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THE EFFECT OF PROBLEM BASED LEARNING WORK SHEET USAGE ON STUDENT LEARNING OUTCOMES

*[1]Enny Diah Astuti, [2]Rachmat Susanto, [3]Didik Cahyono, [4]Sudirman, [5]Missi Tri Astuti

[1]Politeknik LP3I Jakarta, [2]STIKES Serulingmas Cilacap, [3]Universitas Mulawarman, [4]UIN Alauddin Makassar, [5]Universitas Islam Riau

Email: *[1]ennydiah169@gmail.com

Abstrak: *Penelitian ini bertujuan untuk memahami bagaimana hasil belajar siswa pada materi getaran harmonik dipengaruhi oleh penggunaan lembar kerja siswa berbasis pembelajaran berbasis masalah. Salah satu sekolah menengah atas menjadi tempat penelitian. Penelitian ini merupakan penelitian eksperimen semu dengan desain kelompok kontrol non-ekuivalen. Purposive sampling adalah metode pengambilan sampel yang digunakan. Pertanyaan pilihan ganda digunakan sebagai bagian dari instrumen tes. Dua kelas yang diizinkan oleh sekolah untuk diteliti dan dibagi menjadi kelas eksperimen dan kelas kontrol menjadi sampel penelitian. Hasil uji hipotesis dengan menggunakan uji-t menunjukkan bahwa penerapan lembar kerja siswa berbasis problem based learning terhadap hasil belajar siswa pada konsep getaran harmonik memberikan hasil yang signifikan dengan nilai signifikan lebih kecil dari taraf signifikansi. Artinya, penggunaan lembar kerja siswa berbasis problem based learning memberikan pengaruh terhadap hasil belajar siswa pada konsep getaran harmonik.*
Kata kunci: hasil belajar siswa, siswa, lembar kerja, problem based learning.

Abstract: The purpose of this study is to ascertain how students' learning outcomes for the idea of harmonic vibrations are affected by the use of problem-based learning-based student worksheets. One of high schools served as the research site. A quasi-experiment with a non-equivalent control group design was the study methodology employed. Purposive sampling was the method of sampling that was utilized. Multiple choice questions are employed as part of the test instrument. Two classes that the school permitted to be researched and that were split into experimental and control classes served as the study's samples. The results of hypothesis testing using the t-test show that the application of problem-based learning-based student worksheets on student learning outcomes on the concept of harmonic vibrations produces significant results with a significant value less than the significance level. That is, the use of problem-based learning student worksheets has an influence on student learning outcomes for the idea of harmonic vibrations.
Keywords: student learning outcome, student, work sheet, problem based learning.

Introduction

Physics is one of the natural sciences required for science specialization students at the high school level. Physics is one of the most basic fields of natural science, because it deals with the behavior and structure of objects. Many physical phenomena can be observed from the surrounding environment. This should make physics one of the lessons that many students like. However, it is not uncommon for students to think that physics is a very difficult subject to learn because of so much memorization and formulas.

Based on observations in one high school, students have difficulty in understanding physics concepts during learning, this happens because students do not play an active role in expressing and developing their knowledge. In addition, in the physics learning process students tend to learn individually, so there is no opportunity to exchange their understanding between students. So that the physics learning outcomes of

students are still low. The results of the Midterm Examination (UTS) semester have a percentage of completeness of 44.11%, there are 15 students out of 32 students have scores below the Minimum Completion Criteria (KKM) set at 75.00. So, alternative efforts are needed to be able to support the achievement of student learning outcomes.

Based on the results of interviews with students, most students feel that the teaching materials used are less interesting, varied, and not in accordance with student needs. This is in accordance with Made Wena's statement which states that existing teaching materials are sometimes not in accordance with the principles of learning psychology and textbook preparation. Based on the SMOG and FOG formulas, it is revealed that both junior and senior high school worksheets have the potential to be inappropriate for the age level, in addition, many spelling errors were found. The form of questions used tends to lead to easy questions which are dominated by factual and informative questions at the C1 and C2 cognitive levels.

One solution to answer these problems is to provide quality teaching materials that are easy to understand but can activate students to learn independently and be able to improve student learning outcomes in accordance with the objectives to be achieved. One of the teaching materials that meet the above criteria is student worksheets (LKS). As previous researcher stated that LKS is a form of teaching material that can be developed and used in facilitating student learning activities. In addition, LKS includes printed learning media that can be used to create an effective and efficient learning process. The preparation of LKS should be made by a teacher, because based on the results of interviews with several physics teachers and students in high school, LKS circulating in schools is not in accordance with the needs of students. The worksheets commonly used by students do not prioritize and train students' skills. In addition, the worksheets that are commonly used are less interesting and monotonous, making it difficult for students to understand and get bored in learning. Therefore, the worksheets are compiled and made by the teacher concerned so that the worksheets can be designed according to the needs of students and the objectives to be achieved.

Media can be said to be an integral part of learning activities, so its position cannot be separated and influences the course of the learning process. So that learning methods are needed that can encourage the development of students' thinking skills, namely with problem-based learning and appropriate learning media and can facilitate student learning.

Problem-based learning is a learning strategy that provides a range of real-world challenges in students' everyday lives (contextual in nature) in order to motivate pupils to study. Problem Based Learning (PBL) requires students to "learn how to learn" by collaborating in groups to solve real-world issues. The Problem Based Learning (PBL) methodology can also help students learn better. Learning outcomes are the skills that students acquire as a result of their learning experience. There are cognitive, emotional, and psychomotor elements to these skills. Problems created by occurrences in the environment are believed to increase student learning outcomes in the search for potential solutions to each challenge.

Harmonic vibration is the idea that will be examined in this Problem Based Learning (PBL) based LKS. Simple Harmonic Motion (GHS) is a physics material that includes information and computations. Students have a limited comprehension of scientific vocabulary, are inexperienced in identifying parameters used in computations, and lack confidence in solving problems involving basic harmonic motion. As a result, learning that includes students actively in obtaining information is required to teach harmonic vibration content, so that students better comprehend the knowledge they get and are able to solve these physics issues. The goal of this research was to see how employing problem-based learning-based student worksheets affected student learning outcomes on the idea of harmonic vibrations.

Method

This study was carried out at one of the senior high schools. This study took a quantitative approach, employing a quasi-experiment research method with pre- and post-tests. The research design utilized in this study was a nonequivalent control group design, which means that the experimental and control groups were not chosen at random. This study's sample size was 80 people, split into control and experimental groups.

Findings and Discussion

The first test performed in this study was the normalcy test, which yielded a sig value of 0.446 for the control class on the pretest and 0.062 for the posttest. The control class's sig value at pretest and posttest is larger than the significance threshold, indicating that the data is normally distributed. The experimental class's sig value at pretest was 0.591 and 0.054 at posttest. The experimental class's sig value throughout the pretest and posttest is larger than the significance threshold, indicating that the data is normally distributed.

The sig. value is calculated from the homogeneity test using Levene's test at a significance level of 5%

or 0.05. The choice is based on the rules of homogeneity hypothesis testing, which state that if = 5% = 0.05 sig., the data is homogenous. The calculation results reveal that the sig. value of the pretest and posttest data is greater than 0.05, specifically 0.794 and 0.142, implying that the variations of the two classes are the same or homogenous.

The Sig (2-tailed) of the pretest findings of 0.063 is more than the significance threshold () 0.05, suggesting that the null hypothesis (H0) is accepted and the alternative hypothesis (H1) is rejected, according to hypothesis testing. As a result, the control class pretest scores are unaffected. The Sig (2-tailed) value of 0.010 is less than the significance threshold () 0.05, suggesting that the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted, according to the posttest results. It is possible to determine that using problem-based learning-based Student Worksheets (LKS) influences student learning results for the concept of harmonic vibrations.

Based on pretest data from the control and experimental classes, the control class average value was 28.50 and the experimental class average value was 23.37, showing that average learning results remained low. This is because pupils had not learnt the content to be studied at the time of the pretest. The average for the control group is greater than the average for the experimental group. As a result, the two courses received different treatments, with the control class utilizing scientific learning with traditional learning techniques and LKS from the publisher as the primary teaching resource, and the experimental class utilizing scientific learning with Problem Based Learning-based LKS.

The t-test findings at the time of the posttest Sig (2-tailed) of 0.010 are less than the significance level of 0.05, indicating that the Problem Based Learning-based LKS had an impact. The posttest results of both courses illustrate the benefit of employing Problem Based Learning-based LKS. The experimental class's average learning outcomes of 69.62 were higher than the control class's average learning outcomes of 64.25 while using Problem Based Learning-based worksheets as a teaching resource. The experimental class used Problem Based Learning-based worksheets, which explained the difference in learning results between the experimental and control courses. The usage of Problem Based Learning-based worksheets is intended to offer students with direct insight and experience. This is reinforced by earlier research that concludes that creating problem-based student worksheets can boost student learning results. According to previous research, LKS contains printed learning material that may be utilized to establish an effective and efficient learning process in order to improve student learning outcomes.

PBL-based worksheets encourage students to be actively involved in the learning process. In learning the concept of harmonic vibration, LKS can design situations or problems that trigger students' curiosity about the phenomenon of harmonic vibration. By applying the PBL approach, students are given the opportunity to conduct research, analyze data, and find solutions to the problems given. These activities increase students' direct involvement, so they can understand the concept of harmonic vibrations more deeply. PBL-based worksheets also encourage students' problem solving and critical thinking. In harmonic vibration learning, the worksheets can be designed to pose questions or problems that require students' critical thinking and analysis. Students are faced with situations where they need to use the knowledge and skills they have learned to find solutions. Through this process, students will exercise logical thinking skills, identify cause-and-effect relationships, and develop creative problem solving. This can help them deepen their understanding of the concept of harmonic vibration.

PBL-based worksheets facilitate collaboration and communication between students. In the application of PBL, students are given the opportunity to work in groups or teams in solving a given task or problem. This collaboration allows them to discuss, share knowledge, and help each other solve problems. This process of communicating and collaborating can improve student understanding through shared learning experiences. In addition, interaction between students can also stimulate creativity and reflective thinking, which in turn contributes to better learning outcomes on the concept of harmonic vibration.

At the first meeting, it was seen that students were still not used to using LKS. There are still many students who ask about the instructions for using the LKS, students also ask about the material that has been explained in the LKS and other parts of the LKS. Learning is still teacher centered. Students also still feel unfamiliar with the LKS, but these things also make students interested and learn independently. LKS based on Problem Based Learning is a new thing for students, where they learn physics not only from reading, but also from carrying out practicum. In addition, the form of Problem Based Learning-based LKS questions also directs to the cognitive levels C1 to C4. This makes student learning outcomes better than the commonly used worksheets. So far, students only learn physics through worksheets purchased from publishers.

The improvement in learning outcomes in the control class and experimental class can also be seen from the percentage of the average score of the pretest and posttest based on cognitive levels. When viewed from the percentage of the average score on the posttest, control class students who answered correctly at the

C1 cognitive level were 30%, C2 cognitive level was 21%, C3 cognitive level was 15%, C4 cognitive level was 11%. In the experimental class students who answered correctly at the C1 cognitive level by 55%, C2 cognitive level by 57%, C3 cognitive level by 55%, C4 cognitive level by 58%. When compared between the experimental class and the control class, the experimental class has a greater percentage than the control class at each level C1, C2, C3, C4 and C5.

The experimental group outperformed the control group on the C1 cognitive level (remembering). This is because problem-based learning-based LKS may give visualization in the form of real visuals, which helps students recall the subject matter. The experimental group outperformed the control group on cognitive level C2 (understanding). This is because there is additional information connected to the content being discussed in the problem-based learning worksheet, making it simpler for students to grasp the material being discussed.

C3 cognitive level (applying), the experimental class obtained a higher percentage than the control class. This is because in the problem-based learning worksheet there is a try column to demonstrate the material being discussed and there are also practice questions. C4 cognitive level (analyze), the experimental class obtained a greater percentage than the control class. This is because in the problem-based learning worksheet there are questions and discussion questions that require students to analyze the questions and cases contained in the worksheet.

Conclusion

The study's findings and discussion show that problem-based learning-based student worksheets have an impact on student learning outcomes for the concept of harmonic vibrations. This is proved by the hypothesis testing results, which show that the Sig (2-tailed) value of 0.010 is less than the significance level () of 0.05, suggesting that the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. The following are some ideas for this research: When utilizing problem-based learning student worksheets, time should be made to be more efficient in the learning process, and the material utilized in the problem-based learning model on student worksheets should be tailored to the features of the problem-based learning model.

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