a main pillar in self-development and innovation so that it is very important for a teacher to have and master TPACK. Students as prospective teachers have the ability to integrate the main components, namely technology, pedagogy, and content, and must be balanced and able to master all three at once.

Conclusion

Based on the research results obtained, it can be concluded in general that the knowledge of technology, pedagogy and content have a significant positive effect on the readiness of economics students to become economics teachers. This means that prospective teachers must be able to master technology, pedagogy, and content in a balanced way. Based on the results of the study, it shows that the results of the value of technological knowledge with the highest category are 44.9%, pedagogic knowledge with the highest category of 33.7%,

content knowledge with the highest category of 33.7% and the ability to integrate the three components or the ability to integrate the three components. TPACK integration with the highest category of 40.8%. The percentage of scores is higher than the category of presentation of grades at other intervals, in this case it can be said that the ability of prospective economics teachers is in the good category.

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