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IDENTIFICATION OF TPACK ABILITY IN MIDDLE SCHOOL SCIENCE TEACHERS

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Abstract. *In carrying out learning, teachers are required to keep up with the times by integrating knowledge of content, pedagogy and technology into learning. The ability of TPACK is very influential on learning in the classroom. For this reason, the study was conducted to determine the TPACK ability of junior high school science teachers in Central Java and East Java Provinces. The sample was taken through the cluster sampling technique on 33 science teachers through a google form-based questionnaire with 43 TPACK indicators. The results of the analysis show that 87% of teachers have TPACK abilities with good criteria and 13% of teachers have TPACK abilities with poor criteria. The lack of TPACK ability in science teachers can be caused by several factors such as age, less than optimal training attended by teachers and gender. For this reason, it is hoped that the government can help teachers improve their TPACk skills so that the teaching and learning process can be carried out optimally according to the development of the times.*

Keywords: *TPACK Ability.*

Introduction

The world with increasingly rapid technological developments brings the latest technology in the world of education. The integration of technology in the world of education has a big role in creating quality human resources. During the COVID-19 pandemic, the use of the latest technology such as zoom, google meet and other video conferences is mandatory to control the continuity of learning activities. Technology can penetrate space and time, so learning can be carried out anywhere and anytime with and without a teacher. Today many learning models have been developed with the integration of technology in them, such as e-learning (electronic learning), Computer Assisted Instruction (CAI), Computer-Based Instruction (CBI), and e-teaching (electronic teaching). Learning models that have been integrated with technology make it easy for teachers and students to find materials and learning resources independently via the internet (Khotimah et al., 2019). The government has regulated learning that integrates technology in it, through Law no. 20 of 2003 concerning the National Education System article 31. In this policy, distance learning can be implemented by all lines, levels and types of education supported by learning facilities and services by national standards(*UU No. 20 Tahun 2003*, n.d.).

Teachers understand the importance of skills in using technology in learning considering its role in helping solve problems in the classroom, but in the field, there are still many teachers who cannot integrate technology into their learning in the classroom. In addition, some teachers do not master the use of the latest technology itself. For example, in using the computer, the teacher still has difficulties, this will cause the learning carried out to generally seem "old-fashioned" or still teacher center. Technology-based education can be interpreted as a teaching and learning process by utilizing information and communication technology facilities(Khotimah et al., 2019). According to Permendikbud No. 16 of 2007, teachers must have competence in the field of information and communication technology to develop themselves and support the learning process. This policy is closely related to the goals of national education (Kemendikbud, 2007). In addition, it is also related to the framework of teacher knowledge in the 21st century which

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includes pedagogic technology and content knowledge(Koehler, M. J., 2008)(Rosyid, 2016). The pedagogic ability and professionalism of teachers are highly prioritized based on the Law on Teachers and Lecturers no. 14 of 2005, PP No. 19 of 2005 and strengthened by Permendiknas No. 16 of 2007. Therefore, the competencies that must be mastered by teachers are in the form of pedagogic mastery, and a deep understanding of material content. In addition, the government's latest policy through PP No. 74 of 2008 article 12 encourages the implementation of the teacher competency test (UKG). Strengthened by Permendikbud No. 38 of 2020 concerning Teacher Professional Education (PPG).

Teaching and learning activities include the planning process, learning process and evaluation. The planning of learning devices that are integrated with technology is often an obstacle for some teachers. This can be caused by several things such as the lack of mastery of the material, and the low level of media and technology/media literacy and technology(Suyamto et al., 2020). This problem looks very real regarding the certification that has been carried out by the government for teachers but there has been no significant improvement in the quality of education in recent years. The reality in the field is that many teachers get scores below the minimum criteria when developing technology-integrated learning tools in certification activities. Teacher competence in planning learning with integrated technology is called Technological Pedagogical Content Knowledge (TPACK)(Rahmadi, 2019). Professional teachers must have adequate TPACK competence, because TPACK is in the realm of the four main competencies of a teacher which include pedagogic competence, personality competence, social competence and professional competence.

TPACK is a combination of comprehensive knowledge and skills in terms of material and pedagogical abilities that are fused with the latest technological developments(Hariati, 2022). TPACK is knowledge about how to facilitate students in learning certain content through pedagogic and technological approaches(Shulman, 1986). The principle of TPACK is to combine technology, pedagogy and materials in one learning context(Koehler, M. J., 2008). TPACK has 7 variables, namely technological knowledge, pedagogical knowledge, content knowledge, technological content knowledge, pedagogical content knowledge, technological pedagogical knowledge and technological pedagogical content knowledge(Shulman, 1986). Mastery of TPACK by the teacher will make classroom learning more innovative, creative and effective so that students more easily understand the learning material. TPACK is very much needed to keep up with the demands of the times, not least during a pandemic like today(Ajizah & Huda, 2020). If the teacher does not have the TPACK ability, it will greatly disrupt learning activities, especially during the current pandemic, because learning is mostly done remotely with the help of technology. Based on these problems, research was conducted on "Identification of TPACK Ability in Middle School Science Teachers".

Method

The This research is a type of descriptive research with a quantitative approach. The study was conducted to determine the ability of junior high school science teachers in each component of TPACK. Samples were taken using the cluster sampling technique. The sample of public and private junior high school science teachers came from 2 provinces, namely Central Java and East Java. The number of respondents in each junior high school is a maximum of 2 teachers. Data collection was obtained through a google form-based questionnaire. The data obtained were then processed using quantitative analysis. The research instrument was adopted from Schmidt et al. (2009) which consists of 43 indicators. The instrument uses 4 scales which include "1 = strongly disagree", "2 = disagree", "3 = agree", and "4 = strongly agree". The obtained value is converted into a percentage using the formula:

$$\text{Value} = \frac{\text{accepted score}}{\text{maximum score}} \times 100\%$$

The percentage data obtained is then converted into qualitative data based on the table below:

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0% - 20% : Not very good
21% - 40% : Not good
41% - 60% : Not Good
61% - 80% : Good
81% - 100% : Very Good(Riduwan, 2015).

Result and Discussion

Data were obtained from science teachers in junior high schools who teach in public and private schools with a total of 33 people. There are 10 male teachers and 23 female teachers. The research instrument used 43 indicators with components of TK 7 items, CK 8 items, PK 8 items, PCK 4 items, TCK 3 items, TPK 9 items and TPACK 4 items (Schmidt et al., 2009). TPACK ability is Based on the results of the study, it was found that the average TPACK ability for science teachers got a score of 2.85 from an ideal score of 4 with a percentage of 71%. This shows that the average TPACK ability of junior high school science teachers belongs to good criteria(Riduwan, 2015). The average score of teachers' TPACK abilities in terms of indicators can be seen in Table 1.

Table 1. Average score of each TPACK indicator

Indicator	Average Score	Percentage
TK	2.94	73%
CK	2.95	74%
PK	3.09	77%
PCK	2.90	73%
TCK	2.79	70%
TPK	2.84	71%
TPACK	2.45	61%

The average score on the Technology Knowledge indicator reached 2.94 from the ideal score of 4 with a percentage of 73% and was included in the good criteria. The Content Knowledge indicator, reaches a score of 2.95 from an ideal score of 4 with a percentage of 74% and is included in the good criteria. Then the Pedagogical Knowledge indicator, reaches a score of 3.09 out of 4 ideal scores with a percentage of 77% and is included in the good criteria. The Pedagogical Content Knowledge indicator achieved an average score of 2.9 from the ideal score of 4 with a percentage of 73% and was included in the good criteria. Technological Content knowledge, reaches an average score of 2.79 from an ideal score of 4 with a percentage of 70% and is included in the good criteria. The Indicator Technological Pedagogical Knowledge achieved an average score of 2.84 from an ideal score of 4 with a percentage of 71% and was included in the good criteria. And finally, the TPACK indicator reached an average score of 2.45 from the ideal score of 4 with a percentage of 61% and was included in the good criteria. The TPACK Ability Indicator is above 7 indicators. All indicators are included in the good criteria.

Content Knowledge(CK) focuses on a particular body of knowledge or the entirety of learning content. Learning content can be in the form of concepts, theories, principles and facts that are taught to students. Pedagogical Knowledge (PK) refers to the special abilities of teachers to create a conducive learning environment by utilizing various available resources. The teacher's CK and PK abilities will determine the ability of Pedagogical Content Knowledge (PCK) (Roig-Vila et al., 2015). Some teachers who have experience do not necessarily have expertise in PCK. This shows that the teacher's CK and PK abilities are the main keys to developing PCK abilities (Neumann et al., 2019).

When integrating technology into classroom learning, teachers must have adequate knowledge and competence about technology (Sam, 2009). Incorporating technology into the curriculum is one of the challenges for teachers. Because teachers must combine the type of technology with learning objectives that can provide meaningful learning for students. Technology can help the teacher's role when conveying information to students (Hasibuan, 2016). The teacher's TK ability in representing CK will result in Technological Content Knowledge (TCK) abilities. TCK is the ability of teachers to integrate technology with certain learning content so that it can affect students' knowledge in certain fields of study (Nasar & Daud, 2020).

Technological Knowledge (TK) and Pedagogical Knowledge (PK) abilities possessed by teachers will produce Technological Pedagogical Knowledge (TPK) abilities. TPK itself is the ability of teachers to

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integrate technology into learning so that it can affect learning. The technology that can be used in learning is very diverse, but some technologies are not suitable for the characteristics of certain materials. For this reason, teachers must be adept at sorting out the right technology for classroom learning.

TPACK is a teacher's representation of the need to integrate technology in an appropriate way to deliver learning content. Teachers can use technology to help students solve problems in learning, find the meaning of new concepts and reconstruct their knowledge (Hsu & Chen, 2018). The TPACK ability possessed by the teacher illustrates the way the teacher teaches material content through pedagogical and technological approaches. The distribution of the frequency of TPACK capabilities with a sample of 33 respondents can be seen in Tablel 2.

Table 2. Distribution of TPACK Ability

No	Percentage	Criteria	Frequency	Frequency percentage
1	0-20 %	Very bad	0	0%
2	21-40 %	Not very good	1	3%
3	41-60 %	Not good	3	9%
4	61-80 %	Well	22	67%
5	81-100 %	Very good	7	21%
Amount			33	100%

In Table 2. it can be seen that there are no respondents who fall into the very bad criteria. As many as 3% of teachers or 1 out of 33 teachers fall into the bad criteria. Furthermore, as many as 9% or 3 out of 33 teachers fall into the criteria of being unfavorable. As many as 67% or 22 of the 33 teachers fall into the good criteria and 21% or 7 of the 33 teachers fall into the very good criteria. Judging from the frequency distribution, it can be said that 87% of junior high school science teachers in the provinces of Central Java and East Java have TPACK abilities that fall into good criteria. Although there are 13% of junior high school science teachers in Central Java and East Java Provinces who have TPACK abilities, they fall into the criteria of not being good and not good. Lack of TPACK ability in teachers can be caused by several factors such as age. The older the teacher, the lower the ability to integrate technology into learning (Vongkulluksn et al., 2018). Another factor is that the training that is often attended by teachers usually only focuses on how to use content integration with technology but does not integrate technology into learning activities (Yulisman et al., 2020). In addition, another study stated that gender also affects the ability of TPACK in teachers (Jordan, 2011).

Conclusion

The results showed that the TPACK ability of junior high school science teachers in the provinces of Central Java and East Java was quite good. There are only 4 teachers with poor and bad criteria. Based on the data from the analysis, there are 87% of teachers have TPACK abilities with good criteria and 13% of teachers have TPACK abilities with poor criteria. This can be caused by several factors such as age, and less than optimal training that is often attended by teachers and gender.

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