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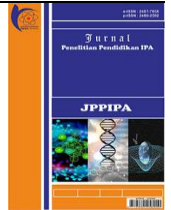
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# Effectiveness of a Problem-Based Learning Model with Quizizz Learning Media on Science Learning Outcomes

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**Abstract:** This study was motivated by the low learning outcomes of grade 5th students at Elementary School 14 Sragen in science subjects due to suboptimal learning. The purpose of this study was to test the effectiveness of the Problem-Based Learning learning model with Quizizz media on the science learning outcomes of fifth grade students of Elementary School 14 Sragen. This type of research is experimental research with a quasi-experimental research design. The research method used is Quasi-experimental design, research sampling involves two study groups of grade V students, namely the experimental class and the control class, with a total of 17 students each. The data analysis method was carried out by applying a paired sample t-test to test the hypothesis and N-gain test to assess the effectiveness of the learning model. The results showed that PBL with Quizizz media was declared effective based on the paired sample t-test with a result of 0.000, which means that there is an average difference in student science learning outcomes between the problem-based learning model with Quizizz media and the STAD model. The experimental class N-gain test results were higher than the control class  $79.2532 > 53.8574$  effective criteria. Based on the results of the study, it shows that the application of the Problem-Based Learning learning model with Quizizz media can improve student learning outcomes and more effectively improve student science learning outcomes.

**Keywords:** Learning outcomes; Problem-based learning; Quizizz media; Science

## Introduction

The progress of a nation is influenced by education. Education plays an important role in developing the potential to create the next generation of the nation with good quality. According to the 1945 Constitution, Article 1 paragraph 1, education is a conscious effort to prepare students through guidance, teaching, and/or training activities for their future roles.

Intelligence and develop various student skills, such as thinking skills, creativity, the ability to build knowledge, problem-solving skills, and the ability to manage material well (Syahputra, 2018). The above skills are skills that need to be developed in the 21st century. The 21st century is characterized by the development of digital information. Digital development is now so advanced that teachers are not the only source of

information for learning. Therefore, teachers act as facilitators, motivators, and inspirers for their students (Syahputra, 2018). However, being learning-centered and placing students as active learners can develop students' potential (Eka & Fajriah, 2019). With this in mind, teachers must be able to innovate in terms of designing strategies, models, and methods that are able to facilitate students being more creative, supported by the use of technology in learning.

Science learning in schools is expected to help students play an active role and learn about themselves and the natural world so that they can be applied in everyday life. The teacher is one of the important factors in determining the success or failure of a lesson. The teacher, acting as a facilitator, must use scientific steps so that students can understand science correctly. Supported by the opinion of Ariandi (2016), the learning

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model that can be used to improve problem-solving skills is problem-based learning. This model helps students apply their understanding of a concept by first being given a problem at the beginning of learning to be discussed and solved together. This model also focuses on student activeness in solving problems (Andriyani & Suniasih, 2021; Winoto & Prasetyo, 2020).

Based on initial observations at Elementary School 14 Sragen, during learning, some fifth grade students are still afraid to ask the teacher, wait for the teacher's explanation, are used to learning first by example, have difficulty remembering the material learned at the previous meeting, and only discuss with certain friends. In addition, the teacher still uses a conventional model. The learning media used are still the blackboard and books. Students in the classroom are not given direct space to talk to each other, causing some students to be passive in groups. Most students are only active individually and not in groups to understand the science concepts conveyed by the teacher. In fact, being active in groups is very important to develop 4C skills. This results in students tending to get bored more easily and have low learning outcomes in science subjects.

For the problems described above, the authors tried to conduct research by applying the PBL learning model using Quizizz media. The use of learning models and media can also help teachers in delivering material and packaging the material presented as interesting as possible so that students do not get bored quickly, and using diverse and interesting media can make students understand learning material in accordance with the expected goals. The learning model and media were chosen because it is expected that students can learn together, increase their own learning, and be responsible, so that learning is more meaningful.

In this study, learning media were also used, namely Quizizz media. Media is a tool used by the teacher to convey a message or material so that students can better understand the content or message of the lesson. The use of learning media for elementary school students is very appropriate because it is in accordance with child development. The presence of media is very helpful in delivering material to students as a concrete object (Afiah et al., 2021). Quizizz is a game-based learning application that brings multiplayer capabilities into the classroom, making practice more interactive and fun (Jothy et al., 2002). Quizizz is an online learning application that consists of quizzes, surveys, games, and discussion features. Besides that, this application contains learning materials full of interactive questions on different subjects and levels, as well as subjects and other material content created by the teacher himself (Mawaddah et al., 2021).

Several studies have stated that the use of Quizizz learning media can improve student learning outcomes.

This is based on previous research conducted by (Annisa & Erwin, 2021), which shows that using the Quizizz application increases student activeness because there are text, images, and game-based quiz exercises that are displayed attractively, thus making students excited and motivated, which increases science learning outcomes. Furthermore, according to research from (Mawaddah et al., 2021), the use of Quizizz learning media in the learning process of mathematics subjects can increase student learning motivation and improve learning outcomes. (Yolanda & Meilana's, 2021) shows that learning using the Quizizz application also has a positive impact on student interest in science learning.

Based on the background of this problem, this study aims to test whether the application of the problem-based learning model with Quizizz media can improve learning outcomes compared to the STAD model for grade 5th students at Elementary School 14 Sragen.

## Method

The type of research used is quantitative research. According to (Nasser, 2021), quantitative research emphasizes the analysis of numerical data processed by statistical methods. This research design uses a nonequivalent pretest-post-test control group design, where the first group is treated (the experimental group) with the PBL model assisted by Quizizz media while the second class uses the STAD model. Before the research began, both classes were given an initial test (pre-test) and a final test (post-test). A pre-test is done to find out the initial knowledge of the material to be taught. post-test to determine the knowledge mastered by students after the learning process.

Variables are behaviors or characteristics that give different values to something, such as objects, humans, and others. The variables in this study are divided into independent variables and dependent variables. Independent variables are variables that cause changes or the emergence of dependent variables (Hidayat, 2014). The independent variables in this study consist of the problem-based learning model and Quizizz learning media. Meanwhile, the dependent variable is the variable that is affected by or becomes the result of the independent variable (Hidayat, 2014). The dependent variable in this study is learning outcomes.

The population of this study were all 5th grade students at Sragen Elementary School. The sampling technique was random sampling. The random groups selected as research samples were grades 5A and 5B in the 2023–2024 school year. The data collection techniques used in this study include tests, observation, and documentation. According to Zuriah (Fiantika et al.,

2020), observation is the systematic observation and recording of symptoms that appear in the object of research. According to Satori (Fiantika et al., 2020). So, in qualitative research, observation is understood as direct observation of objects to find out the truth, situation, conditions, context, space, and their meaning in an effort to collect data for a study.

The test used in this study was a multiple-choice test. Observation is done to observe students during the learning process. Documentation is used to collect data on the names of students who will be sampled in the study and aims to obtain data on daily test scores from previous materials. This documentation is also in the form of photographs that show the learning activities of students. According to Creswell (Ardiansyah et al., 2023), documentation involves collecting data from documents, archives, or other written materials related to the research phenomenon.

This study uses an instrument in the form of a learning outcome test displayed in the form of a Quizizz educational game, which of course has been validated and declared valid. According to Colongesi (Wulan, 2016), tests are one of the planned measurement efforts used by teachers to create opportunities for students to show their achievements related to predetermined goals. According to Guhlin (Aini, 2019), Quizizz is an application for creating multiplayer quizzes whose assessments can be made by others and can be given in class or as homework. Meanwhile, according to Utomo (2020), Quizizz is an online web tool for creating interactive quizzes that are used in class. Previous question instruments have been tested for validity, reliability, difficulty, and question differentiation.

Data analysis used prerequisite tests and hypothesis tests. Prerequisite tests were carried out with normality tests and homogeneity tests. Then the hypothesis test is in the form of a paired sample. T test to determine student learning outcomes before and after being treated, then an independent t test to determine the average difference between the two samples. Finally, the N-Gain test is used to determine the effectiveness of a treatment.

## Result and Discussion

Learning is an activity carried out intentionally or unintentionally by everyone, so that changes occur from not knowing to knowing, from not being able to walk to being able to walk, from not being able to read to being able to read, and the like (Wahab & Rosnawati, 2021). According to Dimiyati (Simanjuntak, 2019), learning is essentially a change that occurs in a person after the end of "learning activities.". Learning is a process carried out by individuals to obtain a new change in behavior as a

whole as a result of the individual's own experience in interaction with the environment (Siregar & Widyaningrum, 2015).

A model is defined as a conceptual framework used as a guideline or reference in carrying out an activity (Tibahary & Maulina, 2018). According to Kemp (Sulisto & Haryanti, 2022), the learning model is learning that must be done by teachers and students so that learning objectives can be achieved effectively and efficiently.

A learning model is a plan or pattern used as a guide for planning classroom learning (Djalal, 2017). Meanwhile, Yusuf et al. (2019) explain that the learning model is a set of strategies based on a certain theoretical and research basis, which includes background, learning procedures, support systems, and learning evaluations aimed at teachers and students to achieve certain measurable learning objectives.

This problem-based learning model is centered on students by confronting them with various problems faced in real life, and students try to solve these problems (Meilasari et al., 2020). The purpose of the problem-based learning (PBL) model is to help students become more active students and always think critically when solving the problems they face in learning (Nofziarni et al., 2019). In line with Hosnan (Farisi et al., 2017), the main purpose of the PBL model is the development of critical thinking and problem-solving skills, as well as the ability of students to actively build their own knowledge. Project-based learning is designed for use with complex problems. Complex problems that require learners to investigate and understand (Listiani & Purwanto, 2018; Munawaroh et al., 2012).

Assessment of learning outcomes is measured using a multiple-choice test totaling 20 questions. The following pretest calculation results for the control class and experimental class can be seen in Table 1.

**Table 1.** Control and experimental class pretest scores

Criteria	Pretest Score	
	Control Class	Experimental Class
Highest Score	70	75
Lowest Score	20	30

While below are the results of posttest calculations for the control class and experimental class, they can be seen in Table 2.

**Table 2.** Posttest scores of control and experimental class

Criteria	Posttest Score	
	Control Class	Experimental Class
Highest Score	85	100
Lowest Score	65	55

With the highest ideal score of 100 and the lowest ideal score of 0. A comparison of the magnitude of the

increase in the control class with the experiment can be seen in Figure 1.

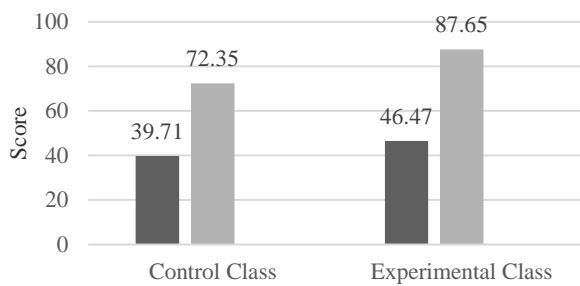


Figure 1. Improvement in Student Learning Outcomes

Figure 1 shows a comparison of the improvement in student learning outcomes between the control class using the STAD model and the experimental class using the problem-based learning model with Quizizz media. These results are known to increase the control class by 32.64 and the experimental class by 41.18; thus, it can be said that the increase in learning outcomes of the experimental class is higher than that of the control class.

The data from the research results needs to be tested before further statistical tests are carried out. The prerequisite tests referred to in this study are the normality test and the homogeneity test. This is done so that the statistical test used is appropriate.

Table 4. PBL Homogeneity Test with Quizizz

Students Learning Outcomes		Levene Statistic			Sig.
		Statistic	df1	df2	
Based on Mean	Based on Mean	.000	1	32	1.000
	Based on Median	.000	1	32	1.000
	Based on Median and with adjusted df	.000	1	32.000	1.000
	Based on trimmed mean	.001	1	32	.978

Based on the output above, it is known that the significance value (Sig.) is  $1.000 > 0.05$ , so it can be concluded that the variance of the experimental class posttest data and the control class posttest is the same or homogeneous.

Hypothesis Test

Hypothesis test is carried out after the prerequisite test. The results of the prerequisite test for the normality test of pretest and posttest data for the control class and experimental class show that the data is normally distributed. The prerequisite test for the homogeneity test of the pretest and posttest data of the control class and the experimental class shows homogeneous data. The prerequisite test results are a reference for determining the hypothesis test used.

Normality test

The normality test is carried out to determine whether the sample under study is normally distributed or not. This normality test uses Shapiro-Wilk because the sample size of this study is less than 50. The provisions in the data normality test are that if the significant value  $> 0.05$ , it means that the data is normally distributed, but if the significance value  $< 0.05$ , it means that the data is not normally distributed. The calculation results are as follows:

Table 3. PBL Normality Test with Quizizz

	Statistic	Df	Shapiro-Wilk
			Sig.
Pretest Eksperimen	.922	17	.158
Posttest Eksperimen	.903	17	.076
Pretest Kontrol	.928	17	.200
Posttest Kontrol	.928	17	.198

Result of all data calculations show that all data have a normal distribution.

Homogeneity test

The homogeneity test in this study was used to determine whether the variance of the experimental class posttest data (PBL with Quizizz) and the control class posttest data (STAD) was homogeneous or not. The following is the processing of the homogeneity test of the posttest scores of the experimental class and control class with SPSS 23:

Students Learning Outcomes		Levene Statistic			Sig.
		Statistic	df1	df2	
Based on Mean	Based on Mean	.000	1	32	1.000
	Based on Median	.000	1	32	1.000
	Based on Median and with adjusted df	.000	1	32.000	1.000
	Based on trimmed mean	.001	1	32	.978

Paired Sample T Test

The experimental class pretest-posttest test used the parametric statistical test Paired Sample T Test. The Paired Sample T Test test was conducted to determine whether the learning outcomes of the group of students who participated in PBL learning assisted by multimedia learning were higher than the learning outcomes before treatment. The hypothesis in the posttest-pretest test is as follows:

Table 5. Result of Pretest-Posttest Test in Experimental Class

Data	Mean	t table	t count	df	Sig. (1-tailed)
Posttest	87.65	1.740	18.646	16	0.000
Pretest	46.47				

The results of these calculations indicate that for the group of students who participated in PBL learning with

Quizizz media, the learning outcomes after treatment were higher than the learning outcomes before treatment.

**Table 6.** Control Class Pretest-Posttest Test Result

Data	Mean	t tabel	t hitung	df	Sig. (1-tailed)
Posttest	72.35	1.740	12.333	16	0.000
Pretest	39.71				

The results of these calculations indicate that for the group of students who followed STAD learning, the learning outcomes after treatment were higher than the learning outcomes before treatment.

*Independent Sample T Test*

The independent sample t test is used to determine whether there is a difference in the average of two unpaired samples. The independent sample t test in this study was used to determine whether there were differences in student science learning outcomes between the PBL model with quiz media and the STAD model. The following is the processing of the independent sample t test on the experimental class posttest data and control class posttest data with SPSS 23:

**Table 4.7.** Control Class Pretest-Posttest Test Result

	Class	Sig.
Pretest & Posttest	Control	0.000
Pretest & Posttest	Experiment	0.000

Based on the output above and the sig. (2-tailed) of 0.000 < 0.05, it can be concluded that there is a difference in the average student science learning outcomes between the problem-based learning model with Quizizz media and the STAD model.

*N-Gain Score Test*

The N-Gain test is used to determine the effectiveness of a treatment based on the expected results.

**Table 8.** Result of The N-Gain Test

	Class	Mean
Pretest & Posttest	Control	79.2532
Pretest & Posttest	Experiment	53.8574

**Table 9.** Effectiveness Interpretation Category:

Percentage (%)	Interpretation
< 40	Ineffective
40-55	Less Effective
56-75	Effective Enough
> 76	Effective

The results of the gain test in the experimental class averaged a pretest of 46.47 while the posttest value was 87.65, so a gain of 79.2532 was obtained, meaning that

the increase in learning outcomes for the experimental class was in the effective category. As for the control class, the average for the pretest was 39.71 and the posttest was 72.35, so a gain of 53.8574 was obtained, which means that the increase in learning outcomes for the control class is in the less effective category.

Based on this research, using application media to facilitate the learning process takes place in the PBL model with Quizizz application media at Elementary School 14 Sragen. Quizizz application media that has features such as illustrated questions, sound questions, and many other features so that students are happy to answer questions and learn.

The application of the problem-based learning model (PBL) with Quizizz media makes students more active and responsive, which affects student learning outcomes and understanding of the material of the digestive system in humans. Based on the problem-based learning model (PBL) in accordance with the objectives of the 2013 curriculum science learning process, the use of problem-based learning models has a positive impact on the learning atmosphere; students become active and responsive to problems in teaching and learning activities at Elementary School Negeri 14 Sragen.

Learning using the PBL model with Quizizz media is more effective than using the STAD method because there are also several advantages that exist in the Quizizz application. According to Damayanti and Mulyadi (Safitri & Madiun, 2023), learning media through the PBL model assisted by the Quizizz application aims to increase students' understanding of learning material and encourage students to use critical thinking when answering questions. As supported by (Hafid and Mayasari, 2023) that the Quizizz application is different from other educational applications because it has game characteristics such as memes, avatars, themes, and entertaining music in the learning process. In addition, the Quizizz application also allows students to be motivated to learn and compete with each other so that students' learning outcomes can increase.

**Conclusion**

Based on the results of data analysis and discussion, it can be concluded that the application of a problem-based learning model with Quizizz media is more effective in improving the science learning outcomes of fifth grade students in Elementary School 14 Sragen compared to the STAD learning model.

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#### Author Contributions

Denis Novitasari conceptualized the research idea, research methods, data analysis, acquisition of funds, and management and responsibility for the planning and implementation of research activities. Isa Ansori and Arif Widagdo guided, supervised, and validated the instruments in the research.

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#### Conflicts of Interest

The authors declare no conflict of interest. In the data published in this article, whether in data collection, data analysis, data interpretation, in writing the manuscript, or in the decision to publish the research results, there is no conflict of interest with any party.

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