



The Effectiveness of Real Problem-Based e-LKPD to Improve Problem Solving and Collaboration Abilities on Environmental Change Material in Madrasah Aliyah

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Abstract

LKPD is a form of teaching material that is part of the learning tool. LKPD can experience innovation along with developments in terms of presentation that can be integrated with electronic media or a technology known as e-LKPD. Schools still don't use e-LKPD and learning resources only use textbooks. This study aims to analyze the effectiveness of e-LKPD based on real problems to improve students' problem solving and collaboration abilities on environmental change material at Madrasah Aliyah. Data collection in this study was carried out by tests and observations. The type of this research was Quasi Experiment Design which was carried out at MA Negeri 2 Pati with the research population being class X at MA Negeri 2 Pati, the samples for this research were classes X2, X4, X6, and X9. Sampling was done by purposive sampling technique. Learning outcomes based on classical completeness scores, the percentage of students who passed was 83.33% in the experimental class and 26.67% in the control class. The Independent Sample t-Test shows that the problem solving ability is obtained by Sig 0.000 < 0.05, meaning that there is an average difference between the posttest scores of the experimental class and the control class. The N-Gain test results for the experimental class obtained a value of 0.60 in the medium category and 0.29 in the control class in the low category. The results of the experimental class collaboration ability at each meeting increased and the value was higher than the control class. From the results of the study, it was concluded that problem-based e-LKPD was real effective for increasing students' problem-solving and collaboration abilities on Environmental Change material at Madrasah Aliyah.

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INTRODUCTION

Developments in the field of science and technology which are increasing rapidly in the 21st century are becoming new challenges in the world of education. Currently, students and educators are asked to master various kinds of technology, skills, and other knowledge to maintain balance in their environment. Digital technology influences learning so it is important to design learning by utilizing digital technology. There needs to be innovation to follow the development of digital technology in the learning process. LKPD is a form of teaching material that is part of the learning tools. LKPD can experience innovation along with developments in terms of presentation which can be integrated with electronic media or technology known as e-LKPD. e-LKPD can be used as one of the innovations in learning and has advantages over conventional learning. In addition, e-LKPD can be an interesting tool when students' interest in learning decreases (Suryaningsih & Nurlita, 2021). e-LKPD can be accessed easily using a PC/laptop or smartphone.

A conducive and pleasant learning atmosphere for students is something that must be considered by the teacher so that learning objectives can be achieved properly. Teaching material with a real problem-based approach or real problems that exist around students so that students can practice problem solving ability and make activities a learning tool. Many methods can be used with the help of various kinds of media as learning resources to hone students' problem solving and to make it easier for students to fully understand the material. Problem solving abilities or problem solving is the ability to think as an effort to find a problem and solve it based on information collected from various sources so that an appropriate conclusion can be drawn (Argusni & Sylvia, 2019). Students' problem solving abilities need to be assessed to determine how prepared they are to face 21st-century problems (Melawati et al., 2022). In learning, problem solving abilities are also very important because they allow students to find solutions to the problems they face. In addition, understanding the problem to find a solution that is given as input, output, and process is also important (Malik et al., 2022). Problem solving can be done individually or in groups. In groups, of course, students can practice collaboration ability. Collaboration can make students work together, reach mutual agreements, and get the best results in solving problems (Kholifah et al., 2022). Collaboration can be done utilizing group discussions by providing opportunities for students to think, argue, argue, and also issue ideas. The teacher's task is to coordinate how the discussion process can run well. Students can develop ways of thinking and their minds will be wide open by collaborating while listening to some views and new ideas from other friends (Wulandari et al., 2021).

Environmental Change Material has characteristics related to the environment in everyday life, students will be faced with Biological problems that occur in the surrounding environment (Azaly, 2022). Real problem-based learning is characterized by the existence of real problems as a context for students to learn to solve problems and gain knowledge. Students will be more active in building their knowledge from facts that come from the surrounding environment. Students can see the relationship between everyday life and the material being studied, students will be more interested in the learning that takes place. Teaching material that are related to real problems are carried out by presenting learning material by making the problem a starting point for discussion to be analyzed to find solutions to problems in biology learning, especially in the subject of Environmental Change. The use of e-LKPD is expected to improve students' problem solving and collaboration abilities. Teaching material in the form of e-LKPD can be linked to real problems in the environment around students, one of which is the real problem learning approach.

Based on interviews with Biology teachers at MA Negeri 2 Pati which were conducted previously, it was found that Biology lessons at MA Negeri 2 Pati had not used teaching material in the form of e-LKPD. In addition, students' classical completeness on Environmental Change material in the previous year had not been fulfilled, which was 60%. This can be caused because the teaching material used, namely in the form of textbooks, is poorly understood by students. Therefore, other teaching material is needed to suit the needs of students such as teaching material that can be accessed anytime, anywhere, and also keep abreast of technological developments. Learning in the independent curriculum on environmental change material based on real problems using e-LKPD can train students' problem solving ability. Problem solving can be done individually or in groups. The existence of Electronic Student Worksheets (e-LKPD) is a source of student learning in the learning process. LKPD learning tools are needed as an alternative to overcoming problems in a lesson. The ability of problem solving, and collaboration of Madrasah Aliyah students is still relatively low.

Based on the description above, it is necessary to have a real problem-based e-LKPD as a teaching material that aims to improve problem solving and collaboration abilities in learning Biology on Environmental Change material at Madrasah Aliyah.

METHOD

The research was conducted at MA Negeri 2 Pati in even semesters from March-May 2023. The research method used was Quasi Experiment Design. This type of research design has a control group and an experimental group that is not randomly selected. The sample in this study was four classes at MA Negeri 2 Pati consisting of classes X2, X4, X6, and X9. Class X2 and X9 as the experimental class while class X6 and X4 as the control class. The sampling technique used was purposive sampling. The determination of the sample was chosen based on the consideration of the ability of the same students. In the experimental class, learning was given teaching material in the form of real problem-based e-LKPD while in the control class learning was carried out without providing real problem-based e-LKPD teaching material. The independent variable in this study is the use of real problem-based e-LKPD on Environmental Change material. The dependent variable in this study is the effectiveness of real problem-based e-LKPD in improving problem solving and collaboration abilities on Environmental Change material. The controlled variable in this study is the researcher as the teacher in the class, learning models in the form of PBL (Problem Based Learning), discussion methods, and the number of students. Data collection techniques in this study were interviews, test instruments in the form of pretest and posttest, observation, and documentation. Interviews were conducted to find out the problems and potential underlying the research. The test instruments in this study were carried out to analyze the value of classical completeness, the Independent Sample t-Test, and the N-Gain Test to determine the effectiveness of e-LKPD real problems to improving problem solving abilities. Observations in this study were carried out to analyze the increase in collaboration ability by using a comparison of the increase in each meeting between the experimental class and the control class. Documentation in this study was carried out by taking pictures of every research activity in class.

RESULTS AND DISCUSSION

This section presents the results and discussion of problem solving and collaboration abilities.

Problem Solving Ability

Classical Mastery

Measuring the increase in problem solving abilities in this study can be seen from the results of students' posttest scores between the experimental class and the control class in the material on Environmental Change. The Minimum Completeness Criteria Biology score at MA Negeri 2 Pati is ≥ 70 . The percentage of students who complete the experimental and control classes can be seen in Figure 1.

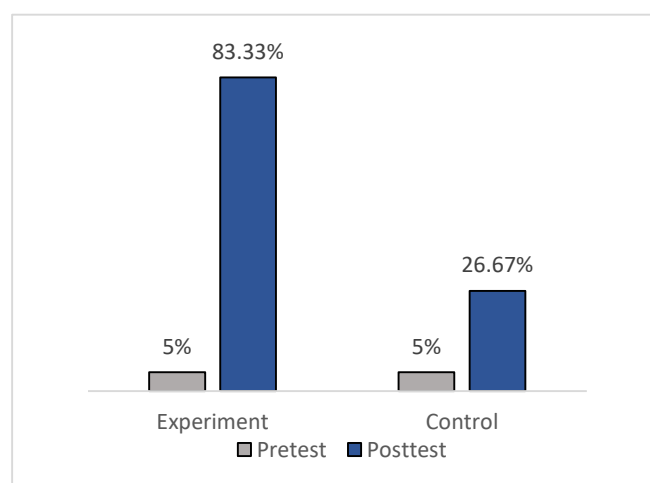


Figure 1 Percentage of Completed Students in Experimental and Control Classes

The results of the percentage comparison in Figure 1 show that the abilities of students in the experimental and control classes are the same as can be seen with the results of the percentage of students who passed the pretest. The percentage of the number of students who complete the posttest results from the experimental class is higher than the control class. Based on the results of the percentage comparison, it can be concluded that the use of real problem-based e-LKPD can improve students' problem solving abilities in the Environmental Change material. In the experimental class, 50 students completed and 10 others did not complete. There are inhibiting factors that affect the problem solving abilities of 10 students who do not complete. Several factors that influence learning outcomes are internal and external (Gulo, 2022). Internal factors come from the students themselves in the form of low interest, motivation, and cognitive ability. External factors come from outside the students themselves in the form of the school environment, family, and community. Judging from the learning process, incomplete students tend to be more silent in the discussion process when compared to other friends who are active in discussions.

Problem-based learning can train students to be more active in solving problems and experiencing the benefits of learning because the problems solved are related to everyday life, and make participants able to accept the opinions of others (Kusumawati et al., 2022). Problem-based learning has the goal of helping students develop thinking skills and solve problems (Saputra, 2021). The problem-based learning approach emphasizes the activeness of students in finding information, solving problems, and also exploring their ideas (Nurlatifah et al., 2022). Problem-based learning uses real-world problems (real problems) as a context for learning about problem solving students and acquiring essential knowledge and concepts from the material being studied (Misidawati & Sundari, 2021).

Average Difference Test

To find out the effectiveness of real problem-based e-LKPD, can be seen by conducting an average difference test with the t-test. The next effectiveness test is to do an average difference test using the t-test. Prerequisites for the t-test must be met first, including the data to be tested must be normally distributed and homogeneous. The t-test was carried out to find out whether there was an effect of real problem-based e-LKPD on the problem solving abilities of Pati 2 Public High School students. The t-test in this study used the Independent Sample t-Test. The Independent Sample t-Test test is used to analyze the mean difference between two samples that are not related and do not affect each other. Calculation of the t-test between the experimental and control classes was carried out with the help of SPSS 26 software. The results of the t-test can be seen in Table 1.

Table 1. Independent Sample t-Test Results

| Independent Samples Test | | | | | |
|---------------------------------|------|------|-------|---------|-----------------|
| | F | Sig. | t | df | Sig. (2-Tailed) |
| Equal variances assumed | .005 | .941 | 9.732 | 118 | .000 |
| Equal variances not assumed | | | 9.732 | 117.880 | .000 |

Table 1 shows the Sig. (2-tailed) or the level of error obtained is 0.000 or <0.05 so it can be concluded that there is a difference in the average posttest scores between the experimental class (using real problem-based e-LKPD) and control (without using real-based e-LKPD problem). The results of the analysis in Table 4.1 show that the use of real problem-based e-LKPD on Environmental Change material can improve students' problem solving abilities.

Test N-Gain

The N-Gain test was carried out to analyze how effective the real problem-based e-LKPD is in improving problem solving in Environmental Change material. Based on the N-Gain test, the analysis results are obtained in Table 2.

Table 2. Results of the N Gain Score Test and the N Gain Percentage Test

| Class | N-gain | N-gain (%) |
|--------------|---------------|-------------------|
| Experiment | 0.60 | 60.151 |
| Control | 0.29 | 29.180 |

Table 3. Real Problem-Based e-LKPD Effectiveness Criteria for Problem Solving Ability

| N-Gain Score | Criteria |
|------------------------|----------|
| $(g) \geq 0.70$ | High |
| $0.30 \leq (g) < 0.70$ | Medium |
| $(g) < 0.30$ | Low |

Table 2 shows that the N-Gain Score value in the experimental class is higher than the control class. Based on the effectiveness criteria in table 3 shows that the N-Gain experimental class is included in the medium criteria while the control class is included in the low criteria. The results of the N-Gain test show that the use of real problem-based e-LKPD on Environmental Change material can improve students' problem solving abilities.

Based on the results of measuring problem solving abilities between the experimental class and the control class using classical completeness scores, the average difference test, and the N-Gain Test, it can be concluded that real problem-based e-LKPD is effective for improving students' problem solving abilities in Environmental Change material in Senior High School.

Collaborative Ability

Students will have the ability to mobilize and provide energy for other people to form a common goal to solve problems through discussion activities. Problem-based learning can train students to be more active in solving problems and feel the benefits of learning because the problems solved are related to everyday life, and make participants able to accept the opinions of others. The discussion method can train collaboration ability so that they can overcome obstacles and obstacles that cannot be handled alone. Obstacles that encourage collaboration in the form of limited knowledge or availability of supporting physical resources. Collaboration ability has an important role to be developed by students because collaboration ability is key in achieving an effective learning process and is needed in education and the world of work. This study, in addition to measuring problem solving abilities, also measured the collaboration abilities of Madrasah Aliyah students, which can be seen by observing in class. Indicators of collaboration ability are as follows: 1) contribute actively, 2) work productively, 3) be responsible, 4) show flexibility, and 5) show respect (Greenstein, 2012). Observations were made during the discussion process, both in the experimental class using real problem-based e-LKPD and in the control class on Environmental Change material and were carried out three times. The recapitulation of the observations of students' collaboration abilities at each meeting can be seen in Figures 2, 3, and 4.

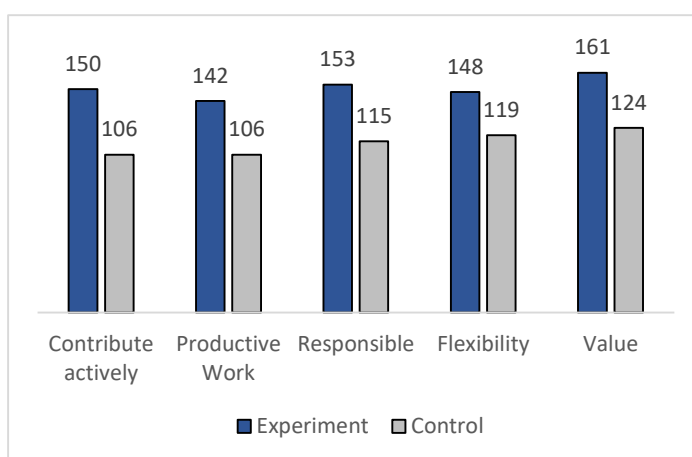


Figure 2. Recapitulation of Collaborative Ability of First Meeting Students

Figure 2 shows that the collaboration ability of first meeting students in the experimental class is higher when compared to the control class in each indicator.

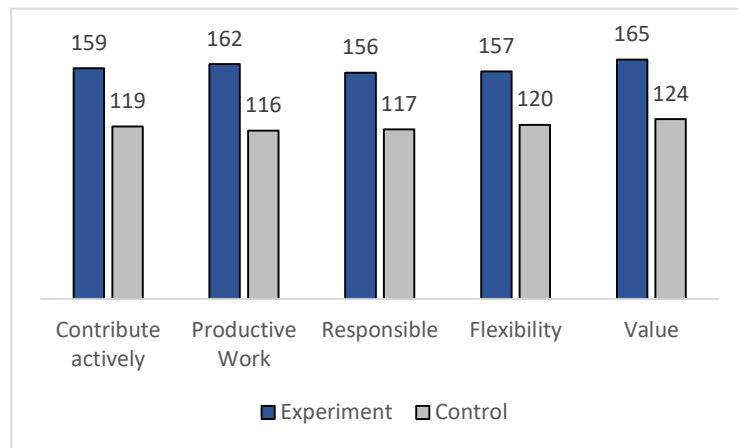


Figure 3. Recapitulation of Collaborative Ability of Second Meeting Students

Figure 3 shows that the collaboration ability of second-meeting students in the experimental class is higher when compared to the control class in each indicator. Each indicator in the experimental class is higher than the first meeting and can be said to have increased. In the control class, there is one indicator whose data is the same from the first meeting or does not increase, namely the value indicator.

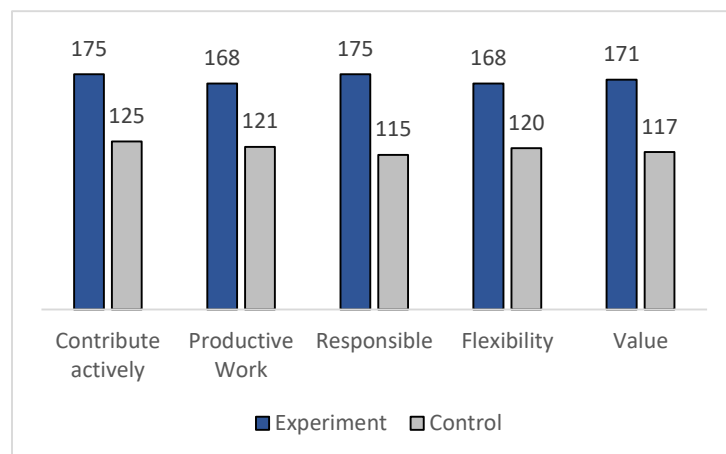


Figure 4. Recapitulation of Collaborative Ability of Third Meeting Students

Figure 4 shows that the collaboration ability of third-meeting students in the experimental class is higher when compared to the control class in each indicator. The experimental class experienced an increase in each indicator from the first to the third meeting, while the control class had an indicator whose data were the same as the second meeting or did not increase, namely the flexibility indicator. In addition, in the control class, there are also indicators whose data has decreased, namely indicators of responsibility and respect.

Based on the recapitulation of collaboration ability data at each meeting, it was concluded that the collaboration ability of students in the experimental class from the first to the third meeting was always higher when compared to the control class. Each indicator in the experimental class has increased while in the control class, there are indicators whose data have not increased, and some have decreased. The results of the analysis of the experimental class' collaboration abilities can be seen in Table 4.

Table 4. Results of Experimental Class Collaboration Ability Analysis

| Percentage Range | Criteria | Number of Students | | |
|------------------|-----------|--------------------|-----------|-----------|
| | | Meeting 1 | Meeting 2 | Meeting 3 |
| 76-100% | Very Good | 3 | 10 | 11 |
| 51-75% | Good | 47 | 44 | 47 |
| 26-50% | Less Good | 10 | 6 | 2 |
| 0-25% | Not Good | 0 | 0 | 0 |

In Table 4 results of the analysis of the collaborative abilities of the experimental class which are included in the very good and good categories are higher than the unfavorable category and none of the students are included in the bad category. The results of the analysis of the experimental class' collaboration abilities can be seen in Table 5.

Table 5. Results of Control Class Collaboration Ability Analysis

| Percentage Range | Criteria | Number of Students | | |
|------------------|-----------|--------------------|-----------|-----------|
| | | Meeting 1 | Meeting 2 | Meeting 3 |
| 76-100% | Very Good | 0 | 0 | 0 |
| 51-75% | Good | 6 | 7 | 7 |
| 26-50% | Less Good | 56 | 53 | 53 |
| 0-25% | Not Good | 0 | 0 | 0 |

In Table 5 results of the analysis of the collaboration ability of the control class which are included in the less good category are higher than the very good and good categories and there are no students who are included in the bad category.

The results of the analysis of the collaboration abilities of the two classes show that the experimental class has more students who fall into the good to very good category while the control class has more students who fall into the less good category. Based on the results of this analysis, it can be concluded that e-LKPD based on real problems can effectively improve students' collaboration ability on Environmental Change material.

Based on observations made in the experimental class, students in the discussion process in class tend to be more active in discussing and exchanging opinions to solve problems in the e-LKPD. The first meeting to the third meeting of the experimental class experienced an increase in each indicator. In contrast to the results of observations in the control class, the students tended to be less active in conducting discussions. Based on the data obtained, in the third meeting in the control class, the flexibility indicator did not increase and the appreciation indicator decreased. There was no increase or decrease in the control class due to several things such as the lack of interest of students to learn by discussion and tend to be silent or limited in expressing opinions.

CONCLUSION

Based on the results of research and discussion on the effectiveness of real problem-based e-LKPD to improve problem solving and collaboration abilities, it can be concluded that:

1. e-LKPD based on real problems is effective to improving students' problem solving ability on Environmental Change material at Madrasah Aliyah.
2. e-LKPD based on real problems is effective to improving students' collaboration ability on Environmental Change material at Madrasah Aliyah.

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