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Effectiveness of Gamification Problem Based Learning on the Topic of Physical and Chemicsl Change on the Improvement of Student Results of MTs Nurul Islam

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Abstract:
This study aims to determine the effectiveness of the use of Problem-based learning (PBL) model based on wordwall on the topic of physical and chemical changes to improve the learning outcomes of students of class VII B MTs Nurul Islam. Learners are able to analyze problems that occur in everyday events, because science is side by side with surrounding life. Through PBL students can hone and improve critical thinking skills. The use of wordwall as a learning media in this study makes students more active in learning. Learning in the classroom becomes interactive and the interaction between teachers and students is well developed. Data in this study were obtained from pre-test and post-test scores. This research uses a quantitative approach method using paired t-test and N-gain test. The paired t-test sample test was used to determine any changes in the implementation of research using the wordwall-based PBL learning model. To determine the effectiveness of the learning model, the N-gain test was used. From the results of the paired t-test analysis, it is known that the Sig. (2-tailed) of 0.000 which is smaller than the significance level of 0.05. These results indicate a change in the form of an increase in learning outcomes. It can be concluded that this research is in accordance with the formulation of the hypothesis. The N-gain test was 59.09% and categorized as quite effective. So the use of problem-based learning method is considered effective in this study.

Keywords: *Problem Based Learning, Wordwall, Physical and Chemical Changes.*

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Introduction

Learning is a process in education that consists of teachers as educators and students as students. Educators in learning activities not only transfer knowledge materials, teachers also play a role in developing various abilities that students need to have. Learners, especially in the 21st century, need to have basic skills including the ability to think critically, the ability to construct knowledge, creativity, and problem solving skills (Rohman, 2022). The rapid development of technology and information is a sign of the digital era, especially in the 21st century. The development of technology and information makes it easier for educators to deliver learning materials. In this era, educators must have high creativity in delivering learning topics. The delivery of material that is carried out in a concise and interesting manner makes it easy for students to understand. In addition, students become more active in learning. Learners are encouraged to be active in learning, so they need to have learning skills and innovate with the help of technology.

21st century learning emphasizes basic abilities, including creative thinking, critical thinking, communicative, and collaborative. The ability is prepared so that students are able to compete in this digital revolution era. one that needs to be instilled is the ability to think critically. During the rapid development of the world in various aspects of life requires the next generation of the nation to have more open and creative thinking. There are various kinds of information spread on the internet and all of them are not always true. Critical and logical thinking skills need to be trained so that students do not easily accept information spread on the internet. Because technological developments also have a negative influence on learning. Indirectly, the development of technology can affect the behavior and ethics of a person who tends to be inappropriate with the local culture. The use of technology such as games, playing social media, and so on if not limited can interfere with students' learning time. These less useful activities can indirectly reduce the motivation of students in learning (Muhasim, 2017).

Teachers need to pay attention to the process of students in learning. Boring learning can affect learning motivation (Rahman, 2021). Homework for teachers is to implement learning that is interesting and fun. Learning media can be a tool to achieve learning objectives. Conventional learning tends to be teacher-centered so that students are less active when the learning process is carried out. Students are not accustomed to thinking or solving problems that are in accordance with the topics studied. As a result, students have difficulty when faced with simple problems in everyday life. Teachers should prepare lessons that can help students improve basic skills, such as critical thinking. Critical thinking is the ability to understand problems, connect information, and use cognitive strategies to increase the probability of achievement. Learning that can train critical thinking skills is the problem-based learning approach, cooperative group investigation, and inquiry learning (Aditya, 2020). The low level of thinking of students' understanding of science learning is partly due to the learning process that is less interesting and boring. It can be seen that students dislike science lessons because there is too much memorization and concepts that need to be understood. Teachers who teach only using the lecture method make students easily bored. Learning experiences like this are what causes students' low understanding of science material and when faced with real-life problems, students have not been able to handle logically.

Conventional learning tends to be teacher-centered so that students are less active when the learning process is carried out. Learners are not accustomed to thinking or solving problems that are in accordance with the topics studied. As a result, students have difficulty when faced with simple problems in everyday life. Teachers should

prepare learning that can help students improve basic skills. By applying an interesting learning model. One of the interesting and renewable learning models is the problem-based learning model. This learning model is expected to be able to improve basic skills such as critical thinking and is expected to increase learning motivation in students. Compared to conventional learning, learning with the latest models can be a breakthrough for more interactive learning (Prihadi & Endarto, 2014).

The right learning model can improve the ability to think critically about the subjects they learn and also affect learning outcomes. Problem-based learning (PBL) is learning that emphasizes the process of solving problems faced scientifically. Problem-based teaching is expected to improve concept understanding on the topic being discussed, because students learn to solve problems independently (Rio Candra, 2013). The characteristics of the Problem Based Learning model according to Tan involve several aspects, including: (1) utilization of problems as the starting point of learning; (2) presentation of problems in the context of the real world and dynamic situations; (3) emphasizing diverse perspectives in problem solving; (4) encouraging learners to engage in learning in new and challenging domains; (5) placing great emphasis on independent learning; (6) using various sources of knowledge from various sources, not just one; and (7) emphasizing collaboration, communication, and cooperation in the learning process. These features encourage students to develop higher-order thinking skills, particularly in the context of problem-solving ability. (Sirait et al., 2022).

The application of the problem-based learning model can improve students' understanding of physical and chemical changes. Physical and chemical changes are closely related to daily events or events. through problem-based learning, students are able to analyze the problems around them, so that their level of understanding of the material increases. In this learning not only the understanding of the material obtained by students. Learners get meaningful learning, are able to solve problems, hone critical thinking skills, and also work collaboratively with their groupmates.

Learning media has many advantages in the teaching and learning process, including: learning media can increase student motivation and learning outcomes, time and energy efficiency, learning becomes more interactive and effective, and learning media can promote students. positive attitude towards material and process (Nurjanah et al., 2023). There are many types of technology-based learning media. One type of technology-based learning media is wordwall. Wordwall is one of the educational games whose application is easily done independently by students. An attractive wordwall display can increase the spirit of learning. Students who are enthusiastic will easily understand the concept of the material explained by the teacher. Wordwall is used as a learning assessment media containing quizzes and interesting games, there are also teacher creations that can be used as an illustration of new users to start creating (Pamungkas et al., 2021).

Based on the results of observations of researchers before conducting research, it is known that the science learning outcomes in class VII B MTs Nurul Islam are less than optimal. Of the total VII B class students totaling 19 students, only 10 completed the KKM. The results are not optimal because the motivation of students in studying science tends to be low. This shows that science learning has not been maximized so that students get bored quickly in the learning process. One of the causes is learning that is less interesting and usually teacher-centered. The lack of teacher attention to the understanding and abilities of students will be serious if not addressed immediately.

The purpose of this research is to determine the effectiveness of the Problem-based learning or PBL model based on gamification on student learning outcomes on

the topic of physical and chemical changes in class VII B MTs Nurul Islam. From the results that have been obtained, it is hoped that the PBL learning model can improve students' critical thinking in solving problems. The reason for using wordwall in this study is that the application is very easy to use, there are various interesting quiz features, besides that this application is used as a medium for evaluating student learning outcomes. It is expected that students are able to understand the topics presented so that it will affect learning outcomes and can increase their learning motivation.

Methods

This research was conducted on September 20, 2023 at MTs Nurul Islam Kota Kediri and addressed to students of class VII B. This research uses quantitative methods. The hypothesis of this research is as follows:

With reference to the context of the problem that has been described, the authors can state the hypothesis of Classroom Action Research as follows: If you apply a Wordwall-based learning model with a problem-based learning approach, it is expected that there will be an increase in understanding of science material in class VII B students at MTs Nurul Islam. To test the statistical hypothesis, it is necessary to know.

$$H_0 : \mu_1 \geq \mu_2 \ atau \ \mu_1 - \mu_2 \geq 0 \ atau \ \mu_d \geq 0$$

$$H_1 : \mu_1 < \mu_2 \ atau \ \mu_1 - \mu_2 < 0 \ atau \ \mu_d < 0$$

Description: μ1 value before, μ2 value after, H_0 there is no increase and H_1 there is an increase.

Data collection was carried out through two methods, namely observation and tests. Observations were made by researchers during the learning process to determine the individual attitudes of students. Data obtained from observation techniques in the form of subjective descriptions by researchers. While the data collection technique in the form of a test is in the form of pretest and post-test results which are used to measure whether there is an increase in student learning outcomes in the cognitive aspect. The data analysis technique begins by reviewing the data that has been collected from observations, and pre-test and post-test scores. The pre-test and post-test scores were then tested using the paired t-test sample test to determine the success of the hypothesis that had been made previously. The paired sample t-test test has a requirement that the data owned by the subject is interval or ratio data. Both groups of paired data are normally distributed. In this study, data was obtained in the form of intervals so that a normality test was needed to determine the feasibility of using the paired t-test sample test. In addition to the paired sample t-test, the N-gain test is needed to determine the effectiveness of learning in this study.

Normality test is said to be normally distributed if the significance> 0.05. The hypothesis analysis test carried out uses a significance value of 5% with a confidence level of 95%. The paired t-test sample test is needed to determine whether there is an increase in learning outcomes during this study. This study can be said to be successful if the t statistic value is significant.

Results and Discussion

Learners need effective learning to help develop their thinking power without ignoring the level of understanding of students. Providing as many learning opportunities as possible to students is applied with the aim that students are able to understand the material being studied. The application of these methods can be one

way to achieve effective learning (Rohmawati, 2018). Effective learning is also influenced by the harmony between learning models, learning methods, and learning media with the topic of discussion. Among the three factors in its application, there must be a match between one factor and another (Mahyudi, 2023). Problem solving skills need to be trained early before facing more complex problems as an adult. In learning, it is necessary to insert things that can be used to train how to solve problems. There are learning models that aim to train and develop problem-solving skills in order to stimulate higher-order thinking. It is important to maintain a conducive, open, negotiable and democratic learning atmosphere.

This learning model is known as problem-based learning or PBL. In problem-based learning (PBL), students engage in real-world problem solving related to a specific learning topic. Through these tasks, students investigate the problem based on prior knowledge and experience, resulting in new knowledge and experience (Zaid, 2014). The implementation of Problem Based Learning involves a series of steps that have been organized by the teacher, including: (1) Including guidance to learners in recognizing the problem; (2) Directing learners in the learning stages; (3) Providing direction for investigation, both individually and in groups; (4) Encouraging the development and presentation of work; (5) Analyzing and evaluating the problem-solving process. The application of this problem-based learning model has advantages and disadvantages in practice. The advantages of implementing a problem-based learning model are: improving student learning. By solving problems, it is considered more fun and students like it, students acquire new information through self-learning and by solving problems students can improve critical thinking and apply knowledge in the real world. Among these advantages there are also weaknesses in the application of problem-based learning models, for example students lack of interest and problems are difficult to solve, do not want to try, long time to prepare for solving a problem, if students do not want to understand the problems they learn then they will not understand what they learn.

One method that is in accordance with the PBL learning model is the discussion method. The discussion method is one of the methods used in solving problems together which is done in a group way that exchanges ideas, argues in solving problems so that it can expand knowledge and horizons of thought. The discussion method is used for learning that focuses on discussion and problem solving by exchanging opinions, ideas and exchanging ideas in a group of students to make and reach a conclusion. The discussion method can train critical thinking in students in solving a problem, train courage to express opinions during the discussion process and students can have an attitude of tolerance between group friends. The weakness of the discussion method is the limited information that students will get, discussion learning usually tends to be dominated by students who like to talk. To minimize the weaknesses of the discussion method is by motivating students in carrying out group discussions, good time management, giving awards to groups that are successful in discussions so that students can be more active in learning (Khsanah, 2020).

Currently, technological development is developing very rapidly into several fields of life, one of which is in the field of education. In the field of education, technology functions as a learning medium to deliver messages in the form of knowledge to students. Forms of technology used as learning media such as projectors, gadgets, computers, laptops, and so on. In addition, technology-based learning media can also be in the form of online learning websites, such as ruang guru, zenius, quiz, google classroom, wordwall, and many websites that can be utilized as learning media.

There are various types of learning media including audiovisual, audiovisual and multimedia. In this research, multimedia is used as learning media. Multimedia is all types of media grouped together. For example, the Internet means the application of all existing media, including distance learning. One example of learning media in the form of multimedia is the wordwall used in this study (Fanny Mestyana Putri, 2020).

Wordwall as an educational game has advantages in the application of learning. Here are the advantages of using wordwall in learning:

1) Encourage the growth of students' thinking skills and sensitivity.

2) Creating an interesting, creative and innovative play atmosphere.

3) Improves students' logic and understanding.

4) Two-way interactive educational media.

5) Uses assessment guidelines and student skills

In accordance with the advantages of wordwall, learning can be achieved effectively. In addition, wordwall can be used as a tool for assessment at the end of learning in the form of interesting games. Educational games such as wordwall are able to create effective learning that involves teacher interaction with students.

Action planning is carried out by researchers to compile several instruments needed in research. Namely the action of PBL learning with discussion methods and with the help of wordwall in delivering material on physical changes and chemical changes. The hope is that the application of the PBL learning model can provide support to students in understanding the concept of the material being studied. Thus, students can experience more meaningful learning, not only limited to answering questions but also understanding the concept of material that has been learned. In addition, learning is carried out in discussion, by discussing it is hoped that students will be able to exchange ideas with a group of friends about solving the problem at hand. The media used in this study is to use the wordwall application to measure students' understanding after going through a series of lessons. Researchers prepare several questions that will be displayed on the wordwall application. Learning tools and instruments that are prepared include: Independent Curriculum Teaching Modules, Learner Worksheets (LKPD), pre-test questions, post-test questions, and observation sheets for group activities.

The application of learner-centered learning has proven successful in increasing enthusiasm for learning and learning outcomes. The application of learning models that are up-to-date and relevant to the material is better received by students, so that learning objectives can be achieved effectively. One example of a learner-centered learning model is problem-based learning. This learner-centered learning approach provides a deeper meaning in the learning process because learners become the center of the process by themselves understanding the topic being studied. Problem-based learning also sharpens students' critical thinking in solving problems that exist in everyday life. The application of this problem-based learning model is accompanied by a discussion learning method. With discussion, students can share knowledge, solve problems together, argue with each other, and build cohesiveness in one group. In one series of learning processes, learning objectives can be achieved effectively. This is the advantage of applying the problem-based learning model. However, in learning, the factor that needs to be considered by educators is not only increasing learning outcomes which are the main focus of teachers in teaching, but teachers also need to

pay attention to the attitudes and skills of students. The disadvantage of applying this model is that there are some students who are less capable in discussing, thus making the discussion group not run actively.

The application of wordwall-based learning media is very easy and can be used anytime and anywhere. The ease of accessing this wordwall makes students gain new knowledge anywhere. In addition, the appearance and features of wordwall are very interesting and diverse, so that the enthusiasm for learning increases. Today's learners prefer technology-based learning media rather than conventional. In research (Pratama, 2017) it is proven that the application of technology-based learning is very attractive to students, especially teenagers. This wordwall application is used to evaluate learning outcomes. The post-test as a benchmark for learning through wordwall media makes students able to know the extent of their understanding of the material studied. Fun learning evaluation using wordwall makes students excited and motivated to learn even harder. The disadvantage of using wordwall as a learning media is that it requires a strong and stable network.

It can be seen that before this research was conducted, the interest in learning class VII B MTs Nurul Islam was very low. This is due to the lack of teacher knowledge of the latest interesting learning models. Interesting learning makes students' enthusiasm for learning increase. After this research, the enthusiasm for learning class VII B MTs Nurul Islam increased, which was marked by an increase in learning outcomes.

Table 1. Descriptive of Pretest Result

	Pretest Score
N	19
Min	40
Max	70
Mean	50,0
Std.D	10,0

Pretest value data is obtained before the implementation of learning activities. This pre-test activity is to determine students' understanding of the material to be studied. The results obtained are the minimum or lowest value of 40 and the maximum or highest value of 70. From these results, the average value is 50.0 and the standard deviation is 10.0.

Table 2. Description of Posttest Result

	Posttest Score
N	19
Min	70
Max	90
Mean	79,74
Std.D	5,886

Post-test data were obtained after learning using the wordwall-based PBL model. Based on the table above, it is known that the post-test results with a minimum value of 70, a maximum value of 90 with an average of 79.74 and a standard deviation of 5.886.

Table 3. Results of the Normality Test

Class	Statistic	df	Sig.
Pretest	0,157	19	0,200
Posttest	0,166	19	0,2

Based on the results of the normality test, it is known that the Sig. pre-test value is ,200 and the Sig. post-test value is ,176. Both data Sig. values in the Kolmograv-Smirnov test significance value (p-value) > 0.05, so the decision accepts H0 (normally distributed data).

Table 4. Paired Samples t-Test

	Mean	N	Std. Dev	Sig.
Pretest	50,00	19	10,000	0,200
Posttest	79,74	19	34	0,200

Table 5. Paired Samples Test

	Mean	t	df	Sig. (2-tailed)
Pretest - Posttest	-29,731	-15,721	18	0,000

The Paired Sample t-Test is used to compare the means of two samples. The pre-test and post-test results are known to show an increase from the pre-test value of 50.00 and the post-test value of 79.74. Based on the analysis of two related values (pre-test and post-test), it can be seen that the significance value (p-value) ,000 <0.05, which means reject H0. From the results obtained, there is sufficient evidence to state that there is a significant difference or improvement between the pre-test and post-test results. It can be concluded that there is an increase in learning outcomes using the wordwall-based problem-based learning model.

The application of the wordwall-based Problem-based learning (PBL) learning model in this study showed success. Overall the value of students has exceeded the minimum KKM of 80% of all students in class VII B MTs Nurul Islam. In learning outcomes, the comparison of pre-test and post-test scores looks very significant. This learning model can affect the improvement of learning outcomes in the research sample class. This research can be said to be successful if there is an increase in learning outcomes after learning using the wordwall-based problem-based learning model. Based on the paired t test, the results of the significance value <0.05 mean that rejecting H0 and accepting H1 in the sense that this study is proven to have increased the learning outcomes of students in class VII B MTs Nurul Islam on the material of physical and chemical changes. The N-gain test shows the effectiveness of the application of the learning model in this study. From the results of the N-gain test analysis, the results obtained were 50.09% and categorized as quite effective. It can be concluded that the

application of the wordwall-based problem-based learning model to the material of physical and chemical changes is quite effective and can be used as a reference material for similar studies.

Conclusion

Teacher responsibility involves improving learning outcomes and concept understanding in the learning process. One of the efforts that teachers can take is to change the learning process to make it more interesting and interactive. The selection of learning models, methods, and media that are appropriate to the topic can create effective learning, with the aim of learning not only focusing on the final score, but also on the process. The application of the Wordwall-based Problem Based Learning model on the material of physical and chemical changes shows an increase in learning outcomes that are considered effective, as evidenced in the paired t-test and N-gain test. Significant results at sig. values greater than 0.05 indicate an increase in learning outcomes, while the N-gain test shows good effectiveness. In addition, the use of this learning model can also develop students' critical thinking skills, which is reflected in their attitude in solving problems given by the teacher. Learners are able to complete the tasks on the worksheet well, and can overcome the pre-test and post-test competently.

Based on the above conclusions, the researcher provides suggestions in accordance with the results of the study. Learners as the next generation of the nation should have a high spirit in learning. Curiosity must be possessed by each individual to hone the way of thinking which will be very useful in the future. It is not only the final score that must be considered by students but the process of learning also needs to be considered. Students' understanding of the material studied is very important, because natural science is interconnected. Nowadays it is not difficult to access various knowledge through digital applications. The hope is that students use digital media wisely and intelligently.

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