ANALYSIS IMPLEMENTATION OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE BY SCIENCE TEACHERS THROUGH DISTANCE LEARNING AT JUNIOR HIGH SCHOOL IN MEDAN

Rizky Agassy Sihombing¹*, Grace Angeline Manurung¹, Lia Angraini Simanjuntak¹

¹Student of Natural Science Education, State University of Medan, Indonesia
Email: rizkyagassy@mhs.unimed.ac.id

DOI: http://dx.doi.org/10.26418/jpmipa.v13i2.48260

Abstract
This research aims to analyze the application of the TPACK framework by teachers in distance learning at junior high schools in Medan. Curriculum 2013 in Indonesia been applying for 5 years. However, an evaluation of how does the teacher deliver learning subjects (pedagogy knowledge), and the implementation of subject mastery (content knowledge) and technology mastery (technology knowledge) is strongly suggested. In this research also used a qualitative descriptive method by providing a google form questionnaire to 10 junior high school teachers in the city of Medan as samples drawn with simple random sampling. The data was obtained based on the answers to questions from 10 junior high school science teachers, where 7 teachers were public school educators and the other 3 teachers were educators in private schools from different schools. The process of collecting data through a questionnaire containing questions that must be filled in by the teacher about their agreement or disagreement with the questions given in the questionnaire (Likert scale). The questions made are invincible with TPACK aspect. Based on the instruments that have been developed, researchers have obtained that the teachers already know and apply TPACK in distance learning well through the understanding and abilities possessed by the junior high school science teachers in carrying out the learning process in the classroom, especially on the topic of temperature and heat.

Keywords: TPACK Framework, Science, Science Teacher, Distance Learning
INTRODUCTION

Based on the government's decision on March 24, 2020, the Ministry of Education and Culture issued circular letter number 4 of 2020 concerning the implementation of education policies in the emergency period of the spread of COVID-19. The letter describes the learning process carried out online/remotely in their respective homes to provide new and meaningful learning experiences for educators, students and parents. Online learning is a reality that must be faced along with the development of science and technology or communication technology. The number of online learning platforms that can be applied these days, changes habits in the world of education. Online learning is a learning system that is carried out not face to face, but using a platform that can help the teaching and learning process that is carried out even though it is a long distance. The purpose of online learning is to provide quality learning services in a network that is massive and open to reach more and wider study space enthusiasts (Sofyana & Abdul, 2019).

Online distance learning is carried out to avoid the spread of the COVID-19 virus with school clusters. Therefore, the learning atmosphere changes and must immediately adapt to new habits, namely students learning from home. So blended learning is applied by combining synchronous and asynchronous learning. Synchronous or virtual face-to-face using Web Conferences from various platforms, which are combined with asynchronous learning or outside learning hours that have been scheduled by the school. Asynchronous activities can be in the form of students studying the learning.

System in the form of teaching materials in the format of pdf, power point, student worksheets or video scribe which can be used to support discussion taught.

Implementation of distance learning activities teachers and students face various challenges in its implementation. Teaching with technology is not a one-size-fits-all approach because it depends on the type of technology at the time it is used and also on the content of the curriculum being taught (Orlando & Attard, 2015). This means, the use of technology raises another additional factor in the pedagogy of teaching and the process of building learning experiences (Swan, 2017). Likewise with PJJ during a pandemic where the strategy of implementing online-based learning also caused various kinds of problems, both from students and teachers.

Curriculum 2013 has been applying for 5 years. However, there should be an evaluation to assess how the teachers deliver learning subjects (pedagogy knowledge), subject mastery (content knowledge) and technology mastery (technology knowledge); and to ease measurement of integration achievement of TIK by combining the abilities had by the teacher in teaching at schools (Absari, Priyanto & Muslihhin, 2020).

The creativity of educators is very influential in achieving online learning goals. The obstacle faced is that teachers have to innovate so as to create pleasant learning conditions for students by utilizing existing technology. As professional educators, teachers must be able to collaborate on
a variety of learning methods. Teachers are expected to be able to act as mentors or remote tutors as well as facilitators for students. This can be achieved if an educator is able to innovate in online learning by taking advantage of technological advances. But in reality in the field, there are still teachers who cannot operate technology so that it affects the learning objectives not being achieved online. This is due to the lack of counseling and training for educators about the technology in the learning system of education.

Based on Shulman’s ideas about PCK, Mishra & Koehler (2006) have added technology to PCK, with the term TPACK (technological pedagogical and content knowledge). According to Mishra & Koehler (2006), TPACK is a framework that tries to understand the relationship between pedagogical knowledge, content knowledge, and the use of technology (technological knowledge). In TPACK, the teacher’s knowledge to integrate technology in learning makes learning effective and efficient.

Natural Science Education is a term related to how to find out about nature systematically, this is intended so that students not only master a collection of knowledge in the form of facts, concepts or principles, but also a process of discovering natural science to function to provide knowledge about various types of natural and artificial environments in relation to everyday life, which are concrete and can be proven mathematically by using formulas in equations in the teaching and learning process in schools. The science concept contains concepts from three disciplines, namely physics, chemistry, and biology. Temperature and heat are physical materials. This material has been obtained by students from the elementary school level (Witanecahya, 2014).

Natural Science is a science that equips students with knowledge, understanding, and abilities, therefore science learning needs strategies to determine student learning success because students are not only required to master knowledge but also skills. It is not uncommon to find in the learning process the role of students only as listeners and teachers only to convey information, therefore a learning strategy using appropriate methods so that students’ learning skills and success can achieved (Rossicca et al., 2019).

Farikhah’s research (in Yulida, 2014), about TPACK says that TPACK is a knowledge framework for learning writing skills. lecturers in the learning process of writing (writing) in the classroom. Similarity, this study has similarities in the importance of integrating the skills of content knowledge, pedagogy, and technology integration in the learning process. The difference, this study focuses on integrating TPACK in lecturers, learning to write in class, and the author focuses on integrating the application of TPACK in junior high school teachers and in distance learning on temperature and heat material. The novelty of this research that is not found in previous research is the integration of the actualized application of TPACK in distance learning about temperature and heat material.
Technology pedagogy and content knowledge tends to identify the characteristic of knowledge required by the teacher to integrate technology into learning. The point of the framework of TPACK is complex interaction to three major pieces of knowledge; CK, PK, and TK. The framework of TPACK runs further by emphasizing the type of knowledge that exists at the intersection between the four main forms, namely: PCK, TCK, TPK, and TPACK (Mishra & Koehler, 2006).

Content knowledge are the teacher's knowledge of subject matters being learned and taught. The knowledge encompasses knowledge concerning the concept, theory, idea, organization framework, and established practice and approach to improve the knowing. Additionally, content knowledge is defined as knowledge concerning subject matter to be learned or taught to students (Chai et al., 2011).

Pedagogical knowledge is a knowledge concerning process and practice or learning methods and learning, also how these matters encompass relatively the purposes, values, and learning purposes. Therefore, the pedagogy knowledge requires comprehension about learning theories of cognitive, social, and the development of how to behave towards students in the class (Yeh et al., 2016).

Technological knowledge is knowledge concerning standard technology such as book, chalk, and blackboard, and more sophisticated technologies, such as internet and digital video. Knowledge is a certain way of thinking and works with technology, tools, and source of technology (Abidin, 2005).

Technology content knowledge is knowledge concerning procedures and content which are reciprocally related. The comprehension of procedures of technology and content influence limit each other.

Technology pedagogical knowledge concerning existence, component, and capabilities of various techniques used in teaching and learning arrangements and reversely knowing how teaching experiencing changes as the result of the use of certain technologies. It also encompasses knowing the ability and pedagogical limitation of technology for it associates with pedagogical design and strategies at the right time and under its development.

Pedagogical content knowledge can be taught by microteaching lesson study. The teacher can confidently express the knowledge he composes through the transfer of knowledge of material content to pedagogical knowledge (Purnomo & Hidayati, 2018).

Technology pedagogy and content knowledge is a form of knowledge that arouses over those three components (content, pedagogy, and technology). TPACK is influenced by many factors, in which gender is one factor that remains unclear (Cahyani, Azizah & Evans, 2021). It underlies meaningful and skilled teaching using technology. TPACK is developed through the intersection of the three components. TPACK is effective basic teaching with technology, that needs comprehension about the representation of constructively use of technical concepts to teach contents, knowledge of what makes the concepts difficult or easy to learn and how do technology can assist to improve
several problems faced by students, and knowledge of how does it is used to construct the existing knowledge to develop a new epistemology or strengthen its old version consider to rewrite this sentence (Jang, 2010).

Integrating both technology, pedagogy and teaching materials is an important thing to apply. This closely related to the TPACK framework (Koehler, Mishra & Cain, 2013). TPACK integration helps in the implementation of online learning (Kohler et al., 2013). According to Pinkley (2010) adding in global life where technology has become an integral part of everyday life, more and more people use technology both for personal needs and needs in the professional world. However, teachers in implementing online learning tend to carry out online learning through applications. Teachers have not integrated pedagogy and teaching materials. This was conveyed by Drajati (2020) that teachers have not integrated TPACK in online learning. So that students have not actively involved in learning and students tend to feel bored and seem to ignore the teaching material provided by the teacher.

Based on the description above, the main objective in this study is to analyze the application of the TPACK framework by teachers in distance learning at junior high schools in Medan.

METHODS

The research method used by the writer in this research is descriptive qualitative method. The methodology itself is a process, principles, and procedures that we use to approach problems and seek answers (Mulyana, 2008). Another meaning of methodology according to Arina (2018), methodology is a formula in the application of research where in carrying out the research there are steps and also the results of the research. While the research methodology is a method or technique that is arranged regularly used by a researcher to collect data and information in conducting research that is tailored to the subject and object under study.

According to Arikunto's (2010) opinion, descriptive research is not intended to test certain hypotheses, but only describes what it is about a variable. According to Arikunto (2010) the qualitative research method is a display in the form of spoken or written words that are observed by researchers, and objects that are observed in detail so that the implied meaning in the document or object can be captured. So it can be concluded that qualitative descriptive research in this study is to see, review and describe in numbers about the object under study as it is and draw conclusions about it according to the phenomena that appear at the time the research was carried out.

The data collection technique was carried out through the technique of giving a modified google form questionnaire from a Denise journal questionnaire (2009) to several junior high school teachers in the city of Medan. Data is needed to complete the focus of this research in describing and analyzing various problems faced by teachers regarding the application of the TPACK framework during distance learning in several junior high schools in Medan. In addition, this study also describes the framework of the TPACK that is applied by the teacher.
so that the distance learning process continues to run effectively.

RESULT AND DISCUSSION
The results of the analysis of the TPACK questionnaire data by several junior high school teachers in Medan are presented in the following tables.

The instrument used in this study was a closed questionnaire contains statements that must be filled in by the teacher about their agreement or disagreement with the questions given in the questionnaire (Likert scale). The questions that have been made are adjusted to the TPACK aspects (adapted by Suryawati et al., 2014; Tian et al., 2012; Chai et al., 2011; Schmidt et al., 2009) which includes: technology knowledge, content knowledge, pedagogical knowledge, technological content knowledge, pedagogical content knowledge, technological pedagogical knowledge, and technological pedagogical and content knowledge. The results on TPACK that was developed consists of 28 questions that must be filled in by the respondent.

The data is obtained based on the answers to questions from 10 junior high school science teachers, where 7 teachers are public school educators and the other 3 teachers are educators in private schools from different schools.

That have 10 teachers, it is known that 8 teachers have teaching experience over 5 years and the other 2 teachers have teaching experience for 1-5 years. The answers are obtained based on answers to questions via the google online form. The results of the google form show that:

Technology Knowledge
Technology Knowledge refers to knowledge of various technologies from low-technology to digital technology that can be integrated into curriculum and learning and refers to skills in using it (Schimdt, 2009; Kohler et al, 2014; De Rossi & Trevisan, 2018). The results of the aspect technology knowledge questionnaire data analysis can be seen in Table 1.

Table 1. Questionnaire results for aspects of technology knowledge

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Often (%)</th>
<th>Always (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I know how to solve technical problems that occur</td>
<td>10</td>
<td>20</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I can learn technology easily</td>
<td></td>
<td>40</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I follow important new technological developments</td>
<td></td>
<td>80</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>I often and excited to try the latest development of technology</td>
<td></td>
<td>80</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>I have technical skills that I can use with the help of technology</td>
<td>60</td>
<td></td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Based on the data table 1, the results of the questionnaire for the technology knowledge aspects can be explained and concluded that:

a. Question number 1 about the teacher knowing how to solve technical problems that occur. From this data, the average teacher knows how to solve technical problems that occur in the classroom.
b. Question number 2 about teachers being able to learn technology easily. This shows average teacher often studies technology, can learn it easily.
c. Question number 3 about teachers following important new technology developments. This shows that the average teacher is always up to date with very important of the new technology developments.
d. Question number 4 is about the teacher often and likes to try the latest development technology. This shows that the average teacher often likes to try the latest technology developments.
e. Question number 5 regarding teachers have technical skills that they can use with the help of technology. This shows that on average teachers have technical skills that they can use with the help of technology.

So it can be concluded that some junior high school teachers in the city of Medan are in the good category in the aspect of technology knowledge. This means that the ability of teachers in the field of technology, both knowledge and skills, is good.

This data is in line with a survey conducted by the association of Indonesian internet service providers (APJII, 2016) which that internet users in Indonesia in 2016 were 132.7 million people (50% of the total population) with 22.3 million users aged between 20-24 years of age and the internet content most accessed by internet users is social media as many as 129.2 million people (97.7%).

Content Knowledge

Content knowledge refers to subject matter knowledge that must be mastered when teaching (Kohler et al, 2014; Schmidt & Mishra, 2009), which in the context of this research is science material or content. Knowledge of material content includes various terms, theories, ideas, frameworks (Shulman, 1986). The results of the questionnaire data analysis on the content knowledge aspect are presented in Table 2.

Based on the data table 2 the results of the questionnaire for aspects of content knowledge social and science studies can be explained and concluded that:

a. Question number 1 was about the teacher having sufficient knowledge about social studies. This shows that the average teacher has sufficient knowledge about social studies.
b. Question number 2 about teachers can use historical thinking. This shows that the average teacher often uses historical thinking.
c. Question number 3 regarding teachers has various ways and strategies to develop my understanding of social studies. This show shows that the average teacher has various ways and strategies to develop teachers' understanding of social studies.

Meanwhile, based on the data the results of the questionnaire for aspects
of content knowledge science can be explained and concluded that:

a. Question number 1 is about the teacher having sufficient knowledge about science. This shows that the average teacher has sufficient knowledge about science.

b. Question number 2 is about teachers being able to use scientific thinking. This shows that the average teacher always uses scientific thinking.

c. Question number 3 regarding teachers has various ways and strategies to develop my understanding of science. This shows that the average teacher always has various ways and strategies to develop their understanding of science.

Table 2. Questionnaire results for aspects of content knowledge (social and science studies)

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Often (%)</th>
<th>Always (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I have sufficient knowledge about social studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>50</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I can use a historical way of thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I have a variety of ways and strategies to develop my understanding of social studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>40</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I have sufficient knowledge about science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I can use a scientific way of thinking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I have a variety of ways and strategies to develop my understanding of science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tables 2 show that the aspects of content knowledge for junior high school teachers in the city of Medan are in the good category. Content knowledge is important for teachers to master (Mishra & Koehler, 2008). If a teacher does not have a good knowledge of the content of the material to be taught, it can cause misconceptions (Koehler & Mishra, 2009).

Pedagogical Knowledge

This aspect refers to knowledge of various teaching strategies and methods including knowledge of classroom management, learning assessment, and development plan (Kohler et al., 2014; Schmidt & Mishra, 2009). The results of the questionnaire data analysis the pedagogical knowledge aspect can be seen in Table 3.
### Table 3. Questionnaire results for aspects of pedagogical knowledge

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Often (%)</th>
<th>Always (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I know how to assess student performance in a classroom</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I can adjust the way I teach based on the understanding of the students</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I can adapt my teaching style in different ways</td>
<td>10</td>
<td>40</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>I can assess students in many ways</td>
<td>10</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>I can assess student learning in many ways</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>I understand students understandings and also misconceptions</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>I know how to organize and how to maintain classroom management</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on table 3 data, the results of the questionnaire for aspects of pedagogical knowledge can be explained and concluded that:

a. Question number 1 was about the teacher knowing how to assess student performance in the classroom. This shows that the average teacher knows how to assess student performance in the classroom.

b. Question number 2 about the teacher can adjust the way I teach based on the students’ understanding. This shows that the average teacher can always adjust the way teacher teach based on the understanding of the students.

c. Question number 3 about the teacher can adjust my teaching style in different ways. This shows that the average teacher can adapt their teaching style in different ways.

d. Question number 4 is about teachers being able to assess students in various ways. This shows that the average teacher can always assess students in various ways.

e. Question number 5 is about teachers being able to assess student learning in various ways. This shows that the average teacher can always assess student learning in...
various ways.

f. Question number 6 is about the teacher understanding students understanding and misunderstanding. This shows that the average teacher always understands students understandings, misunderstandings.

g. Question number 7 is about the teacher knowing how to organize and maintain classroom management. This shows that the average teacher always knows how to organize and maintain classroom management.

Table 3 above shows the Pedagogical Knowledge aspects of several junior high school teachers in the city of Medan who are in the good category. This means that the teacher has implemented pedagogical principles from planning, implementing, and assessing in classroom learning. Pedagogical knowledge is an important knowledge for teachers to master. As stated in Undang-Undang No. 14 of 2005 on teachers and lecturers, one of the competencies that teachers and lecturers must have is pedagogical competence.

Pedagogical Content Knowledge

Pedagogical content knowledge according to Shulman (1986) is an understanding of how certain topics or problems in a field of science are organized, represented, and adapted to the various interests and abilities of students, and implemented in the learning process. The results of the questionnaire data analysis on the pedagogical content knowledge aspects can be seen in Table 4.

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Often (%)</th>
<th>Always (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I can choose an effective teaching approach to guide students to think and learn science, especially temperature and heat materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the data table 4, the results of the questionnaire for aspects of pedagogical content knowledge can be explained and it can be concluded that:

a. Question number 1 about the teacher can choose an effective teaching approach to guide students to think and learn science, especially the material on temperature and heat. This shows that the average teacher can often choose an effective teaching approach to guide students to think and learn science. This means that some junior high school teachers in the city of Medan are able to combine knowledge them about pedagogy and science of the some content/material/temperature and heat in classroom learning.
Technological Content Knowledge

Aspect technological content knowledge is knowledge about the reciprocal relationship between technology and content (Kohler et al., 2014), which in this case is science content. The results of the questionnaire data analysis are presented in Table 5.

Table 5. Questionnaire results for aspects of technological content knowledge

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Often (%)</th>
<th>Always (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I know about technology that I can use to understand and teach science, especially temperature and heat materials</td>
<td>70</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I know to use technology that can be used in understanding students to do literacy</td>
<td>70</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I know about technology that I can use to help students understand and do science</td>
<td>10</td>
<td>50</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on table 5 data, the results of the questionnaire for aspects of technological content knowledge can be explained and concluded that:

a. Question number 1 was about teachers knowing about the technology they could use in understanding and teaching science, especially temperature and heat. This shows that the average teacher does not always know about the technology they can use in understanding and teaching science, especially temperature and heat material.

b. Question number 2 is about the teacher knows to use technology that can be used in understanding students to do literacy. This shows that the average teacher knows how to use technology that can be used in understanding students to do literacy.

c. Question number 3 is about teachers knowing about the technology they can use in helping students understand and do science. This shows that the average teacher often knows about technology that they can use in helping students understand and do science.

Table 5 above shows that the average technological content knowledge aspects of some junior high school teachers in Medan are in good categories. This can be interpreted that the teacher knows and uses technology well in delivering material when learning takes place. As stated by Abbitt (2014) that technology content knowledge is a knowledge of how technology can influence and can be used in exploring scientific disciplines. Schmidt & Mishra (2009) revealed that with technology content knowledge a
teacher can change the way students understand.

**Technological Pedagogical Knowledge**
Technological aspects of pedagogical knowledge are knowledge of how various technologies can be used in teaching, understanding that using technology can change the way teachers teach (Schmidt & Mishra, 2009). In other words, technology has an effect on the learning process (Abbitt, 2014). The results of the data analysis on the Technological pedagogical knowledge aspects can be seen in Table 6.

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Never (%)</th>
<th>Rarely (%)</th>
<th>Sometimes (%)</th>
<th>Often (%)</th>
<th>Always (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I can choose technology that can improve student learning for temperature and heat science subjects</td>
<td>50</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I think critically about how to use technology in my classroom</td>
<td>30</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the data table 6, the results of the questionnaire for aspects of technological pedagogical knowledge can be explained and it can be concluded that:

a. Question number 1 is about the teacher being able to choose technology that can improve student learning for temperature and heat material science lessons. This shows that the average teacher can choose technology that can improve student learning for temperature and heat science lessons.

b. Question number 2 is about teachers being able to think critically about how to use technology in the classroom. This shows that the average teacher always thinks critically about how to use technology in the classroom.

The data contained in the results of Table 6 shows that the aspects of technological pedagogical knowledge several junior high school teachers in the city of Medan are in good category. This is because the Technological Pedagogical Knowledge aspect requires technological means in educational institutions, technological completeness is facilitated so that the use of technology becomes effective in the process of learning temperature and heat.

**Technological Pedagogical and Content Knowledge**
Technological pedagogical and content knowledge is knowledge about integrating technology into learning on specific or specific content (Schmidt & Mishra, 2009; Kohler et al., 2014). The results of the questionnaire data
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technology knowledge, pedagogy and material in classroom learning.

The results of the study have been found several facts that age affects a person to learn new things, in this case learning various new technologies to support the teaching and learning process in the classroom. The solution to this problem is to conduct training facilitated by the government and independently of the initiatives and policies of each school. Besides, another way to do this is that each teacher helps each other when there are difficulties, mutual teaching if there is no understanding of the use of technology to be used. Every teacher tends to master the content to be taught in class. Each teacher develops the subject matter to be taught.

CONCLUSION AND SUGGESTION

Based on the instruments that have been developed, researchers have obtained that the teachers already know and apply TPACK in distance learning well through the understanding and abilities possessed by the junior high school science teachers in carrying out the learning process in the classroom, especially on the topic of temperature and heat.

The teachers’ ability in delivering subjects in the learning process in the class has a significant effect on the ability to combine technological knowledge, pedagogical knowledge, and content knowledge in the teaching and learning process in the class. The teachers have understood and been able to use various teaching methods in the class. But, in technological knowledge and content knowledge, the teachers have not used it maximally. In technological knowledge, the age factor affects someone in gaining knowledge of technology. On the other hand, in content knowledge, subject mastery fewer influences on the teaching and learning process in the class.

Furthermore, the characteristics of the Curriculum 2013 application will be achieved if the teachers can combine technological knowledge, content knowledge, and pedagogical knowledge in the learning process in the class. If the teachers only master one or two of the knowledge aspects, then the expected result will not be achieved or will not maximally be performed.

ACKNOWLEDGEMENT

The author's would say thanks for the completion of this research to science teachers at several Junior High Schools in Medan who can, even have willingly and accept the author to do the research. Thank you to the authors parents for all prayers and affections, as well as to the lecturers for all their advice and guidance, as well as to the friends of NSES 2019 who have been supportive in conducting this research.

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