Journal of Educational Research and Evaluation
Volume 8, Issue 3, 2024, pp. 499-507
P-ISSN: 2597-422x E-ISSN: 2549-2675
Open Access: https://doi.org/10.23887/jere.v8i3.77204

The Problem-Based Learning Model Assisted by Quizizz Papermode Improves Critical Thinking Ability in Mathematics Learning

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ARTICLE INFO

Article history:
Received April 09, 2024
Accepted July 22, 2024
Available online August 25, 2024

Kata Kunci :
Pembelajaran Berbasis Masalah, Quizizz Mode Kertas, Berpikir Kritis, Pecahan

Keywords:
Problem Based Learning, Quizizz Papermode, Critical Thinking, Fraction

ABSTRAK

Rendahnya kemampuan berpikir kritis disebabkan oleh pelaksanaan pembelajaran yang masih berpusat pada guru. Hal ini menjadikan siswa memiliki pemahaman yang masih rendah sehingga menyulitkan dalam mengerjakan soal evaluasi. Tujuan penelitian ini adalah mengukur efektivitas penggunaan model Problem-based learning berbantuan media quizizz paper mode terhadap kemampuan berpikir kritis siswa. Jenis penelitian ini adalah penelitian eksperimen semu. Populasi dari penelitian ini adalah siswa kelas IV Sekolah Dasar. Sampel dari penelitian dipilih menggunakan random sampling dengan jumlah 33 siswa. Metode pengumpulan data yaitu tes. Instrumen yang digunakan dalam mengumpulkan data yaitu soal tes. Teknik analisis data yaitu analisis statistik inferensial. Hasil dari penelitian yaitu terdapat perbedaan yang signifikan kemampuan berpikir kritis yang termuat dari hasil belajar antara kelas kontrol dan kelas eksperimen. Hasil belajar siswa dengan model Problem-based learning berbantuan media quizizz paper mode lebih tinggi dibandingkan dengan hasil belajar siswa dengan model pembelajaran konvensional. Disimpulkan bahwa model Problem-based learning berbantuan media quizizz paper mode dapat meningkatkan berpikir kritis. Implikasi penelitian yaitu penerapan model Problem-based learning berbantuan media quizizz paper mode efektif digunakan untuk meningkatkan kemampuan berpikir kritis siswa.

ABSTRACT

The low critical thinking ability is caused by the implementation of learning, which is still teacher-centered. This causes students to have a low level of understanding, making it challenging to work on evaluation questions. This research aims to measure the effectiveness of using the problem-based learning model assisted by Quizizz paper mode on students' critical thinking abilities. This type of research is quasi-experimental research. The population of this study was fourth-grade elementary school students. The research sample was selected using random sampling with 33 students. The data collection method is a test. The instrument used to collect data is test questions. The data analysis technique is inferential statistical analysis. The results of the research show that there are significant differences in critical thinking abilities in the learning outcomes between the control class and the experimental class. Student learning outcomes using the Problem-based learning model assisted by Quizzizz paper mode media are higher than those using the conventional learning model. It was concluded that the problem-based learning model assisted by Quizizz paper mode media could improve critical thinking. The research implies that applying the Problem-based learning model assisted by Quizzizz Paper mode effectively improves students' critical thinking abilities..

1. INTRODUCTION

The learning process can help teachers provide information so that students can learn well and increase knowledge. Teachers must create an effective and enjoyable learning atmosphere so that teachers are required to have the ability to manage a class (Putri & Prihatnani, 2020; Rahmatika et al., 2020). Class management is an effort made in learning activities to achieve optimal conditions so that the expected learning activities can be carried out (Faidar et al., 2023; Kurniasih et al., 2020). Learning is an individual activity to gain knowledge, behavior, and skills by processing learning materials. The purpose of learning is to increase knowledge in various fields of study, improve skills, develop and improve thinking skills. Learning objectives can be in the form of knowledge, attitudes and skills compiled by the teacher in accordance with the material taught or often referred to as learning outcomes (Mertasari & Ganing, 2021; Trevallion & Nischang, 2021). Learning outcomes are patterns of actions, values, understanding, attitudes,

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appreciation, and skills (Dariyah, 2020; Mertasari & Ganing, 2021). Learning outcomes are changes in knowledge, actions, attitudes, values, and skills.

However, the problem that occurs today is that many learning objectives have not been achieved optimally. Previous research findings also reveal that there are still many students who have not understood the learning material due to boredom in participating in classroom learning (Anggreni et al., 2021; Lesi & Nuraeni, 2021; Safithri et al., 2021). Other research also reveals that low learning outcomes in students are due to teachers not using appropriate media or learning models for students so that students have difficulty learning (Arianti et al., 2019; Prabaningrum & Putra, 2019). Other findings also reveal that critical thinking skills in Indonesia are still relatively low (Asta Jaya, 2021; Fitriani et al., 2021). The results of observations made in the elementary school of Gugus Dewi Sartika, Gabus District, Pati Regency in class IV SD found that students' critical thinking skills were low. In learning activities, students only listen to explanations from the teacher and tend to be passive when the three teachers ask questions. In addition, learning activities that occur in the classroom are less varied so that students feel bored in learning. In learning activities students only listen to the teacher so that it does not train critical thinking skills in students. In addition, the results of interviews with teachers also found that there are still many students who have low learning outcomes.

Based on this, one way that can improve critical thinking skills in students is through the use of the right learning model. One of the learning models that can be used is the *Problem Based Learning* model. The learning approach using the *Problem-based learning* model will develop problem-solving and critical thinking skills and at the same time build new knowledge (Amerstorfer & Freiin von Münster-Kistner, 2021; Suryawati et al., 2020). Learners critically identify informal and relevant strategies and conduct investigations to solve the problem. By solving these problems, learners acquire or build certain knowledge and at the same time develop critical thinking skills and problem-solving skills (Masitoh & Prasetyawan, 2020; Munir, 2020). *Problem-based learning* model is learning that uses real (authentic) problems that are*ill-structured* and open-ended as a context for learners (Mertasari & Ganing, 2021; Nisaa & Heynoek, 2021). *Problem-based learning* model is a learning concept that helps a teacher to create a learning environment based on problems that are important and relevant to students, and allows students to gain more real learning experiences (Pinandhita & Nurjannah, 2023; Pramana et al., 2020).

The application of a learning model can also be assisted by the use of a learning media, so the use of this *Problem-based learning* model can be collaborated with the use of electronic-based learning media in order to attract more students' interest in learning with groups. Learning media is one of the important aspects that serves as a tool in teaching which is expected to improve student learning outcomes (Kurniati et al., 2022; Mashuri & Budiyono, 2020; Pinatih et al., 2021). The use of technology in learning to increase interactivity, engagement, and learning effectiveness emphasizes the importance of technology integration in the learning process to create a more interesting, interactive, and effective learning environment (Kurniati et al., 2022; Megantari et al., 2021; Wijaya et al., 2020). One of the learning media that can be used is *Quizizz*. *Quizizz* is a *web tool* for creating interactive quiz games that can be used as learning media (Lider, 2022; Wibawa et al., 2019). *Quizizz* is an *e-learning-based* evaluation tool that is very suitable for evaluating quickly and learning results directly to the teacher. *Quizizz* provides interesting features that can be used as a tool in learning, one of which is *paper mode* which is a new feature of this web application (Fauziah & Hadi, 2023; Pavita & Nirmala, 2021). A new feature in *quizizz* called "*Paper Mode*" allows students to answer the quiz manually using paper and pencil. This allows teacher and learner interaction through a question and answer displayed on the screen and filled manually by learners on the paper provided. This feature attracts the attention of educators because it is effectively used in improving student interaction and engagement in the learning process (Ully & Dewi, 2022; Yunus & Hua, 2021).

Previous research findings also revealed that the *Problem-based learning* model is a problem-centered learning model that can improve students' critical thinking skills (Seibert, 2021; Sugiharti et al., 2020). Other studies have also revealed that *quizizz* media can help increase student enthusiasm in learning so that it can motivate students in learning (Islami & Soekamto, 2022; Setiyani et al., 2020; Sitorus & Santoso, 2022). It is concluded that the Problem-Based Learning Model assisted by Quizizz Papermode can help improve critical thinking skills in students. However, there is no study on the Problem-Based Learning Model Assisted by Quizizz Papermode can help improve critical thinking skills in grade IV elementary school students, especially in mathematics learning. The novelty of previous research and this research is in the learning model used by collaborating with quizizz media with paper mode features to improve students' critical thinking skills through fun activities. In previous studies only used learning models and or only the effect of quizizz media without specifying what features were used. Based on this, the purpose of this study is to analyze the Problem-Based Learning Model Assisted by Quizizz Papermode on critical thinking skills in grade IV elementary school students, especially in learning mathematics fraction material.

2. METHODS

This type of research is quantitative using an inferential approach to draw statistical conclusions from empirical data obtained through measurement. The type of quantitative research applied is *quasi experimental* research (pseudo experiment). Quasi *experiment* research has a control group but does not function fully to control outside variables that affect the results of the study. The research design used in this study is a form of *nonequivalent control group design*. In this design, the experimental group and control group are compared, with random sample selection. Both groups will be given different treatments. The experimental group applied the *problem-based learning* model accompanied by *quizizz paper mode* media, while the control group did not apply the *problem-based learning* model, where both groups were given a *pre-test* to determine the initial conditions.

This study focuses on the application of the *Problem-based learning* (PBL) Model with the support of Quizizz media. The focus is on evaluating its impact on mathematical critical thinking skills on fraction material in class IV of the State Elementary School in Gugus Dewi Sartika, Gabus District. Elementary school students in Gugus Dewi Sartika, Gabus District, Pati Regency who are in grade IV are the population of this study. The sample was determined using *random sampling* technique. From 6 schools, 2 schools were selected, 1 school as an experimental group including class IV B SD N Gabus 01 with a total of 21 students, and 1 school again as a control group including class IV SD N Tanjunganom 01 with a total of 12 students. The research instrument was tested outside the sample, which was tested in class IV A SD N Gabus 01 with 25 students. Then the validity, reliability, differentiating power, and difficulty level of each tested question were analyzed. There were 25 questions that were valid and suitable for use in research. The critical thinking ability test was tested for reliability and had a reliability of 0.882 so it was used in this study.

The method used in collecting data is a test. The methods used were *pre-test* and *post-test* given before and after treatment using the Problem-based learning model assisted by quizizz in the experimental group, as well as in the control group which was given a *pre-test* and *post-test* before and after learning with a conventional model. The *problem-based learning* model assisted by *quizizz* was applied in the experimental group schools and the conventional learning model was applied in the control group schools. The test consisted of 25 valid items with multiple choice type. The instrument lattice is the main guide in determining the questions or statements that will form the data collection instrument in the study. The critical thinking grid is presented in Table 1.

Table 1. Critical Thinking Ability Test Grid

Indicators	Description	Question Item Number
Clafication	• Learners can mention the known information in the problem correctly • Learners can state the information asked in the problem correctly	1, 2, 3, 7, 8
Assesment	• Learners can sort out the information needed to solve the problem • Learners can state the reasons for selecting information	4, 5, 6, 9, 10
Inference	• Learners can explain the relationship between the known or questioned information and the information selected to solve the problem	11, 12, 13, 14, 15, 16
Strategies	• Learners can use the selected information to solve the problem • Learners can explain each step taken in the solution • Learners can conclude the final answer correctly	17, 18, 19, 20, 21, 22, 23, 24, 25

Instrument trials were conducted on 25 students outside the experimental group and control group to determine the validity, reliability, differentiating power, and difficulty level of the items. Of the 30 questions, there were 25 valid questions after being tested and tested for validity. Then, 25 valid questions are ready to be used to test the experimental and control classes. The technique used to analyze data is inferential statistical analysis. There are three steps of data analysis carried out in this study, namely data description, prerequisite analysis, and hypothesis testing. At the data description stage, a number of data were described, including mean, standard deviation, variance, minimum score, maximum score, and range. Furthermore, the prerequisite analysis stage includes data normality test using Kolmogorov-Smirnov, variance homogeneity test using Levene Statistics, and linearity test. If the data is normally distributed and

homogeneous, and the variables have a linear relationship, then proceed with hypothesis testing using paired sample t-test and one way anova test, and test the effectiveness of the treatment.

3. RESULT AND DISCUSSION

Results

Based on the learning model and media used, students are categorized into 2 categories, namely students taught with *problem-based learning* model assisted by *quizizz* (A1), and students taught with conventional learning model (A2). Based on data analysis found that students in the experimental group taught using the *problem-based learning* model assisted by *quizizz* media have an average higher critical thinking result of 84.86 compared to the critical thinking results of students taught using the conventional learning model of 63.67, so that in achieving the results of critical thinking skills, students in the experimental group are superior to students in the control group. Before conducting hypothesis testing, it is necessary to test the prerequisites of data analysis which includes normality test, homogeneity test, and linearity test. This test was carried out using SPSS. The statistical test used for the normality test is the *Kolmogorov-Smirnov* test which has criteria if the significance value or probability is> 0.05 then the data distribution is said to be normal. Data normality produces a significance value of more than 0.05 as shown in Table 4. This means that the data on the results of critical thinking skills are normally distributed. The results of the Critical Thinking Data Normality Test are presented in Table 2.

Table 2. Critical Thinking Data Normality Test Results

	Data Category	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Hasil Kemampuan Berpikir Kritis	A1	0.155	21	0.200	0.965	21	0.627
	A2	0.198	12	0.200	0.917	12	0.260

Then the statistical levene test was carried out to determine the results of the homogeneity of variance test resulting in a significance value of more than 0.05 as in Table 3. These results indicate that the results of critical thinking skills with the treatment applied are homogeneous.

Table 3. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Hasil Kemampuan Berpikir Kritis	Based on Mean	3.801	1	31	0.060
	Based on Median	3.452	1	31	0.073
	Based on Median and with adjusted df	3.452	1	26.800	0.074
	Based on trimmed mean	4.090	1	31	0.052

Then the linearity test was conducted to test the relationship between variables. Two variables are said to have a linear relationship if the significance of *deviation from linearity* > 0.05. The linearity test results show a significance value of more than 0.05 as in Table 4.

Table 4. Linearity Test Results

	Data Category	Sum of Squares	df	Mean Square	F	Sig.
Deviation from linearity	A1	67.024	8	8.378	0.655	0.720
	A2	93.254	5	18.651	1.590	0.312

Based on the results of the normality, homogeneity, and linearity tests of students' critical thinking skills above, it can be said that the requirements for hypothesis testing with the paired sample t-test and one way anova test can be met. Thus, hypothesis testing is continued using the paired sample t-test and one way anova test whose results are presented in Table 5, and Table 6.

Table 5. Paired T-test Results

		Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Paired Sample Test	Pretest eksperimen-Postest Eksperimen	-14.190	9.506	2.074	-6.841	20	0.000
	Pretest Kontrol-Postest Kontrol	-7.333	5.069	1.463	-5.011	11	0.000

Table 6. Anova Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7255.368	3	2418.456	20.743	0.000
Within Groups	7228.571	62	116.590		
Total	**14483.939**	**65**			

Based on the paired t-test test results, the significance value is less than 0.05 (0.00 <0.05) so that there is an influence between the independent variable and the dependent variable. Then, the anova test results have a significance value of less than 0.05 (0.00 <0.05), so it can be said that there is a significant difference for each variable. Thus, based on the results of hypothesis testing using the paired t-test and anova test that have been carried out, the results show that there is a significant difference in the results of critical thinking skills of students taught using the *problem-based learning* model assisted by *quizizz* with students taught using the conventional model. So, it can be concluded that H_0 is rejected and H_1 is accepted, that is, there is an effect of applying the *Problem-based learning* (PBL) model assisted by *quizizz* on the critical thinking skills of students in class IV elementary schools in Dewi Sartika Gugus Pati Regency.

Discussion

Based on the analysis that has been done, it is known that there is a significant difference in critical thinking skills between students who learn through the *problem-based learning* model assisted by *quizizz* than students who learn through conventional learning models. This is due to several factors, namely as follows. First, the *problem-based learning* model assisted by *quizizz* can improve critical thinking skills in students. Learning mathematics related to fraction material that focuses on contextual problems will improve students' critical thinking skills in the process of making decisions from discussions related to solutions to solve problems. Giving evaluation questions by involving the use of *quizizz* media with *paper mode* features can also stimulate and improve students' thinking skills (Sitorus & Santoso, 2022; Wahyuillahi et al., 2021). Penggunaan teknologi seperti *quizizz paper mode* yang memiliki fitur-fitur interaktif memungkinka The use of technology such as *quizizz paper mode* which has interactive features allows students to be actively involved in learning (Pavita & Nirmala, 2021; Yulianto et al., 2020). These interactive features such as engaging questions, instant responses, and interactive answer selection, so that learners can be directly involved in the learning process (Yulistiarawati et al., 2021; Zuhriyah & Pratolo, 2020). In this way, learners can achieve better performance through fun, real-world activities and optimize their potential.

Second, the *problem-based learning* model assisted by *quizizz* can facilitate students in learning. The use of *problem-based learning* models makes it easy for students to stimulate material in everyday life. This model features real problems that occur in everyday life that are integrated into the learning *syntax* (Mertasari & Ganing, 2021; Rahmat et al., 2020).The problem-based learning process can improve students' critical thinking skills because the presentation of problems is contextual so that student learning activities can be more meaningful (Yuni & Haninda Bharata, 2020; Yunita et al., 2020). *Quizizz-based* learning media used in the evaluation process of students is also able to improve critical thinking skills, because students are stimulated to answer questions spontaneously and can see evaluation results directly so as to further increase the spirit of competition in answering questions. Providing problems in a real context as the first step of the learning process will have an influence on improving learning outcomes for the better (Yulistiarawati et al., 2021; Zuhriyah & Pratolo, 2020). Learning that focuses on contextual problems like this will improve students' critical thinking skills (Mustofa & Hidayah, 2020; Pramitha & Wahjudi, 2020; Tamam & Subrata, 2022). With this learning process, each learner will exchange opinions and thoughts so that it will be easier to understand the material. Thus, learning objectives can be achieved properly, and will improve students' critical thinking skills.

Third, the *problem-based learning* model assisted by *quizizz* can increase student learning motivation. During the learning process using the *problem-based learning* model , each student who is

divided into several groups will gradually try to solve the problem (Mertasari & Ganing, 2021; Nisaa & Heynoek, 2021). This is because each syntax in the *problem-based learning* model is interconnected and stimulates each student to discuss together to solve the given problem. The activity causes mutual exchange of ideas and with the facilitator by the teacher, each learner will better understand the material being taugh. Student activities in the *Problem-based learning* model can motivate students because they are trained to think critically, analyze, and improve higher-order thinking skills. The learning process with the PBL model begins with a problem raised by students or teachers (Pramana et al., 2020; Rahmawati et al., 2020). The teacher introduces the problem situation then guides to investigate the problem presented. Furthermore, learners actively think to solve problems. Learners also work with their groups to solve the problems presented. Furthermore, the learning stage ends with the presentation and analysis of the results of students' work. Thus learners learn to solve problems in a systematic and planned manner (Yuni & Haninda Bharata, 2020; Yunita et al., 2020).

Previous research findings also reveal that through the *Problem-based learning* model, students not only listen, but actively think, communicate, search and process data, and conclude problem solving so that it can improve student learning outcomes (Desyawati et al., 2021; Ramli et al., 2021). Other research also explains that the main purpose of the *Problem-based learning* model is not the delivery of a large amount of knowledge to students, but rather the development of thinking skills and problem solving skills and developing students' ability to build their own knowledge (Davidsen et al., 2019; Primadewi & Agustika, 2022). In addition, the use of *quizizz* media can increase student learning motivation (Setiyani et al., 2020; Ully & Dewi, 2022). By integrating math problems in this *problem-based learning* model, it will stimulate students to be more active and discuss together in solving the problems given. The use of *quizizz* media features *paper mode* can also improve learning outcomes from the student learning evaluation process that has been integrated into the critical thinking ability grid. The learning evaluation process with the help of *quizizz* can speed up the teacher in providing remedial, because every question that has been answered by students will be recorded by the system in the form of right and wrong and automatically calculate the final score. The *paper mode* feature will increase student interaction and engagement in the learning process. This makes the enthusiasm of students increase because they feel competitive with other friends and want to get the highest score. The implication of this research is that the application of *problem-based learning* models along with *quizizz* media can help and facilitate students in learning so that it can improve critical thinking skills in students. The *problem-based learning* model assisted by *quizizz* media features *paper mode* effectively used to improve students' critical thinking skills.

4. CONCLUSION

The results of data analysis show that there is a significant difference in the results of critical thinking skills of students taught using the *problem-based learning* model assisted by *quizizz* with students taught using conventional models. The results of the analysis revealed that there was an effect of applying the *Problem-based learning* (PBL) model assisted by *quizizz* on students critical thinking skills. It is concluded that the *Problem-based learning* (PBL) model assisted by *quizizz* can improve the critical thinking skills of students in class IV elementary schools in Dewi Sartika Gugus Pati Regency.

5. REFERENCES

Amerstorfer, C. M., & Freiin von Münster-Kistner, C. (2021). Student Perceptions of Academic Engagement and Student-Teacher Relationships in Problem-Based Learning. *Frontiers in Psychology*, *12*(October), 1–18. https://doi.org/10.3389/fpsyg.2021.713057.

Anggreni, Jayanta, & Mahadewi. (2021). Multimedia Interaktif Berorientasi Model Problem Based Learning (PBL) Pada Muatan IPA. *Jurnal Mimbar Ilmu*, *26*(2). https://doi.org/10.23887/mi.v26i2.35715.

Arianti, N. M., Wiarta, I. W., & Darsana, I. W. (2019). Pengaruh Model Pembelajaran Problem Posing Berbantuan Media Semi Konkret terhadap Kompetensi Pengetahuan Matematika. *Jurnal Ilmiah Sekolah Dasar*. https://doi.org/10.23887/jisd.v3i4.21765.

Asta Jaya, I. K. M. (2021). Peran Guru Ips Meningkatkan Kemampuan Berpikir Kritis Siswa Melalui Metode Pembelajaran Inkuiri. *Sang Acharya : Jurnal Profesi Guru*, *2*(1), 22. https://doi.org/10.25078/sa.v2i1.3235.

Dariyah, N. (2020). Meta analisis model pembelajaran problem based learning dalam meningkatkan hasil belajar matematika. *Jurnal Ilmiah Pendidikan Profesi Guru*, *3*(1), 152–158. https://doi.org/10.23887/jippg.v3i1.27973.

Davidsen, J., Andersen, P. V. K., & Christiansen, E. (2019). Problem-based Learning in a Box: Lessons learned from an Educational Design Experiment. *Journal of Problem Based Learning in Higher Education*,

7(1), 120–132. https://doi.org/10.5278/ojs.jpblhe.v7i1.2375.
Desyawati, K., Maria Goreti Rini Kristiantari, & I Gusti Agung Oka Negara. (2021). Media Permainan Monopoli Berbasis Problem Based Learning Pada Pembelajaran Tematik di Sekolah Dasar. *Jurnal Penelitian dan Pengembangan Pendidikan*, *5*(2), 168–174. https://doi.org/10.23887/jppp.v5i2.32466.
Faidar, I., Sakdiyah, & Azis, A. (2023). Pengembangan Modul Elektronik Sejarah Berbasis Problem Based Learning (PBL) untuk Siswa Kelas XII di SMA Labschool. *Riwayat: Educational Journal of History and Humanities*, *6*(4), 3071–3090. https://doi.org/10.24815/jr.v6i4.36595.
Fauziah, R., & Hadi, M. S. (2023). Analisis efektivitas dan manfaat quizizz paper mode dalam pembelajaran interaktif di kelas III SDN singabraja 02. *JIMPS: Jurnal Ilmiah Mahasiswa Pendidikan Sejarah*, *8*(3), 2721–2730. https://doi.org/10.24815/jimps.v8i3.26049.
Fitriani, W., Suwarjo, S., & Wangid, M. N. (2021). Berpikir Kritis dan Komputasi: Analisis Kebutuhan Media Pembelajaran di Sekolah Dasar. *Jurnal Pendidikan Sains Indonesia*, *9*(2), 234–242. https://doi.org/10.24815/jpsi.v9i2.19040.
Islami, M., & Soekamto, H. (2022). Efektivitas model pembelajaran inquiry menggunakan quizizz multimedia berbasis gamification terhadap kemampuan berpikir kritis siswa. *Jurnal ilmiah pendidikan profesi guru*, *5*(2), 383–392. https://doi.org/10.23887/jippg.v5i2.48338.
Kurniasih, P. D., Nugroho, A., & Hermianto, S. (2020). Peningkatan Higher Order Thinking Skill (HOTS) dan Kerjasama Antar Peserta Didik Melalui Model Pembelajaran Problem Based Learning (PBL) dengan Media Kokami di Kelas IV SD Negeri Dukuhwaluh. *Attadib Journal of Elementary Education*, *4*(1). https://doi.org/10.32507/attadib.v4i1.627.
Kurniati, A., Oktaviani, U. D., & Thomas, J. (2022). Digitalisasi Dongeng Nusantara Sebagai Alternatif Media Pembelajaran Era Digital Di Tingkat Sekolah Dasar. *jurnal Pendidikan Dasar Perkhasa*, *8*(2), 173–181. https://doi.org/10.31932/jpdp.v8i2.1964.
Lesi, A. N., & Nuraeni, R. (2021). Perbedaan Kemampuan Pemecahan Masalah Matematis dan Self-Confidence Siswa antara Model TPS dan PBL. *Jurnal Pendidikan Matematika*, *1*, 249–262. https://doi.org/10.31980/plusminus.v1i2.1260.
Lider, G. (2022). Penerapan model pembelajaran problem based learning berbantuan aplikasi quizizz untuk meningkatkan prestasi belajar matematika siswa kelas VI semester I SD Negeri 5 Sangsit. *Indonesian Journal of Educational Development*, *3*(1), 189–198. https://doi.org/10.5281/zenodo.6575177.
Mashuri, D. K., & Budiyono. (2020). Pengembangan Media Pembelajaran Video Animasi Materi Volume Bangun Ruang untuk SD Kelas V. *JPGSD: Jurnal Pendidikan Guru Sekolah Dasar*, *8*(5), 893–903.
Masitoh, L. F., & Prasetyawan, E. (2020). The effectiveness of scientific approach with open-ended problem based learning worksheet viewed from learning achievement, creative thinking ability, interest, and mathematics self-efficacy. *Daya Matematis: Jurnal Inovasi Pendidikan Matematika*, *7*(3), 292. https://doi.org/10.26858/jds.v7i3.11874.
Megantari, K. A., Margunayasa, I. G., & Agustina, A. G. T. (2021). Belajar Sumber Daya Alam Melalui Media Komik Digital. *Jurnal Jurusan Pendidikan Guru Sekolah Dasar*, *9*(1), 140. https://doi.org/10.23887/jjpgsd.v9i1.34251.
Mertasari, P. S., & Ganing, N. N. (2021). Pengembangan Media Pembelajaran Powtoon Berbasis Problem Based Learning Pada Materi Ekosistem Muatan Ipa Kelas V Sekolah Dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, *10*, 288–298. https://doi.org/10.23887/jippg.v4i2.
Munir, M. (2020). Strategi Guru Dalam Problem Based Learning Untuk Meningkatkan Penalaran Matematika Siswa. *De Fermat : Jurnal Pendidikan Matematika*, *2*(2), 103–108. https://doi.org/10.36277/defermat.v2i2.51.
Mustofa, R. F., & Hidayah, Y. R. (2020). The effect of problem-based learning on lateral thinking skills. *International Journal of Instruction*, *13*(1), 463–474. https://doi.org/10.29333/iji.2020.13130a.
Nisaa, Y. T. A., & Heynoek, F. P. (2021). Pengembangan perangkat pembelajaran berbasis problem based learning materi gerak lokomotor di sekolah dasar Kabupaten Blitar. *Gelanggang Pendidikan Jasmani Indonesia*, *5*(1), 98–107. https://doi.org/10.17977/um040v5i1p98-107.
Pavita, M. D. A., & Nirmala, D. N. (2021). Merdeka Belajar In Pandemic: Using Quizizz Game Based Learning To Improve Students' Vocabulary Mastery. *Language Literacy: Journal of Linguistics, Literature, and Language Teaching*, *5*(1). https://doi.org/10.30743/ll.v5i1.3842.
Pinandhita, S. W., & Nurjannah, I. (2023). Pengaruh model PBL terhadap hasil belajar pada mata pelajaran PKKR kelas XI TKR di SMKN 1 Jabon. *Journal of Vocational and Technical Education*, *5*(2), 125–133. https://doi.org/10.26740/jvte.v5n2.p125-133.
Pinatih, S. A. C., Putra, D. B. K., & Semara, N. (2021). Pengembangan Media Komik Digital Berbasis Pendekatan Saintifik pada Muatan IPA. *Jurnal Penelitian dan Pengembangan Pendidikan*, *5*(1), 115–

121. https://doi.org/10.23887/jppp.v5i1.32279.
Prabaningrum, & Putra. (2019). Pengaruh Model Pembelajaran Kooperatif Team Assisted Individualization Berbantuan Media Semi Konkret Terhadap Kompetensi Pengetahuan Matematika. *Jurnal Ilmiah Sekolah Dasar*, *3*(4), 414. https://doi.org/10.23887/jisd.v3i4.21775.
Pramana, M. W. A., Jampel, & Pudjawan, K. (2020). Meningkatkan Hasil Belajar Biologi Melalui E-Modul Berbasis Problem Based Learning. *Jurnal Edutech Undiksha*, *8*(2), 17. https://doi.org/10.23887/jeu.v8i2.28921.
Pramitha, D. A., & Wahjudi, E. (2020). Penerapan Model Pembelajaran Problem Based Learning Untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Pendidikan Ekonomi Undiksha*, *12*(2), 216–224. https://doi.org/10.61798/get.v1i2.43.
Primadewi, A., & Agustika, S. (2022). Video Animasi Berorientasi Problem-Based Learning untuk Meningkatkan Motivasi Belajar Matematika Siswa Kelas IV SD. *Jurnal Edutech Undiksha*, *10*(1), 167–177. https://doi.org//10.23887/jeu.v10i1.46477.
Putri, Y. E., & Prihatnani, E. (2020). Perbandingan PBL Dan DL Terhadap Pemahaman Konseptual Siswa Kelas XI Ditinjau Dari Motivasi Belajar. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(1). https://doi.org/10.31004/cendekia.v4i1.154.
Rahmat, M. R., Arip, A., & Nur, S. (2020). Implementation of Problem- Based Learning Model Assisted by E-Modules on Students' Critical Thinking Ability. *Indonesian of Educational Journal*, *9*(3). https://doi.org/10.23887/jpi-undiksha.v9i3.22410.
Rahmatika, H., Lestari, S. R., & Sari, M. S. (2020). A PBL-Based Circulatory System E-Module Based on Research Result to Improve Students' Critical Thinking Skills and Cognitive Learning Outcome. *JPI (Jurnal Pendidikan Indonesia)*, *9*(4), 565–575. https://doi.org/10.1063/5.0043319.
Rahmawati, D. U., Jumadi, & Ramadan, E. M. (2020). Developing Physics Learning Tools of Blended Learning Using Schoology with Problem-Based Learning Model. *Jurnal Penelitian Dan Pengembangan Pendidikan Fisika*, *6*(2), 139–152. https://doi.org/10.21009/1.06201.
Ramli, Z., Sunaryo, & Serevina, V. (2021). E-book static fluid and dynamic fluid web-based with a problem-based learning model to improve students physics problem-solving skills. *Journal of Physics: Conference Series*, *2019*(1). https://doi.org/10.1088/1742-6596/2019/1/012001.
Safithri, R., Syaiful, S., & Huda, N. (2021). Pengaruh Penerapan Problem Based Learning (PBL) dan Project Based Learning (PjBL) Terhadap Kemampuan Pemecahan Masalah Berdasarkan Self Efficacy Siswa. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(1), 335–346. https://doi.org/10.31004/cendekia.v5i1.539.
Seibert, S. A. (2021). Problem-based learning: A strategy to foster generation Z's critical thinking and perseverance. *Teaching and Learning in Nursing*, *16*(1). https://doi.org/10.1016/j.teln.2020.09.002.
Setiyani, S., Fitriyani, N., & Sagita, L. (2020). Improving student's mathematical problem solving skills through Quizizz. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *5*(3), 276–288. https://doi.org/10.23917/jramathedu.v5i3.10696.
Sitorus, D. S., & Santoso, T. N. B. (2022). Pemanfaatan Quizizz Sebagai Media Pembelajaran Berbasis Game Pada Masa Pandemi Covid-19. *Scholaria: Jurnal Pendidikan dan Kebudayaan*, *12*(2), 81–88. https://doi.org/10.24246/j.js.2022.v12.i2.p81-88.
Sugiharti, S., Joharman, J., & Suhartono, S. (2020). Pengaruh Model Pembelajaran Problem Based Learning dan Ekspositori terhadap Kemampuan Berpikir Kritis dalam Pembelajaran IPS tentang Keragaman Budaya pada Siswa Kelas IV SD Negeri se-Kecamatan Kutowinangun. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, *8*(3). https://doi.org/10.20961/jkc.v8i3.43711.
Suryawati, E., Suzanti, F., Zulfarina, Putriana, A. R., & Febrianti, L. (2020). The implementation of local environmental problem-based learning student worksheets to strengthen environmental literacy. *Jurnal Pendidikan IPA Indonesia*, *9*(2), 169–178. https://doi.org/10.15294/jpii.v9i2.22892.
Tamam, A., & Subrata, H. (2022). Penerapan Model Problem Based Learning (PBL) Terhadap Literasi Sains Pada Siswa Sekolah Dasar: Literatur Review. *Jurnal Ilmiah Mandala Education*, *8*(4), 3035–3040. https://doi.org/10.58258/jime.v8i4.4092.
Trevallion, D., & Nischang, L. C. (2021). The Creativity Revolution and 21 st Century Learning. *International Journal of Innovation, Creativity and Change*, *15*(8), 1–25.
Ully, S. A., & Dewi, I. P. (2022). Pengaruh Game-Based Learning Menggunakan Aplikasi Quizizz Terhadap Hasil Belajar. *Voteteknika (Vocational Teknik Elektronika dan Informatika)*, *10*(4), 79. https://doi.org/10.24036/voteteknika.v10i4.120039.
Wahyuillahi, N. I., Nawawi, I., & Mahanani, P. (2021). Penggunaan Aplikasi Quizizz Sebagai Metode Evaluasi dalam Pembelajaran Daring terhadap Hasil Belajar pada Muatan PKn Kelas V SD. *Jurnal Pembelajaran, Bimbingan, dan Pengelolaan Pendidikan*, *1*(7), 597–604.

https://doi.org/10.17977/um065v1i72021p597-604.

Wibawa, R. P., Astuti, R. I., & Pangestu, B. A. (2019). Smartphone-Based Application "quizizz" as a Learning Media. *Dinamika Pendidikan*, *14*(2), 244–253. https://doi.org/10.15294/dp.v14i2.23359.

Wijaya, S. N., Johari, A., & Wicaksana, E. J. (2020). Pengembangan Media Pembelajaran Komik Digital Berbasis Karakter Hero Indonesia pada Materi Sistem Peredaran Darah. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, *4*, 67–78. https://doi.org/10.32502/dikbio.v4i2.2582.

Yulianto, I., Warsono, W., Nasution, N., & Rendy A.P, D. B. (2020). The Effect of Learning Model STAD (Student Team Achievement Division) Assisted by Media Quizizz on Motivation and Learning Outcomes in Class XI Indonesian History Subjects at SMA Trimurti Surabaya. *International Journal for Educational and Vocational Studies*, *2*(11), 923–927. https://doi.org/10.29103/ijevs.v2i11.2746.

Yulistiarawati, D. N., Umayaroh, S., & Linguistika, Y. (2021). Analisis Minat Belajar Siswa dalam Penggunaan Aplikasi Belajar Quizizz pada Pembelajaran Tematik Kelas III Sekolah Dasar. *Jurnal Pembelajaran, Bimbingan, dan Pengelolaan Pendidikan*, *1*(7), 573–584. https://doi.org/10.17977/um065v1i72021p573-584.

Yuni, S., & Haninda Bharata, C. (2020). Pengaruh Model Problem Based Learning Terhadap Kemampuan Komunikasi Matematis Siswa. *Jurnal Pendidikan Matematika Universitas Lampung*, *8*(3), 182–192. https://doi.org/10.23960/mtk/v8i2.pp182-192.

Yunita, Y., Juandi, D., Tamur, M., Adem, A. M. G., & Pereira, J. (2020). A meta-analysis of the effects of problem-based learning on students' creative thinking in mathematics. *Beta: Jurnal Tadris Matematika*, *13*(2), 104–116. https://doi.org/10.20414/betajtm.v13i2.380.

Yunus, C. C. A., & Hua, T. K. (2021). Exploring a Gamified Learning Tool in the ESL Classroom: The Case of Quizizz. *Journal of Education and e-Learning Research*, *8*(1), 103–108.

Zuhriyah, S., & Pratolo, B. W. (2020). Exploring Students' Views in the Use of Quizizz as an Assessment Tool in English as a Foreign Language (EFL) Class. *Universal Journal of Educational Research*, *8*(11). https://doi.org/10.13189/ujer.2020.081132.