

Application of Cooperative Learning Model with TPACK in Improving Learning Outcomes of Grade 7

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Abstract

This study aims to improve the learning outcomes of Grade 7 students in Mathematics by applying a cooperative learning model integrated with the Technological Pedagogical and Content Knowledge (TPACK) framework. The research was conducted at SMP Negeri 5 Jember with 32 students as participants. This classroom action research was carried out in two cycles, each consisting of planning, action, observation, and reflection stages. The findings indicate that students' learning outcomes increased significantly after the implementation of the TPACK-assisted cooperative learning model. The percentage of students achieving minimum mastery criteria improved from 21.87% in the pre-cycle to 87.50% in the second cycle, representing a classical improvement of 65.63%. These results suggest that the integration of TPACK in cooperative learning effectively enhances students' engagement and academic achievement in Mathematics.

Keywords: cooperative learning, TPACK, learning outcomes

Introduction

Changes in the curriculum that continue to evolve have a significant impact on classroom learning. Learning is no longer merely a transfer of knowledge from teacher to students but a complex, student-centered process. In line with the Kurikulum Merdeka, learning must promote active participation and critical thinking to improve learning quality and outcomes. One of the main components in achieving this goal is the implementation of effective learning models. Cooperative learning is one such model that emphasizes collaboration, communication, and shared responsibility among students. This model includes various types, such as Jigsaw, Student Teams Achievement Division (STAD), Make a Match, and Think-Pair-Share, which can be applied interchangeably to maintain engagement and facilitate understanding (Fadlurreja et al., 2019; Rusman, 2014 in Marfu'ah et al., 2022). Based on Vygotsky's social constructivist theory, cooperative learning fosters students' cognitive development through social interaction within their Zone of Proximal Development (ZPD).

In addition to pedagogical shifts, 21st-century learning also demands the integration of technology. Teachers must not only master content and pedagogy but also be proficient in technological tools. The Technological Pedagogical Content Knowledge (TPACK) framework responds to this need by combining content knowledge (CK), pedagogical

knowledge (PK), and technological knowledge (TK) (Mishra & Koehler, 2006; Akturk & Ozturk, 2019). TPACK enables teachers to design effective and engaging learning using appropriate technology.

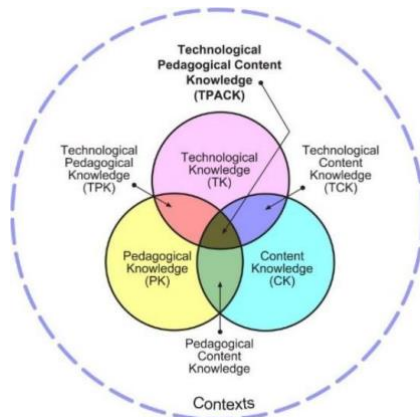


Figure 1. TPACK Framework (Mishra & Koehler, 2006)

Field observations at SMP Negeri 5 Jember show that students tend to be passive, feel bored, and are less motivated during mathematics lessons. Teachers still apply teacher-centered approaches, relying heavily on textbooks and note-taking. This method often leads students to write without truly understanding the material. Interviews with math teachers also reveal that the lack of technology integration contributes to disengagement and low achievement. Previous research indicates that integrating TPACK into cooperative learning enhances student engagement and achievement (Widaningsih et al., 2023). Therefore, this study aims to apply a cooperative learning model assisted by the TPACK framework to improve the learning outcomes and motivation of Grade 7 students in mathematics.

Method

This study employed Classroom Action Research (CAR), a cyclical and reflective approach designed to improve teaching practices and student learning outcomes. CAR consists of four stages: planning, action, observation, and reflection, which are carried out repeatedly until the desired improvement is achieved (Kemmis & McTaggart, 1998; Pahleviannur et al., 2022). First, the planning phase involves developing a detailed learning plan. This includes identifying problems, formulating research questions, and establishing problem-solving strategies. Additionally, this phase encompasses preparation for action implementation, including instructional materials or teaching resources, lesson plans that incorporate teaching methods, observation/evaluation techniques, and assessment instruments. Second, the implementation phase involves executing the plans developed in

the first phase. During this stage, researchers carry out the predetermined actions according to the established framework. Third, the observation phase is conducted simultaneously with the implementation phase. In this stage, researchers outline the types of data to be collected through systematic data collection procedures. During the observation process, researchers are assisted by peer colleagues and mathematics teachers from the respective school. Fourth, the reflection phase involves conducting evaluations to assess the outcomes of the implemented learning program activities. The reflection process plays a crucial role in determining the success of classroom action research, as its results serve as both considerations and foundations for improvements in subsequent action cycles (Maslakhah, Suhartono, et al., 2024).

The research took place at SMP Negeri 5 Jember, East Java, Indonesia, during the second semester of the 2023/2024 academic year, spanning February to May 2024. The research was conducted from February to May 2024. The subjects in this study were 32 students of Class VIIA, aged 12–13 years, selected through purposive sampling. The class was chosen based on initial observations showing low mathematics achievement and teacher-centered instruction. Students had not previously experienced cooperative learning systematically, and the classroom had access to basic technological facilities needed for TPACK integration.

The presence of the researcher was central throughout the research process, acting as the planner, observer, and collaborator with the mathematics teacher. Data collection techniques included learning achievement tests, classroom observations, interviews, and reflection sheets. Instruments used were pre-cycle diagnostic tests, evaluation tests after each cycle, structured observation sheets to assess student engagement and technology use, and interview guidelines for teachers and students. The instruments were validated by expert judgment, and reliability was confirmed through Cronbach's alpha, which exceeded 0.70.

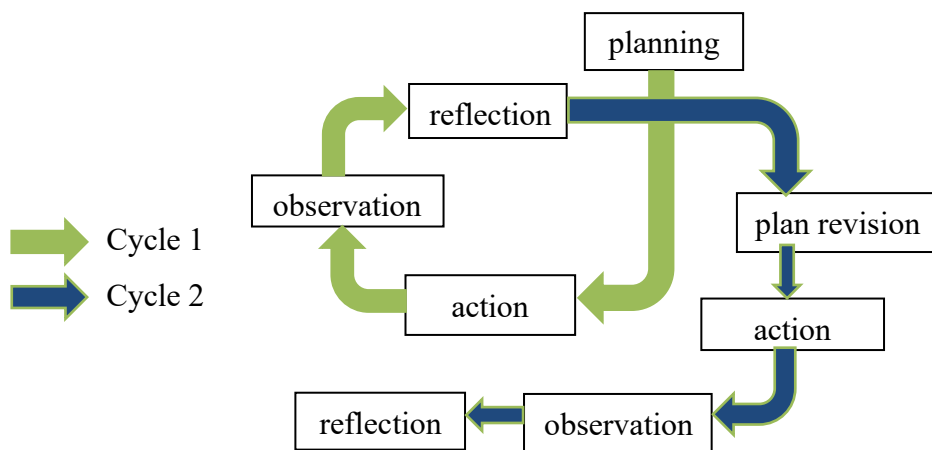


Figure 2. Steps of Classroom Action Research

The data collection process began with a pre-cycle to collect baseline information. Cycle I involved the implementation of the Make a Match cooperative model supported by digital tools such as Wordwall and Liveworksheet. After reflection and evaluation, improvements were made in Cycle II, which applied the STAD model and incorporated more advanced technology such as GeoGebra. Each cycle followed the action research procedure in sequence. Quantitative data from test results were analyzed descriptively by calculating the percentage of students achieving the minimum mastery criterion (KKTP) of 75. Classical completeness was defined as 85% of students reaching this criterion. The formula used is:

$$\text{Classical Completeness} = \frac{\text{Students meeting passing grade}}{\text{Total students}} \times 100\% \quad (1)$$

Qualitative data were analyzed thematically by identifying patterns from observation notes, interviews, and student-teacher reflections. Data triangulation, member checking, and peer discussions were used to ensure the validity of findings. Limitations of the study included the narrow scope of one class and the short duration of two cycles.

Results and Discussion

The research was carried out in two cycles, preceded by a pre-cycle stage. Prior to the implementation of the cooperative learning model integrated with the TPACK framework, initial data were collected through interviews and classroom observations involving Grade VIIA students and their mathematics teacher. This pre-cycle phase aimed to identify existing learning conditions, student challenges, and teaching approaches, serving as the foundation for planning the intervention in the subsequent cycles. The following are the results of the description of each cycle:

a. Cycle 1

The implementation of cycle I consists of 2 meetings for learning and 2 meetings for reflection. The steps of this cycle begin from planning, action, observation, and reflection.

1. Planning stage

The activities carried out at this step were to collect data related to the scores of students in class VIIA from the Mathematics teacher who taught in the class before carrying out the research. Then conduct a diagnostic assessment to determine the initial ability of students and start designing learning devices with a *cooperative learning* model which includes teaching modules that contain teaching materials, assessments, tests, instruments in the form of observation sheets, and reflection sheets.

2. Action or implementation step

Implementation of learning in cycle 1 by applying *cooperative learning* type makes a *match* where activities begin with the introduction (greetings, prayers, apperception, motivation) then core activities. Step in the core activities are teachers providing an explanation of the curved side of the room through Power Point (PPT) and video learning. After that students are given the opportunity to ask questions based on the explanation given from the teacher and observation of the learning video. Then the teacher divides the group consisting of 4 students. The teacher prepares blank paper and 2 types of cards containing problems (card A) and answers to problems (card B). Before being distributed to each group, the teacher explains the rules and ways of working on the problem. So, each group was given 2 types of cards, each of which amounted to the number of members in the group. However, each group has a mismatch between card A and card B. For example, group 1 is given card A (problem) which will be solved by discussing the solution to the problem, then one or two students look for card B (answer to the problem) to other groups until there is a match between the solution found by group 1 and card B in other groups. Likewise for groups 2, 3, and so on. After the match is declared, card A and card B are pasted on the paper provided along with how to get the answer. When all have finished, each group makes a presentation by choosing a problem that is considered difficult and then discussing it together. After all groups have made presentations, the next activity is the closing activity. Students with the guidance of the teacher make conclusions related to learning activities carried out and what students learn at that time and close with prayer. The next meeting is to carry out an independent

learning outcome test of curved side space building material. The purpose of the test is to determine the ability of students personally after applying the TPACK-assisted *cooperative learning* model in cycle 1. After the test, students are given a reflection sheet related to the learning process that has been carried out at the previous meeting.

3. Observation step

Observation activities were carried out during the learning process by two observers consisting of 1 Mathematics teacher and 1 fellow “PPG Prajabatan” student. The results of observations from observers 1 and 2 are that students have participated in learning well and enthusiastically and are also active in conducting discussions to solve problems on the cards given by the teacher. However, there were some students in certain groups who did not look active in conducting discussions, as if they were relying on their friends. Then, the presentation session was quite time consuming because all groups made presentations and things that made it quite time consuming also when looking for answers in other groups. The efforts made by the teacher were good because they monitored all groups even though there were still students who could not be active. In addition, the teacher is also quite good at controlling and managing the class so that it remains conducive, especially when students are looking for answer cards held by other groups.

4. Reflection step

Reflection is carried out to determine the success of the learning process with the TPACK-assisted *cooperative learning* model in cycle 1. Based on the results of observations and tests of learning outcomes conducted, teachers need to provide assistance to students as a whole to observe in each group regarding contributions during discussions. Then it does not matter if when presenting not all groups and in looking for answer cards to save time are given restrictions such as group 1 clue the answer card is in groups 2 and 3.

5. Results from the cycle 1 learning outcomes test

Learning in cycle 1 was carried out with 32 students. Based on the results of the learning test, the data obtained are as follows.

Table 1. Data on Student Learning Outcomes Cycle 1

Number	Aspects	Description
1.	Total of students who participated in cycle 1 learning	32 students
2.	Total students who meet the minimum score on the KKTP	25 students
3.	Total students who did not meet the minimum score on the KKTP	7 students
4.	Highest score	95
5.	Lowest score	60
6.	Average	77,84

The highest score obtained by students was 95 and the lowest score was 60. While the average obtained in cycle 1 was 77.84. The following is a comparison of the percentage of students who fulfill the KKTP and students who do not fulfill the KKTP which is represented in Figure 3.

Percentage of Learning Completeness Results Cycle 1

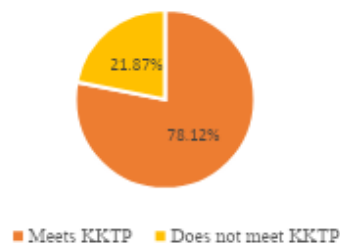


Figure 3. Percentage Diagram of Cycle 1 Learning Completeness Results

b. Cycle II

The implementation of cycle II consisted of 2 learning meetings and 2 meetings for reflection. The stages of this cycle start from planning, action, observation, and reflection.

1. Planning steps

The activities carried out at this stage have different types of *cooperative learning* models from cycle I. It is hoped that the learning carried out in cycle II can be carried out better than cycle I. It is hoped that the learning carried out in cycle II can be carried out better than cycle I. The plan in cycle II was designed to improve learning related to weaknesses and problems that occurred in cycle I. At this stage, researchers compiled and designed learning tools with a *cooperative learning* model with the STAD (Student Teams Achievement Division) type assisted by TPACK including teaching modules containing teaching materials, assessments, tests, instruments in the form of observation sheets, and reflection sheets.

2. Action step

Learning in cycle II using a *cooperative learning* model with the STAD (Student Teams Achievement Division) type where the steps in cycle II learning are first introduced. The teacher opens the lesson with greetings and reads prayers together before learning begins and asks the attendance of students. Then the teacher makes a perception and provides motivation. Then to the core activities which are done conveying learning objectives and presenting material information briefly with PPT and in the middle of the material there are sample questions that are answered together using wordwall. After that, students are grouped differently from cycle I and the teacher distributes students' handphones that were previously collected to the teacher. The thing that is different from cycle I learning is not only the learning model but also the TPACK used. Students' LKPD is accessed with a live worksheet that has been shared by the teacher in the class group regarding the link. In addition, although this is a group, the E-LKPD work is carried out on each learner's cellphone. Students discuss with each other to solve the problems in it. Not only that, the E-LKPD also provides learning videos and GeoGebra. So that students can explore the material of building curved side spaces and can try new things that students have never gotten. After all students have solved the problems on the E-LKPD, then the teacher offers 1 group who wants to present the results of their discussion in front of their friends and 1 group that is selected using the picker on the web wheel of names. While the other groups observe the answers of the group that comes forward if there are differences can comment and provide answers from their group. When 2 groups have delivered and other groups have commented, the teacher provides reinforcement and correction regarding the right answer. Then the teacher gives appreciation to all students and groups who dare to come forward to convey the results of their discussions. The next activity is closing in which students with the guidance of the teacher make conclusions related to learning activities carried out and what students learned at that time and closed with prayer.

The next meeting was an independent learning outcome test with the same material. The purpose of the test is to determine the ability of students personally after reflection and improvement of cycle I learning in the application of the TPACK-assisted *cooperative learning* model in cycle II. After the test, students were given a reflection sheet related to the learning process that had been carried out.



Figure 4. Students Take Action in Learning

3. Observation step

This step is also the same as in cycle I which was carried out by 2 observers, namely the Mathematics subject teacher and fellow “PPG Prajabatan” students. The results of the observation between the 2 observers were that the learning in cycle II was good because what was lacking in cycle I learning had been improved in cycle II. There are suggestions that if you are going to use a cellphone, it is better to have previously connected to the internet, be it the students' internet or the teacher's hotspot, so that you can minimize the time available. Then, different from cycle I, the TPACK used in cycle II also developed. In addition, discussions conducted by students are also effective because the work is done individually on their respective cellphones but can still collaborate well.

4. Reflection steps

Reflection was conducted to determine the success of the learning process with the TPACK-assisted *cooperative learning* model in cycle II. Based on the results of observations and learning outcomes tests conducted, the teacher has improved the shortcomings of cycle I learning. Students were also more active than learning in cycle I and could collaborate with each other well. The use of TPACK is also not only in the explanation of PPT and learning videos, but also equipped using liveworksheet-based E-LKPD and the use of Geogebra.

5. Results from the cycle II learning outcomes test

Learning in cycle II was carried out with 32 students. Based on the results of the learning test, the data obtained are as follows.

Table 2. Data on learning outcomes of students in cycle II

Number	Aspect	Description
1.	Total of students who participated in cycle II learning	32 students
2.	Total students who meet the minimum score on the KKTP	28 students
3.	Total students who did not meet the minimum score on the KKTP	4 students
4.	Highest test	100
5.	Lowest test	60
6.	Rata-rata	85,61

The highest score obtained by students was 100 and the lowest score was 60. While the average obtained in cycle II was 85,61. The following is a comparison of the percentage of students who meet the KKTP and students who do not meet the KKTP which is represented in the diagram illustrated in Figure 4.

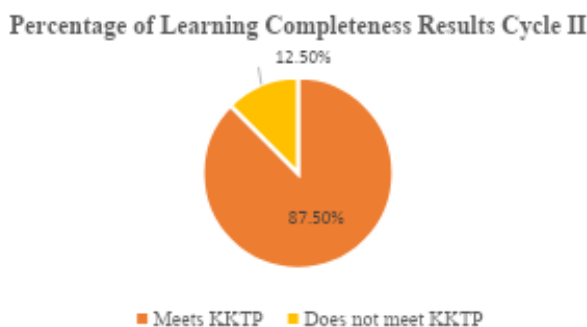


Figure 5. Percentage Diagram of Cycle II Learning Completeness Results

Based on the research results that have been attached, the research flow has been carried out very well in each cycle. Learning with a *cooperative learning* model to improve student learning outcomes is also found in several studies that have been conducted previously by (Widarta, 2021) in his research entitled the application of the jigsaw type *cooperative learning* model to improve motivation and learning outcomes. The results showed an increase in motivation and learning outcomes from the pre-cycle where the average score was 66.18 to cycle II to 72.68 and experienced classical completeness. In addition, research by Suparmini, M. (2021) which experienced an increase between cycle I and cycle II of 7% in the average absorption and an increase in learning completeness of 37%. Based on the results of the research that has been done, it shows that the *cooperative learning* model can improve learning outcomes. Updates from previous studies include different types of *cooperative learning* models between cycle I and cycle II. In addition,

there is TPACK where the use of technology is very supportive of learning in the 21st century. It is also supported by research by Nurmiati, C. (2022) which states that the use of TPACK media is able to provide fundamental changes to the learning system in schools and learning can be more fun and not boring.

Table 3. Data on Students Learning Outcomes Cycle II

Description	Students who completed		Students who didn't complete	
	Frequency	Percentage	Frequency	Percentage
Pre-cycle	7	21,87%	25	78,12%
Cycle I	25	78,12%	7	21,87%
Cycle II	28	87,50%	4	12,50%

Based on the table, it can be seen that before the application of the TPACK-assisted *cooperative learning* model, students who were complete were 21,87% until the application of the model in cycle II, students who were complete 87,50%. It experienced classical completeness with an increase of 65,63%. This increase shows that the student-centered learning model, with an emphasis on cooperation, is able to create a more meaningful learning experience. The increase in the percentage of learning completeness not only reflects the success of individual students, but also indicates that the learning process took place optimally. The model used encouraged students' active involvement. Thus, this success shows that choosing the right learning model contributes significantly to improving the overall quality of learning outcomes.

Conclusion and Suggestion

Based on the results of classroom action research that has been carried out with "Application of Cooperative Learning Model Assisted by TPACK in Improving Learning Outcomes of Grade 7 Students," several key findings have emerged. The cooperative learning model integrated with TPACK has demonstrated significant effectiveness in enhancing student learning outcomes, regardless of the specific model variation implemented. Student engagement and participation levels notably increased throughout the learning process, as the TPACK-enhanced cooperative learning approach successfully reduced classroom monotony and created a more dynamic learning environment. The quantitative data reveals substantial improvement in student completion rates, progressing from 21.87% before implementation to 78.12% in cycle I and ultimately reaching 87.50% in cycle II, demonstrating the sustained positive impact of this pedagogical approach.

Based on the conclusions drawn from this study, the following recommendations are proposed:

- a. Teachers should consider implementing the cooperative learning model with TPACK integration as a regular teaching strategy to enhance student learning outcomes and engagement levels.
- b. Schools should provide adequate technological infrastructure and training programs to support teachers in effectively implementing TPACK-enhanced cooperative learning approaches.
- c. Further research should be conducted to explore the long-term effects of this model on student retention and academic performance across different subject areas.
- d. Professional development programs should be established to help teachers master both cooperative learning techniques and TPACK integration strategies.
- e. Regular monitoring and evaluation systems should be implemented to assess the effectiveness of the cooperative learning model with TPACK in various educational contexts.
- f. Educational institutions should encourage collaboration among teachers to share best practices and experiences in implementing technology-enhanced cooperative learning methods.

References

- Ali, I. (2021). Pembelajaran kooperatif dalam pengajaran pendidikan agama Islam. *Jurnal Mubtadiin*, 7(1), 247–264.
- Akturk, A. O., & Ozturk, H. S. (2019). Teachers' TPACK levels and students' self-efficacy as predictors of students' academic achievement. *International Journal of Research in Education and Science*, 5(1), 283–294.
- Chai, C. S., Koh, J. H. L., & Tsai, C.-C. (2010). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). *Educational Technology & Society*, 13(4), 63–73.
- Fadlurreja, R., Dewi, N. R., & Ridlo, S. (2019). Kemampuan penalaran matematis siswa melalui model. *Prosiding Seminar Nasional Matematika*, 2, 616–621.
- Kemmis, S., & McTaggart, R. (1998). *The nature of action research*. In *The action research planner*. Victoria: Deakin University.
- Larasati, N. I., & Widyasari, N. (2021). Penerapan media pembelajaran berbasis augmented reality terhadap peningkatan pemahaman matematis siswa ditinjau dari gaya belajar. *FIBONACCI: Jurnal Pendidikan Matematika dan Matematika*, 7(1), 45.
- Marfu'ah, S., Zaenuri, Masrukan, & Walid. (2022). Model pembelajaran matematika untuk meningkatkan kemampuan penalaran matematis siswa. *Prosiding Seminar Nasional Matematika*, 5, 50–54.
- Maslakhah, A., Suhartono, & Sulami. (2024). Penerapan Pembelajaran Berdeferensiasi

- Untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas Xi Mipa Sma Negeri 1 Mojosari. *JMER : Journal of Mathematics Education Research*, 2(2), 2829–6001.
- Mirdad, J., & Pd, M. I. (2020). Model-model pembelajaran (empat rumpun model pembelajaran). *Jurnal Pendidikan*, 2(1), 14–23.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054.
- Nurmiati, C. (2022). Penggunaan model discovery learning berbantuan media TPACK untuk meningkatkan hasil belajar peserta didik SMA Negeri 2 Kesuma Bangsa Muara Batu pada materi matriks. *JEMAS: Jurnal Edukasi Matematika dan Sains*, 3(2), 79–85.
- Pahleviannur, M. R., Mudrikah, S., Mulyono, H., Bano, V. O., Rizqi, M., Syahrul, M., Latif, N., Prihastari, E. B., & Aini, K. (2022). *Penelitian tindakan kelas*. Pradina Pustaka.
- So, H. J., & Kim, B. (2009). Learning about problem-based learning: Student teachers integrating technology, pedagogy and content knowledge. *Australasian Journal of Educational Technology*, 25(1), 101–116.
- Suparmini, M. (2021). Penerapan model pembelajaran kooperatif tipe STAD untuk meningkatkan aktivitas dan hasil belajar. *Journal of Education Action Research*, 5(1), 67–73.
- Utomo, P., Asvio, N., & Prayogi, F. (2024). Metode Penelitian Tindakan Kelas (PTK): Panduan Praktis untuk Guru dan Mahasiswa di Institusi Pendidikan. *Pubmedia Jurnal Penelitian Tindakan Kelas Indonesia*, 1(4), 19.
- Widaningsih, R., Irianto, D. M., & Yuniarti, Y. (2023). Pembelajaran berbasis TPACK untuk meningkatkan kemampuan numerasi dan hasil belajar peserta didik. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan dan Hasil Penelitian*, 9(1), 9–16.
- Widarta, G. M. A. (2021). Penerapan model pembelajaran kooperatif tipe jigsaw untuk meningkatkan motivasi dan prestasi belajar peserta didik. *Jurnal Ilmiah Teknologi Pendidikan*, 11(2), 1–23.
- Yurinda, B., & Widyasari, N. (2022). Analisis technological pedagogical content knowledge (TPACK) guru profesional dalam pembelajaran matematika di sekolah dasar. *FIBONACCI: Jurnal Pendidikan Matematika dan Matematika*, 8(1), 47.