

Implementation of Student Worksheets (LKPD) Using Google Sites in the Guided Inquiry Learning Model to Improve Students' Understanding of Physics Concepts

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Abstract: Physics learning that is student-centered and makes use of digital technology should be implemented. In addition, students' conceptual understanding in physics remains low. Therefore, a digital learning medium that can facilitate independent learning and improve students' conceptual understanding is needed. One technology that can be used to create digital learning media is Google Sites. This study aimed to analyze students' conceptual understanding after the implementation of Google Sites-based learning media in the guided inquiry learning model, and to determine the validity and practicality of the student worksheets (LKPD) using Google Sites. This was a quasi-experimental study conducted at SMA Negeri 1 Lemahabang with Grade X MIPA students. Data on students' conceptual understanding were obtained through a pre-test and a post-test. The test results showed that students' conceptual understanding improved, with an N-gain of 0.82, categorized as high. The LKPD using Google Sites obtained a validity score of 3.63, in the very good category. In terms of practicality, the LKPD using Google Sites to improve conceptual understanding obtained a score of 91% from the students, in the very practical category. The implementation of the LKPD using Google Sites with the guided inquiry learning model is valid, effective in improving students' conceptual understanding, and practical for use in the physics learning process.

Keywords: Google Sites, guided inquiry, Conceptual Understanding

Introduction

The paradigm of education has changed significantly under the influence of advances in information and communication technology. The involvement of technology in education is no longer an option but a necessity for achieving quality education that prepares a generation capable of meeting the demands of an ever-changing era. However, it is also possible that technology will hinder the learning process if it is not implemented well. The use of technology in education therefore requires guidance from teachers so that the main objectives of education can be achieved. As stated by Sinaga & Firmansyah (2024), technology has transformed education: classroom learning no longer relies on the traditional teacher- and textbook-centered model but has begun to adopt a more flexible digital education system.

Global competition for human resources in the 21st century is an important problem that must be addressed, beginning with the field of education. Putriani & Hudaidah (2021) stated that there are three major competencies in the 21st century, namely competencies in thinking, acting, and living in the world. Thinking competencies include critical thinking, creative thinking, and problem solving. Acting competencies include communication, collaboration, digital literacy, and technological literacy. Meanwhile, competencies for living in the world include initiative, self-direction, global understanding, and social responsibility. These competencies ought to be developed in 21st-century learning because this era requires innovative and creative people who can adapt quickly. This is a matter of particular concern for the government of the Republic of Indonesia, which needs to provide adequate facilities and infrastructure as soon as possible to face global developments.

To achieve quality education, the most important component that requires special attention is the learning process. A quality learning process produces quality graduates. In the field of education, many learning models, methods, and instruments have been implemented and further developed by teachers to make teaching and learning easier so that students can more readily absorb the lessons.

Learning is the process of preparing students to learn according to their needs and wishes. Learning can be understood as an effort to influence students' emotional, intellectual, and spiritual development. Learning designed by a teacher enhances every potential and a wide range of students' abilities, such as the ability to think, be creative, reconstruct knowledge, solve problems, and collaborate. These are the abilities that 21st-century students must possess.

The curriculum in use has a considerable impact on the quality of learning in schools, because the roles of teachers and students and all other aspects involved in learning are governed by regulations known as the curriculum. The curriculum in Indonesia continues to be updated as times change, and the government of the Republic of Indonesia, through the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), pays close attention to the learning processes implemented in all schools in Indonesia. To produce a generation able to compete globally, in 2022 Kemendikbudristek issued a new curriculum called the Merdeka Curriculum. According to Lestari et al. (2023), the Merdeka Curriculum is an intracurricular learning curriculum that is quite diverse and has more optimized content so that students have sufficient time to strengthen their competencies and understand concepts.

Physics is a branch of science that focuses on matter, energy, and the relationship between them. Yolanda et al. (2019) stated that physics learning emphasizes direct experience for students by involving their active participation in the learning process. In this way, students are expected to gain a better understanding of physics material. For some students, learning physics is often regarded as complicated and difficult to understand because the material taught is frequently associated with long and complex mathematical calculations. In fact, if students understand the basic concepts taught in physics well, they will not feel that learning physics is complicated or boring. Conceptual understanding is an important aspect that must be considered in physics learning because it can affect students' learning outcomes. Azizah et al. (2020) stated that a concept is the product of the thinking of a person or a group of people, expressed through definitions, laws, and theories. In physics learning, teachers must ensure not only that students merely know the material taught, but also that they understand its basic concepts so that they can relate one topic to another. One topic in physics learning is measurement. Sari et al. (2019) explained that measurement is the process of measuring a quantity, namely comparing the value of the quantity being measured with another quantity of the same kind that serves as a reference.

The guided inquiry learning model is a student-centered learning model in which the teacher acts only as a facilitator, providing guidance or directing students during the learning process. Sulistiyono (2020) stated that the guided inquiry learning model makes students more active in the teaching and learning process. This approach gives students richer experiences because they are directly involved in every stage of learning. The model emphasizes not only the cognitive aspect; students are also required to experience and practice the material directly, making the learning process more meaningful. Amijaya et al. (2018) explained that the guided inquiry learning model treats students as the subjects of learning, in which students are encouraged to participate actively in learning activities. The guided inquiry learning model can improve students' learning outcomes.

Students' conceptual understanding in physics learning is very important. By understanding the basic concepts of a physics problem, students can solve it more easily. Moreover, understanding basic concepts allows a physics problem to be modified and related to other physics problems. Kurniasih et al. (2019) likewise explained that conceptual understanding is students' ability to understand a phenomenon being studied, not merely knowing the phenomenon but also having a solid foundation of thinking, such as being able to identify, give examples, apply the mastered concepts to solve a problem, and even understand new concepts.

Methods

This study was a quasi-experimental study. In a quasi-experimental design, the researcher uses two groups, namely an experimental group and a control group. The experimental group used LKPD based on Google Sites within the guided inquiry model, whereas the control group used only the guided inquiry model without the LKPD. The activities consisted of three face-to-face learning sessions and one evaluation session. The first session began with a pre-test, followed by instruction through the second session, and ended with a post-test in the third session to measure the students' final ability. The study was conducted in the even semester of the 2024/2025 academic year, from January to February 2025, at SMA Negeri 1 Lemahabang, Cirebon Regency.

The data in this study were of two types, namely primary and secondary data. According to Sugiyono (2013), primary data are data obtained directly by the researcher, whereas secondary data are data obtained by the researcher through other intermediaries. The primary data in this study were (1) data from the researcher's interview with the physics teacher to obtain preliminary information before the study; (2) questionnaire data containing questions on the physics teacher's opinions about the effectiveness of implementing LKPD using Google Sites with the guided inquiry learning model in learning; (3) the pre-test and post-test results completed by the students to measure the extent of their mastery of concepts; and (4) documentation, which served as supporting data obtained while the students' learning took place.

The secondary data in this study were preliminary information obtained by the researcher about the educational background of the school and the results of tests the students had previously taken, which were then used to determine the research sample.

Results and Discussion

The implementation of LKPD using Google Sites made the students enthusiastic, because previous lessons had used only conventional instruction. The students' enthusiasm was marked by high curiosity when they were given access to the LKPD in the form of a Google Site, which boosted their initial motivation before the discussion of the material began. However, a challenge in this learning was that most students had never used Google Sites, and some of them had heard the term for the first time. To address this problem, the researcher explained how to use Google Sites before the lesson began. This activity helped the students during the learning process, considering that using Google Sites as a learning medium is relatively easy and requires no special expertise. The use of the Google Sites-based LKPD in the experimental class made it easier for students to follow the learning sequence that the researcher had prepared in the teaching module; this sequence was integrated with the syntax of the guided inquiry learning model and presented systematically. In addition to containing teaching materials, the LKPD also presented experimental steps that could be followed and carried out directly in groups. This was possible because the LKPD was linked to Google Forms as a medium for collecting the results of group discussions. The Google Sites LKPD also provided features for completing pre-test and post-test questions. In practice, however, the pre-test and post-test were administered manually using printed questions and worksheets. This was intended to minimize the potential for student cheating so that the researcher could obtain more accurate results.

The implementation of learning in the experimental and control classes differed in timing. The experimental class was taught in the first period, in the morning, which made the learning very conducive because the students were still highly focused and well prepared to follow the lesson. In contrast, the control class was taught in the seventh period, in the afternoon. Students' condition in the afternoon is certainly different from that in the morning; their focus tends to be weaker than it is in the morning. Nursalma & Pujiastuti (2023) explained that students' physical condition differs greatly between morning and afternoon: in the afternoon, students tend to feel more tired, so their focus also declines, making learning less conducive. Nevertheless, the researcher tried to keep the lessons conducive by using some humorous

remarks to entertain the students so that their focus was better maintained. Besides affecting the learning process in the classroom, the time difference between the experimental and control classes also affected how the pre-test and post-test were completed. As in the study by Azis & Ali (2020) on mathematics, students' condition in the morning and afternoon greatly affects their focus; mathematics learning is closely related to numbers and mathematical calculations, which demand high concentration, and high concentration is found in the morning. Because students' focus differed between the experimental and control classes, the control class, which took the tests in the afternoon, was treated differently from the experimental class: the experimental class was given 90 minutes to complete 21 questions, whereas the control class was given an additional 20 minutes for both the pre-test and the post-test. This was intended so that the control-class students could be more relaxed and maintain their focus while working through the questions one by one, so that the data obtained would also be more accurate.

The data used as the basis of this study were the pre-test and post-test results of the experimental and control classes. The physics conceptual understanding test used in this study served as the main instrument for measuring the improvement in students' conceptual understanding before and after the implementation of the guided inquiry learning model supported by Google Sites-based LKPD. The test comprised 21 multiple-choice questions, with indicators referring to Anderson & Krathwohl (cited in Trianggono, 2017), namely interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining. The questions were adjusted to the characteristics of Grade X students and the basic material on measurement. The aim was not to measure higher-order thinking skills but to obtain an overview of the extent to which students understood the physics concepts taught.

The pre-test results of the experimental class were used to measure the students' initial ability before the implementation of the Google Sites-based LKPD with the guided inquiry model. Of the 27 students, the lowest score was 14.29, the highest was 38.10, and the mean was 26.46. In the control class, a pre-test was also administered before the lesson. Of the 27 students, the lowest score was 9.52, the highest was 42.86, and the mean was 25.93.

After the treatment, the post-test of the experimental class showed an improvement, with a lowest score of 71.43, a highest score of 100, and a mean of 86.94. Meanwhile, the post-test of the control class yielded a lowest score of 57.14, a highest score of 100, and a mean of 77.07.

Table 1. N-Gain Calculation Results

Class	Min.	Max.	<i>N-Gain Score</i>	Category
Experimental	0.57	1.00	0.82	High
Control	0.36	1.00	0.69	Medium

Table 1 shows the results of the N-gain calculation. The N-gain score of the experimental class, that is, the class that received LKPD using Google Sites with the guided inquiry learning model, was 0.82, which falls in the high category, whereas the control class, that is, the class that did not receive the LKPD using Google Sites and the guided inquiry learning model, obtained an N-gain score of 0.69, which falls in the medium category. These N-gain results indicate a significant difference in conceptual understanding between students who received LKPD using Google Sites with the guided inquiry learning model and students who received conventional instruction.

The results of the practicality test of the LKPD were obtained through a practicality assessment questionnaire administered to the 27 students of the experimental class after the LKPD using Google Sites had been implemented. Using a Guttman scale with two options, "yes" or "no," for each questionnaire item, the experimental-class students were asked to answer 12 questions honestly, based on the impressions they had after using the LKPD. The analysis yielded a practicality percentage of 91%, which falls in the very good category. It can therefore be concluded that the Student Worksheets (LKPD) using Google Sites are very practical for students to use, which is consistent with the study by Putri et al. (2022).

Table 2. Results of the LKPD Practicality Questionnaire

No	Statement	YES	NO
1	The appearance of the learning medium attracted my interest in studying the material	20	7
2	Using the learning medium made me enthusiastic about learning because the lesson became more interesting and less boring	27	0
3	The learning medium is easy to use	27	0
4	I can use the learning medium independently	27	0
5	The learning medium differs from the physics textbooks I usually use	24	3
6	The material in the learning medium uses language that is easy to understand	19	8
7	The material in the learning medium is presented coherently and is easy to understand	27	0
8	The practice questions in the learning medium help me understand the material	15	12
9	I gained new knowledge from the material in the learning medium	27	0
10	The material in the learning medium is interesting to study	27	0
11	The learning medium is comfortable to read	27	0
12	The design and layout do not hinder my understanding of the content	27	0
TOTAL		294	30
PERCENTAGE		91%	

Conclusion

The implementation of Student Worksheets (LKPD) based on Google Sites and integrated with the guided inquiry learning model on the topic of measurement has been shown to have a positive effect on students' conceptual understanding. Through this approach, students find it easier to understand the material because the learning sequence is systematically organized and encourages their active involvement in the inquiry process. In addition, the Google Sites-based LKPD has also proven to be highly practical. Students can access and use it both during lessons at school and independently outside school. Easy access, an interactive appearance, and well-structured content make this medium effective in supporting students' learning anytime and anywhere.

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