



**TECHNIUM**  
**SOCIAL SCIENCES JOURNAL**

**Vol. 27, 2022**

**A new decade  
for social changes**

[www.techniumscience.com](http://www.techniumscience.com)

ISSN 2668-7798



9 772668 779000

# **Evaluation of Technological Pedagogical Content Knowledge (TPACK) Teachers of SMK Negeri 6 Malang (Case Study of Electrical Power Installation Engineering and Autotronic Engineering)**

**Dodik Septian Ferdiansyah<sup>1</sup>, Syaad Patmanthara<sup>2</sup>, Hary Suswanto<sup>3</sup>**

State University of Malang

[dodikseptian1999@gmail.com](mailto:dodikseptian1999@gmail.com), [syaad.ft@um.ac.id](mailto:syaad.ft@um.ac.id), [hary.suswanto.ft@um.ac.id](mailto:hary.suswanto.ft@um.ac.id)

**Abstract.** This study aims to determine the level of Technological Pedagogical Content Knowledge (TPACK) proficiency. This type of research is descriptive quantitative research. The instruments used to measure TPACK are in the form of questionnaires and interview questionnaires using a Likert scale with 5 scales. The samples of this study were Electrical Power Installation Engineering (EPIE) teachers at SMK N 6 Malang, totaling 7 people and Autotronic Engineering (AE) teachers at SMK N 6 Malang totaling 6 people. The results of the study are EPIE teachers' TK skills are in very good criteria with an average of 68, while AE teachers' kindergarten skills are in good criteria with an average of 53. EPIE teachers' PK skills are in good criteria with average - an average of 67.3, while the PK skills of AE teachers are in good criteria with an average of 75.2. EPIE teachers' CK skills are in very good criteria with an average of 31, while the CK skills of AE teachers are in very good criteria good with an average of 31. EPIE teachers' TCK skills are in very good criteria with an average of 26, while AE teachers' TCK skills are in good criteria with an average of 22. EPIE teachers' PCK skills are at criteria very good with an average of 57, while the PCK skills of AE teachers are in very good criteria with an average of 56. EPIE teachers' TPK skills are in good criteria with an average of 26.6, while the TPK skills of AE teachers are at good criteria with an average of 26.8. EPIE teachers' TPACK skills are in good criteria with an average of 18.4, while AE teachers' TPACK skills are in good criteria with an average of 18.2.

**Keywords.** Technological Pedagogical Content Knowledge (*TPACK*), *Teacher, Vocational High School*

## **1. Introduction**

The world today has entered a new era, namely the era of the industrial revolution 4.0, so inevitably it requires humans in that generation to follow the developments of the current era. The industrial revolution 4.0 is marked by industrial automation, knowledge automation and data management automation (Nancy, 2018). The result of the 4.0 industrial revolution era is Cyber Physical System technology. Cyber Physical System technology has begun to enter human life and will become part of human life, thus providing a challenge for humans

themselves how to deal with this opposition. One way to face these challenges is through education.

The world of education cannot be separated from the rapid development of industry in the world, which indirectly, if there is a change in the economic order, will also change the educational order in a country. Education is one of the important items facing the current industrial revolution 4.0, thus providing a challenge for the world of education. The first challenge is how to print the current generation of prospective teachers, namely the millennial generation to have competencies that are aligned and qualified in the era of the industrial revolution 4.0. The second challenge is how to create learning that is in accordance with the current developments in technology and information. The teacher is an important figure in the implementation of education, because the success of students is supported by the role of a teacher. The success of the learning process is supported by the teacher's ability to design and develop a learning plan that is adapted to technological developments. The learning process requires teachers to have competence in teaching for a smooth learning process.

Given that teacher competencies must be in line with science, technology, art and future demands, it is important for teachers to have understanding and skills in TPACK. One of the learning frameworks that serves to develop the competence of prospective teachers or teachers. The development of TPACK is a combination of three knowledge domains (content, pedagogy, and technology) that must be mastered by prospective teachers and teachers in the era of the industrial revolution 4.0. TPACK is the development of Shulman's theory (1986) regarding Pedagogical Content Knowledge (PCK). PCK is a teacher's knowledge that develops continuously through experience related to how to teach certain content or material in a certain way so that student understanding can be achieved (Loughran, 2012). This research resulted in a new framework, namely TPACK. This framework includes three core categories of knowledge: Pedagogical Knowledge (PK), Content Knowledge (CK), and Technological Knowledge (TK). The framework proposes that combining these three types of core knowledge results in four additional types of knowledge: Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Technological Pedagogical Content Knowledge (TPACK).

Various studies have identified that the framework is very important for the professional development of teachers or teacher candidates. TPACK is considered a framework that can provide new directions for teachers to solve problems on how to integrate technology into learning activities in the classroom and outside the classroom (Hewitt, 2008). The development of technology is a challenge that must be faced by prospective teachers by prioritizing their abilities. Teachers at Vocational High Schools (VHS) really need to have TPACK skills. These skills need to be mastered by prospective teachers in order to create an active, effective and efficient learning that is integrated with the times, so that they are able to compete in the current era of the industrial revolution 4.0.

## **2. Research Methods**

The design used in this research is descriptive quantitative research. According to Sugiyono, (2011) descriptive research is a research that aims to provide or describe a current state or phenomenon by using scientific procedures to answer actually. Sukmadinata, (2013) said that quantitative research can be based on the philosophy of positivism which means as an event that actually happened. This research emphasizes on objective phenomena that are studied in the form of quantitative data and supported by qualitative data.

The research aspects that will be studied in the study are divided into 7, namely Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). The data used in this study is divided into two, namely the first quantitative data in the form of numbers derived from the parameters of the questionnaire results. The second is in the form of qualitative data in the form of interviews with informants. The population used in this study were 7 teachers of Electrical Power Installation Engineering at SMK N 6 Malang, and 6 teachers for Autotronic Engineering at SMK N 6 Malang. The sampling technique in this study used a saturated sample technique or total sampling. Saturated sample is a technique in determining research samples by using the entire research population (Sugiyono, 2013:124). So in this study using the entire population as the research sample.

The data collection method starts from looking for data sources. In this study, only primary data were obtained through distributing questionnaires and conducting interviews with respondents. The stages of collecting research data are (1) the preparation stage, this stage begins with preparing the research instruments used, namely in the form of questionnaires and interview sheets, (2) the implementation stage is carried out by distributing questionnaires that have been made and conducting interviews with respondents as samples. , (3) the stage of data collection and data analysis The data analysis stage was carried out in several stages, namely: (1) scoring the results of respondents' answers, (2) summing up the total scores of answers to each question item and respondents, (3) grouping the scores obtained. obtained based on the TPACK sub-description. The criteria for the level of readiness are based on the analysis of the frequency distribution.

### 3. Result and Discussion

#### 3.1. Technological Knowledge (TK)

Technological Knowledge (TK) is knowledge about technology and having the skills to use and learn existing technology (Jordan, 2011). Based on the results of the research data analysis, it was found that the TK skill level of the Electrical Power Installation Engineering teacher is presented in Table 1 and the Autotronic Engineering teacher of SMK N 6 Malang which is presented in Table 2.

**Table 1.** TK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Able to learn technology	3-15	9	7	15	14	Very Good
Able to understand how to use technology	4-20	12	8	18	16	Good
Able to understand the benefits of technology in everyday life	4-20	12	12	20	18	Very Good
Able to understand the benefits of technology in an industrial environment	2-10	6	4	10	10	Very Good

Able to understand the benefits of technology in the educational environment	2-10	6	4	10	10	Very Good
<b>Total Score</b>			<b>35</b>	<b>73</b>	<b>68</b>	<b>Very Good</b>

Based on Table 1, it can be seen that the level of Technological Knowledge (TK) has an average value of 68, where the value is included in the very good criteria. This means that the teacher's knowledge of Electrical Power Installation Engineering at SMK N 6 Malang in the field of technology is very good. So it can be understood that the Electrical Power Installation Engineering teacher at SMK N 6 Malang already has various knowledge about technology in the 4.0 industrial revolution era.

**Table 2.** TK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Able to learn technology	3-15	9	7	15	11	Good
Able to understand how to use technology	4-20	12	8	18	11	Not Good
Able to understand the benefits of technology in everyday life	4-20	12	12	20	17	Very Good
Able to understand the benefits of technology in an industrial environment	2-10	6	4	10	7	Good
Able to understand the benefits of technology in the educational environment	2-10	6	4	10	7	Good
<b>Total Score</b>			<b>35</b>	<b>73</b>	<b>53</b>	<b>Good</b>

Based on Table 2, it can be seen that the level of TK has an average value of 53, where the value is included in the good criteria. This means that the knowledge of Autotronic Engineering teachers at SMK N 6 Malang in the field of technology is good. However, it is known that there is one descriptor that is in the less category, namely the descriptor being able to understand how to use technology. It should be underlined that the ability to use technology in this research is technology in the era of the industrial revolution 4.0. So it can be understood that the Autotronic Engineering teacher at SMK N 6 Malang already has various knowledge about technology in the 4.0 industrial revolution era but skills in using the technology are still lacking. There are descriptors with very good criteria, namely the descriptors are able to understand the benefits of technology in everyday life, this is in line with the results of interviews, that they admit that almost all daily activities use technology.

### 3.2. Pedagogical Knowledge (PK)

Pedagogical Knowledge (PK) is teacher knowledge about processes, practices, learning methods and understanding of student learning, classroom management skills, lesson planning, and learning strategies (Kohler et al, 2014; Schmidt & Mishra, 2009). Pedagogical Knowledge (PK) includes knowledge of the techniques or methods used in the classroom, the nature of the

target audience, and strategies for evaluating student understanding. Based on the results of the research data analysis, it was found that the level of PK of the Electrical Power Installation Engineering teacher is presented in Table 3 and the Autotronic Engineering teacher of SMKN 6 Malang which is presented in Table 4.

**Table 3.** PK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Able to identify the characteristics, intellectual, social and moral of students	4-20	12	11	20	16	Good
Able to identify student problems regarding difficulties in understanding the material	2-10	6	5	10	7,7	Good
Able to class management	2-10	6	6	10	7,6	Good
Able to motivate student learning	2-10	6	5	10	8	Very Good
Able to guide students to learn	4-20	12	12	20	16	Good
Able to evaluate student learning	3-15	9	8	15	12	Good
<b>Total Score</b>			<b>47</b>	<b>85</b>	<b>67,3</b>	<b>Good</b>

Based on Table 3, it can be seen that the level of PK proficiency has an average value of 67.3, where the value is included in the good criteria. This means that the Electrical Power Installation Engineering teacher at SMK N 6 Malang has been able to understand and implement pedagogical principles ranging from learning planning, implementation, management and class assessment.

**Table 4.** PK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Able to identify the characteristics, intellectual, social and moral of students	4-20	12	11	20	18	Very Good
Able to identify student problems regarding difficulties in understanding the material	2-10	6	5	10	8,8	Very Good
Able to class management	2-10	6	6	10	7,6	Good
Able to motivate student learning	2-10	6	5	10	8,8	Very Good
Able to guide students to learn	4-20	12	12	20	18	Very Good
Able to evaluate student learning	3-15	9	8	15	14	Very Good

<b>Total Score</b>	<b>47</b>	<b>85</b>	<b>75,2</b>	<b>Very Good</b>
--------------------	-----------	-----------	-------------	------------------

Based on Table 4, it can be seen that the level of PK proficiency has an average value of 75.2, where the value is included in the good criteria. This means that the Autotronic Engineering teacher at SMK N 6 Malang has been able to understand and implement pedagogical principles starting from learning planning, implementation, management and class assessment. Pedagogical knowledge is very important instilled in teachers who aim to manage learning well. Fadlan, (2010) said that systematic efforts are needed to develop teacher competencies, so that they can manage, design, evaluate, and improve learning that has been carried out through various trainings.

### 3.3. Content Knowledge (CK)

Content Knowledge (CK) is the teacher's knowledge and understanding of the subject matter to be studied or taught including facts, theoretical concepts and procedures. Content Knowledge (CK) refers to material knowledge that must be mastered when teaching (Koehler, 2014). Based on the results of the research data analysis, it was found that the CK skill level of the Electrical Power Installation Engineering teacher is presented in Table 5 and the Autotronic Engineering teacher of SMKN 6 Malang which is presented in Table 6.

**Table 5.** CK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Knowledge related to the content/subject matter to be taught	3-15	9	10	15	13	Very Good
Knowledge of the benefits of material content in everyday life	2-10	6	5	10	9	Very Good
Knowledge in learning material	2-10	6	7	10	9	Very Good
<b>Total Score</b>			<b>22</b>	<b>35</b>	<b>31</b>	<b>Very Good</b>

Based on Table 5, it can be seen that the CK skill level has an average value of 31, where the value is included in the very good criteria. This means that the Electrical Power Installation Engineering teacher at SMK N 6 Malang already has knowledge related to the benefits of the material taught in everyday life and is able to teach the material. Knowledge of material content is very important for teachers to master. Mastery of the material aims to overcome misconceptions and errors in showing facts.

**Table 6.** CK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Knowledge related to the content/subject matter to be taught	3-15	9	10	15	13	Very Good

Knowledge of the benefits of material content in everyday life	2-10	6	5	10	9	Very Good
Knowledge in learning material	2-10	6	7	10	9	Very Good
<b>Total Score</b>			<b>22</b>	<b>35</b>	<b>31</b>	<b>Very Good</b>

Based on Table 6, it can be seen that the CK proficiency level has an average value of 31, where the value is included in the very good criteria. Knowledge of material content is very important for teachers to master. Mastery of the material aims to overcome misconceptions and errors in showing facts. Wina Sanjaya (2007) said that the ability to master teaching materials in accordance with the areas of expertise being taught is one of the forms of professionalism of a teacher. This is in line with the regulation of the minister of national education explaining that the competency standards of good professional teachers are stated to be able to master the material (Permendiknas, 2007). In addition, it is important that the teacher has knowledge regarding the benefits of the material taught in everyday life and is able to teach the material.

### 3.4. Technological Content Knowledge (TCK)

Technological Content Knowledge (TCK) is an understanding of the ways in which technology and content influence and limit each other. TCK is knowledge of how technology creates new representations in understanding a concept from subject matter through the use of technology (Koehler, 2013). Based on the results of the research data analysis, it was found that the TCK skill level of the Electrical Power Installation Engineering teacher is presented in Table 7 and the Autotronic Engineering teacher of SMKN 6 Malang which is presented in Table 8.

**Table 7.** TCK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Knowledge of the application of technology to the material being taught	4-20	12	6	20	18	Very Good
Knowledge of how technology creates new representations in understanding a material concept	2-10	6	4	10	8	Very Good
<b>Total Score</b>			<b>10</b>	<b>30</b>	<b>26</b>	<b>Very Good</b>

Based on Table 7, it can be seen that the TCK skill level has an average value of 26, where the value is included in the very good criteria. This means that the Electrical Power Installation Engineering teacher at SMK N 6 Malang already has knowledge and is able to use technology well in delivering material. As explained by Abbitt (2014) TCK is knowledge of how technology is able to influence and be able to explore scientific disciplines.

**Table 8.** TCK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal			Actual		Criteria
	Range	Median	Min	Max	Average	
Knowledge of the application of technology to the material being taught	4-20	12	6	20	15	Good
Knowledge of how technology creates new representations understanding a material concept	2-10	6	4	10	7	Good
<b>Total Score</b>			<b>10</b>	<b>30</b>	<b>22</b>	<b>Good</b>

Based on Table 8, it can be seen that the TCK proficiency level has an average value of 22, where the value is included in the good criteria. This means that the Autotronic Engineering teacher at SMK N 6 Malang already has knowledge and is able to use technology well in delivering material. As explained by Abbitt (2014) TCK is knowledge of how technology is able to influence and be able to explore scientific disciplines. Based on the results of the interview they said that they still use technology as appropriate, such as LCD projectors which are only used to teach material. But they have not been able to create how the LCD projector can be used other than to convey material.

### 3.5. Pedagogical Content Knowledge (PCK)

Pedagogical Content Knowledge (PCK) is the idea of transforming subject matter for teaching. PCK emphasizes how to teach certain materials with certain methods aimed at making it easy for students to understand by providing varied experiences to students. Based on the results of the research data, it was found that the PCK skill level of the Electrical Power Installation Engineering teacher is presented in Table 9 and the Autotronic Engineering teacher of SMKN 6 Malang which is presented in Table 10.

**Table 9.** PCK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal			Actual		Criteria
	Range	Median	Min	Max	Average	
Able to develop lesson plans	6-30	18	18	30	28	Very Good
Can carry out learning according to the lesson plan	2-10	6	6	10	8	Very Good
Have knowledge of various curricula that have been applied in Indonesia	3-15	9	7	15	13	Very Good
Able to apply the current curriculum	2-10	2	7	10	8	Very Good
<b>Total Score</b>			<b>38</b>	<b>65</b>	<b>57</b>	<b>Very Good</b>

Based on Table 9, it can be seen that the PCK skill level has an average value of 57, where the value is included in the very good criteria. This means that the Electrical Power Installation Engineering teacher at SMK N 6 Malang has been able to combine pedagogical knowledge with content or material in learning. They have been able to develop lesson plans according to the

material to be taught, starting from choosing the approach, model, and method that will be used in learning.

**Table 10.** PCK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Able to develop lesson plans	6-30	18	18	30	27	Very Good
Can carry out learning according to the lesson plan	2-10	6	6	10	8	Very Good
Have knowledge of various curricula that have been applied in Indonesia	3-15	9	7	15	13	Very Good
Able to apply the current curriculum	2-10	2	7	10	8	Very Good
<b>Total Score</b>			<b>38</b>	<b>65</b>	<b>56</b>	<b>Very Good</b>

Based on Table 10, it can be seen that the PCK proficiency level has an average value of 56, where the value is included in the very good criteria. This means that the Autotronic Engineering teacher at SMK N 6 Malang has been able to combine pedagogical knowledge with content or material in learning. They have been able to develop lesson plans according to the material to be taught, starting from choosing the approach, model, and method that will be used in learning.

Based on the results of interviews that teachers of Electrical Power Installation Engineering and Autotronic Engineering at SMK N 6 Malang are less able to apply student-centered learning, they say they are still applying teacher-centered learning in accordance with the 2013 curriculum. The biggest obstacle is the lack of adequate facilities and infrastructure, making it difficult to implement learning in accordance with the applicable curriculum.

### 3.6. Technological Pedagogical Knowledge (TPK)

Technological Pedagogical Knowledge (TPK) is an understanding of how the learning and learning process can change along with the technology used (Koehler, 2013). This includes pedagogical knowledge and constraints on technological facilities and infrastructure related to developmentally appropriate pedagogical strategies. Based on the results of the research data analysis, it was found that the TPK skill level of the Electrical Power Installation Engineering teacher is presented in Table 11 and the Autotronic Engineering teacher of SMKN 6 Malang which is presented in Table 12.

**Table 11.** TPK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Knowledge related to the use of technology in learning	3-15	9	9	15	12	Good
Can adapt the use of the latest technology for different teaching activities	2-10	6	4	10	7,2	Good

Can use information and communication technology for learning discussions with students	2-10	6	4	10	7,4	Good
<b>Total Score</b>			<b>17</b>	<b>35</b>	<b>26,6</b>	<b>Good</b>

Based on Table 11, it can be seen that the level of TPK has an average value of 26.6, where the value is included in the good criteria. This means that the Electrical Power Installation Engineering teacher at SMK N 6 Malang has been able to utilize technology into learning and is able to use it for different learning.

**Table 12.** TPK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Knowledge related to the use of technology in learning	3-15	9	9	15	12,2	Good
Can adapt the use of the latest technology for different teaching activities	2-10	6	4	10	7,2	Good
Can use information and communication technology for learning discussions with students	2-10	6	4	10	7,4	Good
<b>Total Score</b>			<b>17</b>	<b>35</b>	<b>26,8</b>	<b>Good</b>

Based on Table 12, it can be seen that the level of TPK has an average value of 26.8, where the value is included in the good criteria. This means that the Autotronic Engineering teacher at SMK N 6 Malang has been able to utilize technology into learning and is able to use it for different learning. The application of TPK requires technological facilities and infrastructure at every educational institution, so that if the provision of technology is not facilitated, the use of technology will be limited. Based on the results of the interview they said that they could apply technology in different learning, but in its application it was constrained by facilities and infrastructure, both technological facilities owned by students and technological facilities provided by schools were not facilitated. So that it is difficult for teachers of Electrical Power Installation Engineering and Autotronic Engineering at SMK N 6 Malang to unite pedagogical components with the technology to be used, even though they already have high technological knowledge.

### 3.7. Technological Pedagogical Content Knowledge (TPK)

Technological Pedagogical Content Knowledge (TPACK) is a new emerging form of knowledge with three "core" components (content, pedagogy, and technology) (Koehler, 2013). TPACK is an understanding that arises from the interaction between content, pedagogy, and technological knowledge. Based on the results of the research data analysis, the TPACK skill level of the Electrical Power Installation Engineering teacher is presented in Table 13 and the Autotronic Engineering teacher of SMKN 6 Malang which is presented in Table 14.

**Table 13.** TPACK Proficiency Level of Teachers in Electrical Power Installation Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Can use strategies that combine material content, technology and teaching approaches in every lesson	2-10	6	4	10	6,4	Good
Knowledge of managing learning with knowledge of material content is associated with the application of technology in learning	3-15	9	6	15	12	Good
<b>Total Score</b>			<b>10</b>	<b>25</b>	<b>18,4</b>	<b>Good</b>

Based on Table 13, it can be seen that the level of Technological Pedagogical Content Knowledge (TPACK) has an average value of 18.4, where this value is included in the good criteria. This means that the Electrical Power Installation Engineering teacher at SMK N 6 Malang has been able to manage learning with knowledge of the content of the material associated with the application of technology in learning.

**Table 14.** TPACK Proficiency Level of Teachers in Autotronic Engineering SMK N 6 Malang

Descriptor	Ideal		Actual			Criteria
	Range	Median	Min	Max	Average	
Can use strategies that combine material content, technology and teaching approaches in every lesson	2-10	6	4	10	6,2	Good
Knowledge of managing learning with knowledge of material content is associated with the application of technology in learning	3-15	9	6	15	12	Good
<b>Total Score</b>			<b>10</b>	<b>25</b>	<b>18,4</b>	<b>Good</b>

Based on Table 14, it can be seen that the level of Technological Pedagogical Content Knowledge (TPACK) has an average value of 18.2, where the value is included in the good criteria. This means that the Autotronic Engineering teacher at SMK N 6 Malang has been able to manage learning with knowledge of material content associated with the application of technology in learning. The results of the evaluation need to be carried out by various trainings to improve teacher competencies related to Technological Pedagogical Content Knowledge (TPACK). Content knowledge can be trained by learning as much literacy as possible about the content. Pedagogical knowledge can be trained through various activities such as microteaching, seminars and so on. Meanwhile, technological knowledge can be trained in various ways, such as independent practice, industrial practice and existing trainings.

#### 4. Result and Discussion

The ability to integrate technology, pedagogy and content or materials (TPACK) is very important for teachers. Seeing the rapid development of technology and the importance of the role of teachers in dealing with rapid technological developments, teachers should make a positive contribution to the development of better human resources. One of the forms of contribution that can be made is to try to evaluate and improve the learning process on an ongoing basis and must always develop their competencies. The use of technology in learning is an alternative that can be used by teachers in creating learning that is integrated with technological developments. Efforts that can be used to integrate technology into learning require a framework, namely Technological Pedagogical Content Knowledge (TPACK) which must be mastered by teachers. Therefore, teachers should have these competencies in order to realize the goals of national education and be able to create graduates who are able to compete in the era of the industrial revolution 4.0.

#### References

- [1] Abbitt, J.T. (2014). An Investigation of the Relationship between Self-Efficacy Beliefs about Technology Integration and Technological Pedagogical Content Knowledge (TPACK) among Preservice Teachers. *Journal of Digital Learning in Teacher Education*, 27 (4), 134-143.
- [2] Alayyar, G., Fisser, P., & Voogt, J. 2012. Developing Technological Pedagogical Content Knowledge in pre-service science teachers: Support from blended learning. *Australasian journal of educational technology*, 28(8), 1298-1316.
- [3] Ay, Y., Karadag, E., & Acat, M. B. 2016. ICT Integration Of Turkish Teachers: An Analysis Within TPACK-Practical Model. *International Journal of Progressive Education*, 12 (2), 148-165.
- [4] Brun M., & Hinostroza, J. E. 2014. Learning to Become a Teacher in the 21st Century: ICT Integration in Initial Teacher Education in Chile. *Educational Technology & Society*, 17 (3), 222–238.
- [5] Figg, C., & Jaipal, K. 2016. Developing a Survey from a Taxonomy of Characteristics for TK, TCK, and TPK to Assess Teacher Candidates' Knowledge of Teaching with Technology. *Society for Information Technology & Teacher Education International Conference*, 4330-4339.
- [6] Geisinger, K. F. 2016. 21st Century Skills: What Are They and How Do We Assess Them?. *Educational Journal*, 29 (4), 245-249.
- [7] Heithink, M., Voogt, J., Verplanken, L., & Break, V. 2017. Eliciting Teachers' Technological Pedagogical Knowledge. *Australasian Journal of Educational Technology*, 3 (33).
- [8] Hennessy, S., Ruthven, K., & Brindley, S. 2005. *Teacher Perspectives On Integrating Ict Into Subject Teaching: Commitment, Constraints, Caution, And Change*. *Journal Of Curriculum Studies*, 37 (2), 155-192.
- [9] Jimoyiannis, A. 2010. Designing And Implementing An Integrated Technological Pedagogical Science Knowledge Framework For Science Teachers Professional Development. *Computers & Education*, 55, 1259-1269.
- [10] Jordan, K. 2011. *Beginning Teacher Knowledge: Result from Self-Assessed TPACK Survey*. *Austra-lian Educational Computing*, 26 (1): 16-26.
- [11] Kemendikbud. 2018. Data Hasil Uji Kompetensi Guru. (Online), (<https://npd.kemdikbud.go.id/?appid=ukg>). Diakses pada tanggal 10 Agustus 2019.

- [12] Koehler, M. J., & Mishra, P. 2008. Introducing TPACK In AACTE Committee on Innovation & Technology (Eds.), *The Handbook of Technological Pedagogical Content Knowledge for Education*. New York: Routledge.
- [13] Koehler, M. J., & Mishra, P. 2009. What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
- [14] Koehler, M. J., & Mishra, P. 2013. What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*.
- [15] Koehler, M.J. Mishra, P. Kereluik, K. Shin, T.S. and Graham, C.R. 2014. The Technological Pedagogical Content Knowledge Framework dalam *Handbook of Research on Educational Communications and Technology*. New york: Springer Science Business Media.
- [16] Maeng, J. L., Muvley, B. K., Smetana, L. K., & Bell, R. L. 2013. Preservice Teachers TPACK: Using Support Inquiry Instruction. *Journal Science Educational Technology*, 22 (6), 838-857.
- [17] Nancy W. G. 2018. Higher education in the era of the fourth industrial revolution. Singapore: Palgrave Macmillan.
- [18] NSTA. 2012. *Standards for science teacher preparation*. National Science Teachers Association in collaboration with the association for the Education of Teachers in Science.
- [19] Sahin, I. (2011). Development of survey of technological pedagogical and content knowledge (TPACK). *Turkish Online Journal of Educational Technology*, 10(1), 97-105.
- [20] Shulman, L. S. 1986. Those who understand: Knowledge growth in teaching. *Educational Researcher*. 15(2), 4-14.
- [21] Sugiyono. 2011. *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Alfabeta.
- [22] Sugiyono. 2013. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- [23] Sukmadinata, N.S. 2011. *Metode Penelitian Pendidikan*. Bandung: Remaja Rosdakarya
- [24] Undang-Undang Republik Indonesia No. 14 tahun 2015 tentang Guru dan Dosen. Direktorat Jendral Kelembagaan IPTEK dan DIKTI Kementerian Riset, Teknologi, dan Pendidikan Tinggi. (Online),(<http://kelembagaan.ristekdikti.go.id/>). Diakses pada tanggal 20 November 2019.
- [25] Loughran, J., Berry, A., & Mulhall, P. 2012, *Understanding and developing science teacher's pedagogical content knowledge*, Rotterdam: Sense Publishers.
- [26] Hewitt, J. 2008. Reviewing the handbook of technological pedagogical content knowledge (TPACK) for educators. *Canadian Journal of Science, Mathematics, and Technology Education*, 8(4), 355–360.
- [27] Wina Sanjaya. 2007. *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana Prenada Media Group.
- [28] Wearesocial. 2019. Digital 2019: Internet Trends in Q3 2019. (Online), (<https://datareportal.com>). Diakses pada tanggal 15 agustus 2019.