



ACCELERATING STUDENTS MATH PROBLEM SOLVING SKILLS USING THINKING ALOUD PAIR PROBLEM SOLVING (TAPPS) ASSISTED WITH QUIZIZZ

Safira Nurul Izzah¹, Alifiani^{*2}, Yuli Ismi Nahdiyati Ilmi³

^{1,2,3}Universitas Islam Malang

Article Info

Article history:

Received Jul 11, 2023

Revised Jan 02, 2024

Accepted Mei 08, 2024

Keywords:

TAPPS

Mathematical Problem Solving

Quizizz

ABSTRACT

The purpose of this study was to describe the implementation of Thinking Aloud Pair Problem Solving (TAPPS) assisted with Quizizz in accelerating mathematical problem solving abilities. The subjects of this study were students of class VIII SMP Negeri 13 Malang consisting of 33 students. This classroom action research was carried out in even semesters with repeated cycles until the indicators of action success were met, each cycle consisting of four stages, namely planning, action implementation, observation, and reflection. The research results in cycle I showed that the results of observation of activity were 79%, the results of observations of student activities were 74.5% and the completeness of learning outcomes reached 63.63% so that they did not meet the indicators of success of the action. In cycle II, the results of observing teacher activity increased by 11.75% to 90.75%, the results of observing student activities increased by 14.25% to 88.75% and the completeness of learning outcomes increased by 18.19% to 81.82%. Based on these results, it can be concluded that the Quizizz-assisted Thinking Aloud Pair Problem Solving (TAPPS) learning model can accelerate the math problem solving abilities of class VIII students of SMP Negeri 13 Malang.

This is an open access article under the [CC BY](#) license.



Corresponding Author:

Alifiani,

Departement of Mathematics Education,

Universitas Islam Malang, Indonesia

Email: alifiani@unisma.ac.id

Phone Number : 0822336165655

How to Cite:

Izzah, S.N., Alifiani., Ilmi, Y.N., (2024). Accelerating Students Math Problem Solving Skills Using Thinking Aloud Pair Problem Solving (TAPPS) assisted with Quizizz. *JME: Journal of Mathematics Education*, 9(1), 58-68.

1. INTRODUCTION

In the post-COVID-19 pandemic, the education system in Indonesia has undergone significant changes. Technology that was still rarely used in learning activities became familiar to the learning process. Given the general crisis caused by the pandemic, especially related to distance learning, teachers need to rethink their role and how to support student

learning (Rapanta et al., 2021). This shift requires new learning innovations, not only for students but particularly for teachers. As (Wilke et al., 2021) said, post-pandemic brought education that was initially implemented with the distance learning system back to school. The following thing that must be a concern in the era of recovery from the pandemic is the optimization of students' offline competencies in the post-pandemic recovery era (Koeswanti, 2021). Therefore, teachers and students must innovate in technology to create attractive, creative, effective, innovative, and fun learning.

Especially in mathematics learning, planning the learning process is one of the supporting factors during the learning process and must be adjusted to student conditions. (Puspitarini, 2022) said that in the 21st century, teachers must be able to adjust learning strategies, methods, and models based on the characteristics of that generation. Therefore, teachers can no longer teach using a learning model that is not student-centered. As educators, teachers must innovate in creating attractive, interactive learning and be able to achieve the goals of mathematics learning, one of which is through technology. However, keep in mind that technology is only a tool used in learning. The most important thing is to help students learn and develop their competencies to meet mathematics learning objectives.

According to the Indonesian Ministry of National Education, one of the objectives of learning mathematics is that students can solve problems or it can be said that students are expected to have a good problem solving skills. Excerpted from Yuliati (2021), mathematics is one of the subjects expected to shape students to have the ability to solve problems both in mathematics and everyday problems. Nussywari et al. (2022) said that problem-solving skills are an essential part of mathematics learning because in the learning process and solving them, students can gain new experiences by using the knowledge and skills they already have. According to Usman et al. (2022), the ability to solve mathematical problems is one of the abilities every student must have. Moreover, problem-solving ability is related to everyday life. Problem-solving ability can be interpreted as applying knowledge obtained previously and then applied to new situations or problems.

Problem-solving is an essential activity in mathematics learning because by solving problems, students can develop the ability to think and curiosity. Problem-solving is a directed thinking process to find a way out in overcoming a mathematical problem (Rachmawati et al., 2021). According to Usman et al. (2022) the ability to solve mathematical problems is a cognitive ability that can be used entirely to find and find a solution and the desired goal. The importance of problem-solving skills is also stated by NCTM, namely: (1) essential elements and become the most significant part of mathematics, (2) have many benefits, such as in the field of work, understanding and communicating in other fields, (3) by inserting mathematical problems in learning can increase student interest and enthusiasm in solving mathematical problems, (4) problem solving can be a fun activity, and (5) problem solving allows students to develop creativity in solving problems.

The indicators of problem-solving ability are identifying the adequacy of data to solve problems, making mathematical models of a problem, choosing and implementing strategies to solve various problems, explaining and interpreting results according to problems, and checking the correctness of results or answers (Meika et al., 2021). Based on this opinion, it can be concluded that the ability to solve mathematical problems is a critical ability students possess in the form of knowledge, skills, and understanding used to solve mathematical problems.

Although problem-solving ability is a crucial ability that students must have, the fact is that students' mathematical problem-solving ability in SMP Negeri 13 Malang is still relatively low. This problem can be seen from the pre-action test results of SMP Negeri 13 Malang grade VIII students, which include problem-solving-based math problems. It was

found that 16 out of 33 or 50% of students have not reached the minimum completeness criteria (KKM). Based on observations, it is known that students are not active during learning, ignore the teacher, and when learning is still teacher-centered. Students can solve routine problems but have difficulties in solving non-routine problems. In addition, the low ability to solve mathematical problems of students is also caused by several things, including the process of learning mathematics in the classroom that does not focus on problem-solving. Students do not build their knowledge of mathematical concepts but tend to memorize mathematical concepts by working on exercise that is similar to the example given. So that the ability of students to solve a mathematical problem is still lacking. Therefore, innovation is needed in learning models that can be used to improve students' mathematical problem-solving abilities. One of them is selecting the Thinking Aloud Pair Problem Solving (TAPPS) learning model.

TAPPS learning model is a learning process in pairs by conveying solutions obtained with a clear voice in solving problems, where one member acts as a problem solver and the other as a listener. TAPPS learning model has several advantages, including being able to develop students' problem-solving abilities, reduce impulsive thinking, improve communication skills, improve active listening skills, more structured thinking patterns, and increase confidence in solving problems (Rachmawati et al., 2021). Thinking Aloud means verbalized thinking (delivered orally), Pair means in pairs, and Problem-Solving means solving or solving problems. So, TAPPS can be interpreted as a thinking technique verbalized in pairs to solve problems. When students solve a problem, students can immediately convey their thoughts to peers (Mandailina & Mahsup, 2018).

According to Artika & Karso (2019), the TAPPS learning model aims to improve the ability in the problem-solving process and assist students in identifying logic or errors in the problem-solving process. The advantage of the TAPPS learning model is that each student works together to solve complex problems, making students active and responsible in the ongoing learning process. In addition, the TAPPS model can reduce impulsive thinking and make students not just passive recipients of information but must actively seek the necessary information (Nufus et al., 2021). One of the shortcomings of the TAPPS learning model is that some students are not happy when told to work together or discuss, so to optimize learning using the TAPPS model, technology-based learning media is needed so that students are interested in participating in learning, one of which is game-based media, namely Quizizz.

Quizizz is an application or web tool for creating interactive quiz games for classroom learning. Through the Quizizz application, teachers can combine discussion, instruction, and evaluation with creativity during learning (Mulyati & Evendi, 2020). Quizizz is very effective for learning and can motivate students because, in quizizz, students compete to answer questions to get the top rank (Supriadi & Pramuditya, 2023). Quizizz makes it easy for users to access and provide detailed assessments, scoring answers from the number of questions that can be answered correctly and the speed of processing time. In addition, Quizizz is supported by an attractive and not dull appearance (Munfarikhatin et al., 2021).

Quizizz has many features that teachers can use, such as creating and providing questions, homework, and student performance data or analysis. Quizizz is very helpful for teachers and students in the learning process if they are well prepared and follow the needs and characteristics of learning. By using the TAPPS learning model assisted by Quizizz media, it is expected to be able to support each other to improve students' mathematical problem-solving skills. This article will discuss applying the TAPPS learning model assisted by Quizizz to improve students' mathematical problem-solving skills.

2. METHOD

The type of research used in this study is classroom action research or commonly referred to as PTK research. According to Arikunto et al. (2015) classroom action research is research that describes the occurrence of cause and effect, what happens, and the entire process from the beginning to the impact of the action. This research was carried out at SMP Negeri 13 Malang in the second semester of the 2022/2023 academic year from March – April 2023. The subjects of this study were class VIII-F students totaling 33 students consisting of 16 male students and 17 female students. The material used in this study is statistics. This research is carried out with a repeating cycle. Each cycle consists of four stages: 1) planning; 2) implementation of actions; 3) observation; 4) reflection. Each cycle consists of three face-to-face meetings. Each cycle is carried out according to the changes to be achieved as planned.

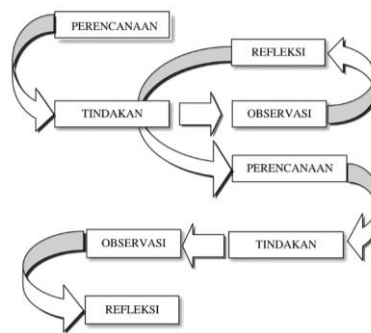


Figure 1. PTK research model according to Taggart and Kemmis
(Source: Parnawi, 2020)

Data collection techniques in this study are a) Pre- action and Final-cycle test, used to obtain data on students' mathematical problem-solving ability; b) Observation, used to obtain data on teacher and student activities in the application of the TAPPS learning model assisted by Quizizz; c) Interviews, conducted to obtain information regarding students' problem-solving abilities and mathematics learning before research to complete the other data (pre-action test). In this case, a test-based interview is carried out. Interviews were also conducted to find out students' responses after taking action; d) Field notes, to obtain information about situations in the classroom that are not on the observation sheet.

The success indicator of each actions in this study is the improvement of the learning process with the percentage of teacher and student activities as seen from the teacher and student observation sheets. The improvement is seen according to the following criteria adapted from (Novianti et al., 2020).

Table 1. Criteria for the success of the action

Success Percentage (SP)	Level of success
$81\% \leq SP \leq 100\%$	Excellent
$61\% \leq SP < 81\%$	Good
$41\% \leq SP < 61\%$	Good Enough
$21\% \leq SP < 41\%$	Low
$0\% \leq SP < 21\%$	Poor

Apart from the several criteria that already mentioned, the final-cycle test scores are also considered as the success indicator of each actions. In the final-cycle test which contains problem solving questions, the action is said to be successful if the student gets a score of

(≥ 75) and the average score of the class is also (≥ 75). This score of (≥ 75) is in line with the KKM set by the school. Considering that the final-cycle test questions is containing problem solving questions, it can be said that if students are successful in the final- cycle test then students' problem solving abilities have also increased..

3. RESULTS AND DISCUSSION

This research is designed in a repeating cycle. Each cycle consists of 4 stages: 1) Planning, 2) Action, 3) Observation, and 4) Reflection. Each cycle consists of 3 face-to-face meetings and is implemented according to the changes to be achieved, such as what has been designed. The following stages are carried out in each cycle in this study:

3.1. Result

Cycle I

a. Planning

This stage has several steps: a) Preparing material; b) Developing learning tools; c) Compile research instruments; d) Setting up Quizizz media; e) Determine the success criteria for the action; f) Divide groups of students.

b. Implementation

The implementation of actions in cycle I consist of 3 meetings. The first and second meetings are mathematics learning with statistical material. The learning process begins with delivering basic competencies and indicators, learning objectives and data analysis materials, and the mean of data. The stages of the Thinking Aloud Pair Problem Solving (TAPPS) learning model are the initial activity, core activities (thinking aloud stage, pair stage, problem-solving stage, and presentation of results), and closing activities working on Quizizz interactive quizzes. At the third meeting, a final test of the cycle is carried out.

c. Observation

Teacher Activities

The first learning cycle consists of 3 meetings with statistical material, data analysis, and the data average. Researchers took action to apply the Thinking Aloud Pair Problem Solving (TAPPS) learning model assisted by Quizizz well. It can be seen from the results of observations by homeroom teachers and fellow mathematics teachers who act as observers. The percentage of teacher activity from meeting one and meeting two has increased slightly, so it can be concluded that teacher performance in first cycle learning is in the good category even though there are still stages that are not carried out optimally.

Table 2. Results of Observations of teacher activities cycle I

No	Activities Teacher	Score Maximum	Meeting I Observer Score		Meeting II Observer Score	
			1	2	1	2
1	Initial activities	20	15	15	15	17
2	Core activities	55	44	43	45	44
3	Concluding activities	15	12	12	12	12
	Total score	90	71	70	72	73
	Percentage	100%	78%	77%	80%	81%
	Success	Excellent	Good	Good	Good	Excellent

Student Activities

Based on observations, student activity in the first learning cycle obtained an average percentage of 74.5% in the good category. It shows that student activities during learning are quite good even though some students still have not been able to follow the learning well. It can also be seen from the results of field notes which show that many students are passive, rowdy, lack enthusiasm, and are not severe.

Table3. Results of Observation of student activities cycle I

No	Activities Student	Score Maximum	Meeting I		Meeting II	
			Observer Score		Observer Score	
			1	2	1	2
1	Initial activities	20	15	15	17	17
2	Core activities	55	38	38	41	40
3	Concluding activities	20	17	16	16	15
	Total score	95	70	69	74	72
	Percentage	100%	74%	72%	77%	75%
	Success	Excellent	Good	Good	Good	Good

d. Cycle I final test results

Based on the results of the first cycle's final test, 21 students out of 33 completed it, with the highest score is 84 and the percentage of completeness of learning outcomes obtained by students was 63.63%, who achieved an average score of 74.5.

e. Reflection

Before carrying out cycle II actions, researchers reflect on cycle I learning with observers starting from the initial learning activities to the end of learning activities and student activities during learning. Reflection on the first cycle of learning is less conducive to learning caused by some students make noise when researchers deliver material, it is difficult to gather and discuss with their groups, students do not understand the role of problem solvers and listeners, and researchers who do not observe and are firm in reprimanding students. Indicators of success of actions in the first cycle are still not met—teacher activity, student activity, and final cycle test results that still do not meet the established indicators.

Cycle II

a. Planning

The results of reflection in cycle I will be used as a reference for planning in cycle II. The planning stages in cycle II have several steps: a) Preparing material; b) Developing learning tools; c) Compile research instruments; d) Setting up Quizizz media; e) Determine the success criteria for the action; f) Divide groups of students.

b. Implementation

The implementation of actions in cycle II consists of 3 meetings. The first and second meetings are mathematics learning with statistical material. The learning process begins with the delivery of basic competencies and indicators, learning objectives and median material, and data mode. The stages of the Thinking Aloud Pair Problem Solving (TAPPS) learning model are the initial activity, core activities (thinking aloud stage, pair stage, problem-solving stage, and presentation of results), and closing activities working on Quizizz interactive quizzes. The end of cycle II test was carried out at the third meeting.

c. Observation

Teacher Activities

In the second cycle of learning, teachers take action to apply the Thinking Aloud Pair Problem Solving (TAPPS) learning model assisted by Quizizz very well. It can be seen from the results of observations by homeroom teachers and fellow mathematics teachers who act as observers. The percentage of teacher activity from meeting 1 and meeting 2 has increased so it can be concluded that teacher performance in the first cycle of learning is in the very good category.

Table 3. Results of Observation of teacher activity cycle II

No	Activities Teacher	Score Maximum	Meeting I Observer Score		Meeting II Observer Score	
			1	2	1	2
1	Initial activities	20	19	15	15	17
2	Core activities	55	50	43	45	44
3	Concluding activities	15	14	12	12	12
	Total score	90	83	70	72	73
	Percentage	100%	88%	94%	89%	92%
	Success	Excellent	Excellent	Excellent	Excellent	Excellent

Student Activities

Based on observations, student activity in the first learning cycle obtained an average percentage of 88.75% in the good category. It shows that student activity during learning is excellent. It can also be seen from the results of field notes that show students have been active and enthusiastic during learning. Student responses in interview activities also said students felt happy and helped by the learning that had been carried out.

Table 4. Results of Observation of Cycle II student activities

No	Activities Student	Score Maximum	Meeting I Observer Score		Meeting II Observer Score	
			1	2	1	2
1	Initial activities	20	19	15	15	17
2	Core activities	55	50	43	45	44
3	Concluding activities	20	14	12	12	12
	Total score	95	83	70	72	73
	Percentage	100%	84%	90%	88%	93%
	Success	Excellent	Excellent	Excellent	Excellent	Excellent

d. Cycle II final test results

Based on the results of the final test of the first cycle, it was obtained that 27 out of 33 students completed, and the percentage of completeness of learning outcomes obtained by students was 81.82%, who achieved an average score of 80.60.

e. Reflection

The reflection of learning in cycle II is that students have experienced the actions given so that students are more active in learning and able to solve the problems

given. Based on the results of observations and end-of-cycle tests, it can be seen that there has been an increase between cycle I and cycle II and has reached success indicators. So, learning in cycle II can be called successful because it has met the predetermined success criteria. Success in cycle II, makes researchers not need to continue to the next cycle.

3.2. Discussion

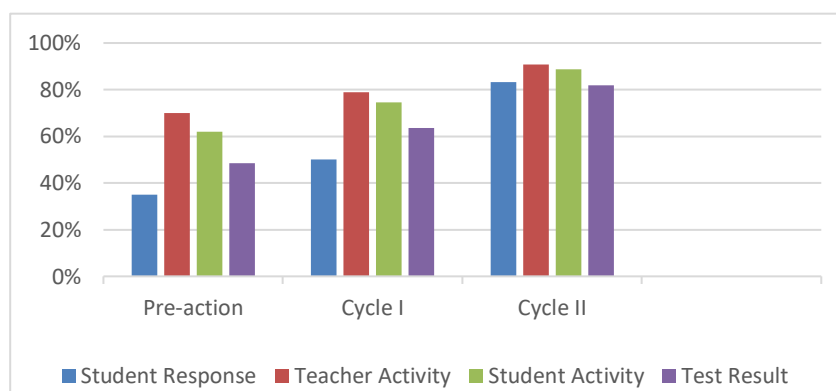


Figure 2. Comparison diagram of pre-action, cycle I and cycle II

Based on the results of the research seen in Figure 2, in the first cycle, it can be seen that the results of the problem-solving ability test after applying the Thinking Aloud Pair Problem Solving (TAPPS) learning model assisted by Quizizz student completeness reached 63.63% better than the test results in pre-action. When learning using the TAPPS learning model assisted by Quizizz, students have practiced solving problems when they become problem solvers and listeners. Quizizz also trains students to solve problems quickly and precisely. So that when the implementation of the final test cycle, students have begun to be able to solve the problems given by the researcher. On implementation, The percentage of cycle II activities increased by 18.19% from 63.63% to 81.82%. This significant increase is due to students already getting used to and experienced with Quizizz's TAPPS learning model. The previous students there are still confused about becoming problem solvers and listeners. In cycle II students have carried out the role of problem solver and listener. In addition, using Quizizz media as a learning evaluation also lets teachers and students know the extent of understanding and problem-solving abilities after studying the material given. So that at the time of the implementation of the final test of cycle II students can smoothly solve the problems given.

This explanation shows that the Thinking Aloud Pair Problem Solving (TAPPS) learning model assisted by Quizizz can improve students' mathematical problem-solving skills. The results of this study follow the opinion of Artika & Karso (2019), who states that students' mathematical problem-solving abilities using the Thinking Aloud Pair Problem Solving (TAPPS) learning model are better or improved than students who use ordinary learning models. Based on the results of data analysis of the end of the student cycle test, it can be seen that the problem-solving steps used are more varied because when learning with the TAPPS model, students can exchange opinions with their friends in solving a given math problem.

Based on Figure 2, it can be seen that student activity has also increased from pre-action to cycle I and to cycle II. Students have become more active in class, their ability to become problem solvers and listeners have also increased, they can discuss well, and they

have become more excited about using Quizizz media. This increase in activity is caused by the TAPPS learning process, which requires students to play an active role in learning by becoming problem solvers and listeners. Students who usually listen to the teacher's explanation must learn to dare to express their opinions when discussing with their group mates. This statement is in line with the opinion of Pujiarti et al., (2022) that the TAPPS learning model is a learning model that focuses on student activity. In addition, Nufus, et al. (2021) said that the TAPPS learning model could also improve students' communication skills because each group member works together to solve complex problems, so students tend to be active and responsible during the learning process.

The use of technology such as Quizizz, which has an attractive appearance and features, also makes learning more fun and not monotonous. At the end of the lesson, students are still excited and challenged to do statistics questions packaged in Quizizz online quizzes. From this study, researchers found that students became more excited and challenged in doing questions through Quizizz media because students could directly see the assessment or ranking of student work. Attractive appearance and easy-to-use features made students have no difficulty using Quizizz media. Assessments packaged using the online game Quizizz prove that technology positively impacts measurement, formative assessment, and challenges educators to use technology that suits student needs (Göksün & Gürsoy, 2019). Quizizz media can also increase student motivation and positively impact learning outcomes with detailed and transparent result information (Pitoyo et al., 2020).

Based on the explanation that has been described, it can be seen that the application of the Thinking Aloud Pair Problem Solving (TAPPS) model assisted by Quizizz can improve the mathematical problem-solving ability of students, especially grade VIII students of SMP Negeri 13 Malang on statistical material.

4. CONCLUSION

Based on the results of research from a series of action activities that have been carried out in cycle I and cycle II, it can be concluded that the Thinking Aloud Pair Problem Solving (TAPPS) learning model assisted by Quizizz can improve the ability to solve mathematical problems in grade VIII students of SMP Negeri 13 Malang. Based on the results of observations of student activities, there are also changes in the learning atmosphere of students in class. Class conditions are increasingly conducive, and students become more focused, active, and enthusiastic in participating in learning. Students' math problem-solving skills have also improved. The improvement can be seen through the results of the final test of cycle I, students who completed as many as 21 out of 33 students with an average student score of 74.5 who achieved a percentage of completeness of 63.63% with a good category and students who completed increased 18.22% in cycle II, namely 27 out of 33 students completed with an average of 80.60 with a percentage of completeness to 81.82% with an excellent category. In addition, based on the interview results, students also felt happy and helped by the Thinking Aloud Pair Problem Solving (TAPPS) learning model assisted by Quizizz.

Based on the conclusions that have been described, the researcher provides the following suggestions: For teachers, they can use the TAPPS learning model assisted by Quizizz on other mathematics materials so that students become more active, dare to express opinions, and learning is not monotonous; For students, it is advisable to be more active when learning, do not be shy to ask the teacher and must dare to express opinions when becoming problem solvers and listeners; For researchers, they should conduct this research

further to develop a better TAPPS learning model assisted by Quizizz and should be carried out further research on other subjects and at different school levels.

ACKNOWLEDGEMENTS

We would like to thank profusely to SMP Negeri 13 Malang City for its invaluable support and contribution. We also thank the validators who have played an important role in perfecting this research and the Islamic University of Malang, which has helped fund the publication of this work.

REFERENCES

- Arikunto, S., Suhardjono, & Supardi. (2015). *Penelitian Tindakan Kelas*. Bumi Aksara.
- Artika, T., & Karso. (2019). Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa dengan Menggunakan Metode Pembelajaran Thinking Aloud Pair Problem Solving (TAPPS). *Prisma*, 8(2), 191–200. <https://jurnal.unsur.ac.id/prisma/article/view/791>
- Koeswanti, H. D. (2021). Optimization of Online Learning with A Combination of Offline Practices in The Post-Pandemic Era. *International Journal of Elementary Education*, 5(2), 315. <https://doi.org/10.23887/ijee.v5i2.34752>
- Mandailina, V., & Mahsup, M. (2018). Efektivitas Pembelajaran Matematika dengan Metode Thinking Aloud Pair Problem Solving (TAPPS) Terhadap Hasil Belajar Siswa Pokok Bahasan Kubus dan Balok Kelas VIII SMP/MTs. *JTAM / Jurnal Teori Dan Aplikasi Matematika*, 2(2), 144. <https://doi.org/10.31764/jtam.v2i2.717>
- Meika, I., Ramadina, I., Sujana, A., & Mauladaniyati, R. (2021). Kemampuan Pemecahan Masalah Matematis Siswa Dengan Menggunakan Model Pembelajaran SSCS. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 5(1), 383–390. <https://doi.org/10.31004/cendekia.v5i1.388>
- Mulyati, S., & Evendi, H. (2020). Pembelajaran Matematika melalui Media Game Quizizz untuk Meningkatkan Hasil Belajar Matematika SMP. *GAUSS: Jurnal Pendidikan Matematika*, 3(1), 64–73. <https://doi.org/10.30656/gauss.v3i1.2127>
- Munfarikhatin, A., Pagiling, S. L., Mayasari, D., & Natsir, I. (2021). Quizizz And Hardwork Character in Geometry Online Lecture: How It Influence? *Journal of Education Research and Evaluation*, 5(1), 33. <https://doi.org/10.23887/jere.v5i1.31644>
- Novianti, A., Bentri, A., & Zikri, A. (2020). Pengaruh Penerapan Model Problem Based Learning (Pbl) Terhadap Aktivitas Dan Hasil Belajar Siswa Pada Pembelajaran Tematik Terpadu Di Sekolah Dasar. *Jurnal Basicedu*, 4(1), 194–202. <https://doi.org/10.31004/basicedu.v4i1.323>
- Nufus, H., Herizal, H., & Atika, F. (2021). Pengaruh Model Pembelajaran Thinking Aloud Pair Problem Solving (TAPPS) Berbantuan Software Autograph Terhadap Kemampuan Komunikasi Matematis Siswa Kelas VIII. *Jurnal Pembelajaran Dan Matematika Sigma (JPMS)*, 7(2), 75–84.
- Nusywardi, W., Prayitno, S., Junaidi, J., & Hikmah, N. (2022). Pengaruh Penerapan Model Pembelajaran Thinking Aloud Pair Problem Solving (TAPPS) terhadap Kemampuan Pemecahan Masalah Matematika. *Jurnal Riset Pendidikan Matematika Jakarta*, 4(1), 23–33. <https://doi.org/10.21009/jrpmj.v4i1.23023>

- Orhan Göksün, D., & Gürsoy, G. (2019). Comparing success and engagement in gamified learning experiences via Kahoot and Quizizz. *Computers and Education*, 135(October 2018), 15–29. <https://doi.org/10.1016/j.compedu.2019.02.015>
- Parnawi, A. (2020). *Penelitian tindakan kelas (classroom action research)*. Deepublish.
- Pitoyo, M. D., Sumardi, & Asib, A. (2020). Gamification-based assessment: The washback effect of quizizz on students' learning in higher education. *International Journal of Language Education*, 4(1), 1–10. <https://doi.org/10.26858/ijole.v4i2.8188>
- Pujiarti, T., Damayanti, P. S., Yusnarti, M., & Yulianti, E. (2022). Pengaruh Model Pembelajaran Kooperatif tipe Thinking Aloud Pair Problem Solving (TAPPS) berbantuan LKS terhadap Pemecahan Masalah Matematika. *Ainara Journal (Jurnal Penelitian Dan PKM Bidang Ilmu Pendidikan)*, 3(3), 196–201.
- Puspitarini, D. (2022). Blended Learning sebagai Model Pembelajaran Abad 21. *Ideguru: Jurnal Karya Ilmiah Guru*, 7(1), 1–6. <https://doi.org/10.51169/ideguru.v7i1.307>
- Rachmawati, I., Baidowi, B., Hikmah, N., & Hayati, L. (2021). Pengaruh Model Pembelajaran Thinking Aloud Pair Problem Solving (TAPPS) Terhadap Kemampuan Pemecahan Masalah Matematika pada Materi Bentuk Aljabar. *Griya Journal of Mathematics Education and Application*, 1(2), 90–98. <https://doi.org/10.29303/griya.v1i2.51>
- Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2021). Balancing Technology, Pedagogy and the New Normal: Post-pandemic Challenges for Higher Education. *Postdigital Science and Education*, 3(3), 715–742. <https://doi.org/10.1007/s42438-021-00249-1>
- Supriadi, I., & Pramuditya, S. A. (2023). Praktikalitas Dan Efektivitas Media Pembelajaran Berbantuan Quizizz Dalam Meningkatkan Motivasi Belajar Matematika Siswa. *Jurnal Karya Pendidikan Matematika*, 10(1), 51. <https://doi.org/10.26714/jkpm.10.1.2023.51-58>
- Usman, P. M., Tintis, I., & Nihayah, E. F. K. (2022). Analisis Kemampuan Pemecahan Masalah Matematika Siswa dalam Menyelesaikan Sistem Persamaan Linear Tiga Variabel. *Jurnal Basicedu*, 6(1), 664–674. <https://doi.org/10.31004/basicedu.v6i1.1990>
- Wilke, J., Mohr, L., Tenforde, A. S., Edouard, P., Fossati, C., González-Gross, M., Ramírez, C. S., Laiño, F., Tan, B., Pillay, J. D., Pigozzi, F., Jimenez-Pavon, D., Novak, B., Jaunig, J., Zhang, M., van Poppel, M., Heidt, C., Willwacher, S., Yuki, G., ... Hollander, K. (2021). A pandemic within the pandemic? Physical activity levels substantially decreased in countries affected by covid-19. *International Journal of Environmental Research and Public Health*, 18(5), 1–12. <https://doi.org/10.3390/ijerph18052235>
- Yuliati, I. (2021). Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Minat Belajar Peserta Didik. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 5(2), 1159–1168. <https://doi.org/10.31004/cendekia.v5i2.547>