



Interactive LKPD Based on Guided Discovery in Improving Science Learning Outcomes of Grade V Elementary School Students

Ni Wayan Suniasih^{1*}, I Wayan Sujana² 

^{1,2} Elementary Education Department, Ganesha University of Education, Singaraja, Indonesia

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ABSTRAK

Penelitian ini dilaksanakan atas dasar guru dan siswa dituntut melek teknologi dalam proses pembelajaran seiring dengan perkembangan ilmu pengetahuan dan teknologi yang semakin cepat agar mampu bersaing dan meningkatkan potensi yang dimiliki. Lembar Kerja Peserta Didik (LKPD) interaktif dibutuhkan untuk menuntun siswa dalam belajar memahami materi pelajaran sesuai kompetensi yang harus dicapai. Penelitian ini bertujuan untuk menganalisis efektivitas penerapan LKPD interaktif berbasis Guided Discovery terhadap hasil belajar IPA siswa kelas V sekolah dasar. Penelitian eksperimen ini dirancang menggunakan non equevalent control group desain. Metode yang digunakan untuk mengumpulkan data penelitian berupa tes hasil belajar IPA yang telah divalidasi. Data yang terkumpul dianalisis menggunakan uji-t yang sebelumnya diuji normalitas sebaran data dan homogenitas varians sebagai prasyarat analisis. Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan hasil belajar IPA kelompok siswa yang dibelajarkan dengan LKPD interaktif berbasis Guided Discovery dengan Kelompok siswa yang dibelajarkan secara konvensional. Hal ini dibuktikan hasil uji t_{hitung} 6,260 lebih dari t_{tabel} 2,052. Selain itu, hasil penelitian ini juga menunjukkan bahwa dari hasil uji Effect Size (ES) diperoleh hasil 0,87 pada rentangan 0,80 kurang dari ES efektif pada kategori efektivitas tinggi. Hal ini berarti pembelajaran dengan menggunakan LKPD interaktif berbasis Guided Discovery efektif meningkatkan hasil belajar IPA siswa kelas V sekolah dasar.

ABSTRACT

This research was carried out on base on phenomena that teachers and students are required to be technologically literate in the learning process along with the development of science and technology which is getting faster in order to be able to compete and increase their potential. Interactive Student Worksheets (LKPD) are needed to guide students in learning to understand the subject matter according to the competencies to be achieved. This study aims to analyze the effectiveness of implementing Guided Discovery-based interactive worksheets on science learning outcomes for fifth grade elementary school students. This experimental research was designed using a non equivalent control group design. The method used to collect research data is in the form of a validated science learning achievement test. The collected data were analyzed using the t-test which was previously tested for normality of data distribution and homogeneity of variance as a prerequisite for analysis. The results showed that there were significant differences in the science learning outcomes of the group of students who were taught with Guided Discovery-based interactive worksheets and the group of students who were taught conventionally. This is evidenced by the results of the tcount test of 6.260 more than the ttable of 2.052. In addition, the results of this study also showed that the results of the Effect Size (ES) test obtained a result of 0.87 in the 0.80 range less than the effective ES in the high effectiveness category. This means that learning using Guided Discovery-based interactive worksheets is effective in improving science learning outcomes for fifth grade elementary school students.

1. INTRODUCTION

Learning in the 21st century emphasizes students' ability to think critically, be able to linking with the real world, master information technology, collaborate, and communicate (Antara & Dewantara, 2022; Pujawan et al., 2022). Teachers and students are required to be technologically literate in the learning process along with the development of science and technology which is getting faster in order to be able to compete and increase their potential. The role of technology in the field of education is being able to improve the quality of education, in which technology assists teachers in reducing the lecture method so that students can develop the learning process effectively and efficiently. Students are given the opportunity to develop their interests, talents and potential but are still under the supervision of the

*Corresponding author.

E-mail addresses: suniasih98@gmail.com (Ni Wayan Suniasih)

teacher. Teachers can also maximize their competencies by adding concrete teaching insights. The basic concept of scientific learning is carried out by means of systematic program planning, developing teaching materials based on scientific principles (Antara et al., 2022; Karuniawati, 2022). The role of the teacher as an educator will not be replaced by machines (technology). The teacher's ability to touch aspects of taste, language and character formation makes the teacher's presence always awaited by students. The teacher's ability to use and master technology can be used as the right solution in the learning process in any situation in order to create a meaningful learning process for students (Kusmayadi et al., 2013; Saleh & Hanik, 2020). So it can be summarized that technology has an important role in the learning process in the 21st century to improve the quality of learning for teachers and students in schools.

The learning process, especially science subject matter in elementary schools, is integrated into a theme (Riwanto & Wulandari, 2018; Salamah et al., 2022). Dense science material in high grades takes a long time if the teacher only uses the lecture method in presenting the material. This makes teachers have to innovate in packaging learning so that it remains interesting, meaningful, and can help students understand each learning material through direct experience. Science lessons are able to invite students to interact with the environment so that students can feel directly the objects around them. Science is a branch of knowledge about nature, such as animals, the environment, plants and other objects that are useful and can be found in the natural surroundings (Priyanti & Manuaba, 2022; Suryani, 2021). So, it can be summarized that science is a collection of knowledge that is arranged systematically so that the application of science is marked by a collection of real facts, but theoretically science also contains concepts that students need to understand in the learning process.

Based on preliminary information in elementary schools, the implementation of the learning process, especially in science lessons, underwent changes during the pandemic, indicating that the learning process was still dominated by teacher-centered learning. This still happens even though learning has been carried out face to face. Concepts and facts that students need to know, are explained by the teacher without discussing through direct examples in their application. The learning resources provided are in the form of printed teaching materials which sometimes the discussion is not thorough in accordance with the learning objectives to be achieved. During online learning activities, to get a response from the assignment given by the teacher to students while learning takes a long time, so it cannot be discussed and given feedback as soon as possible. Meanwhile, during online learning, science material can make it difficult for teachers to convey material in one meeting due to limited study time at school. This also causes students to feel bored quickly, do not understand the material, and tend to forget easily because students do not experience and discover the science concept given through their own experience. In order to achieve a meaningful learning process so as to improve students' science learning outcomes. Teachers can develop teaching materials in the form of electronic interactive worksheets that can be used in any situation adapted to the characteristics of student learning styles so as to increase student learning motivation. This is supported by the availability of learning facilities in schools such as laptops for all students in grades V and VI which can be used to study at school or at home.

As an educational component, what teachers must prepare for the learning process in the 21st century is to use their knowledge of subject matter and technology to facilitate students' learning experiences, creativity, and innovation in the learning process in face-to-face and online situations (Antara & Dewantara, 2022; Sole & Anggraeni, 2018). The teacher is one of the important elements who have the responsibility to give assignments and overcome problems that arise in the learning process. Apart from the teacher, other components are no less important in supporting the successful implementation of learning, one of which is the learning tools prepared by the teacher. Learning devices are a collection of learning resources that can be used by teachers and students in learning activities (Astuti & Sari, 2017; Tanjung & Aminah Nababan, 2019). One of the innovations that can be carried out by teachers is to develop learning tools in the form of interactive worksheets that are effectively used in learning, especially in learning science. Learner Worksheets are teaching materials designed by teachers which contain activities that involve students carrying out real activities with objects and issues studied in the learning process (Ichsan, 2022; Syamsu, 2020).

Research on LKPD has been carried out through the application of the guided inquiry learning model assisted by scientifically based student worksheet which has effectiveness on learning outcomes for class VI science at elementary school of 1 Bakunase Kupang (Nahak & Bulu, 2020). Then, similar research states that the implementation of learning with the inquiry learning model is very effective in improving science learning outcomes for Class VI MIN 29 Bireuen (Suryani, 2021). The thing that distinguishes this research from previous research is that the LKPD developed in this study is in digital form, uses the Guided Discovery learning model, and it is interactive. Interactive LKPD is an alternative media that can be used to support a learning process consisting of material, learning activities, and practice questions which are classified into technology-based media to increase insight into learning material independently with

just one push of a button on the application (Fathulain et al., 2018; Herawati et al., 2017). LKPD digitally utilizes a variety of interactive multimedia such as images, video and audio. This certainly can increase student enthusiasm for learning, develop students' abilities in using technology, and make it easier for students to access LKPD wherever they are.

Selection of a learning model that is in accordance with the demands of the curriculum, the needs of teachers and students is needed in developing interactive worksheets in order to create a meaningful learning process. The Guided Discovery learning model can be used as a learning model in learning activities. The Guided Discovery learning model is a learning model for developing active student learning methods through guessing activities, discovering new knowledge and self-investigation using intuition. So that students can draw a conclusion that will always be remembered by students (Budiarti et al., 2016; Susanti et al., 2017). Learning to find a concept independently does not mean the teacher does not teach, but in guided discovery learning the teacher acts as a facilitator who helps and directs students to find a conclusion (Arung et al., 2022; Pramowardhani, 2020).

The use of LKPD in elementary schools, especially science lessons is still not optimal to help teachers and students in the learning process (Fathulain et al., 2018; Priyanto et al., 2017). This is because the LKPD provided lacks variation according to student learning styles, the material presented is not detailed in accordance with competency demands, is still one-way, and the feedback that students get is not fast enough. The teacher takes a long time to provide an assessment of the LKPD which is still in hardcopy form during online learning. Whereas during offline learning, dense science material in high grades makes it difficult for teachers to discuss the material in one meeting due to limited study time at school. The existence of worksheets that are not in accordance with the needs of students and the learning process which is still teacher-centered makes it difficult for students to understand the concept of science lessons. Therefore it is very necessary LKPD which can be packaged interactively and based on Guided Discovery in supporting the science learning process. Learning with interactive worksheets can create a fun learning atmosphere. Making the atmosphere relaxed and not stressful, so students don't easily feel bored and stressed (Herawati et al., 2017; Priyanto et al., 2017). The developed interactive LKPD is equipped with learning materials and videos that can strengthen understanding and stimulate students' reasoning. As well as being integrated with activities that use the Guided Discovery learning model which consists of the stages of problem orientation, exploration, processing information, making conclusions, and completing practice questions that aim to apply the concepts obtained (Susilawati, 2022). This study aims to analyze the effectiveness of implementing Guided Discovery-based interactive worksheets on science learning outcomes for fifth grade elementary school students.

2. METHODS

This type of research is a quantitative research with a quasi-experimental design. The quasi-experimental design used in this study was the Nonequivalent Control Group Design. The research design involved two class groups, namely one class group as the experimental group and one class group as the control group. The pre-test was given for the control group and the experimental group. The experimental class group was given an Interactive Worksheet based on Guide Discovery, while the control group was not given any treatment. Then after being given treatment, a post test was carried out to find out the results of learning science. The treatment is carried out online and offline, because facilities such as laptops for every grade 5 student at SD No. 2 Tibubeneng, Badung district, are provided by the Education Office to take home. After the Covid-19 pandemic, learning was carried out offline, treatment was given using a blended learning strategy using a rotation model. The type chosen is the station rotation model, which is a blended learning model that combines online learning as an integrated activity during face-to-face class hours (Miyarso, 2019). This model was chosen with the consideration that the school provides computers in the form of laptops that are connected to the internet network at school. The treatment given is in the form of interactive worksheets based on Guide Discovery which can be used by students both online and offline learning.

The data collection technique used in this study is a test. An objective measurement of a person's behavior, so that behavior can be described with the help of numbers, scales or with a system of categories. The test technique is used to obtain data on science learning outcomes. The test used was given at the end of the treatment in accordance with the designed research design. In this study, the test used to measure science learning outcomes was an ordinary multiple choice test. Research data in the form of science learning outcomes came from 61 students from two class groups, namely class VB as the experimental group and class VA as the control group. The analysis technique used to analyze the data in this research is inferential statistics. Inferential statistics are statistics that are used to analyze sample data, and the results will be generalized (inferential) for the population where the sample is taken

(Sugiyono, 2008). The data used to be analyzed are data gain scores from the results of the pre-test and post-test results. Science learning outcomes data from this study were analyzed using the t-test which is part of the comparative analysis method of two averages. The purpose of the t-test is to compare two means. In this study two group averages were tested, namely the science learning outcomes of the experimental group and the control group.

3. RESULT AND DISCUSSION

Results

Descriptive Analysis Results

Science learning outcomes data on the aspect of knowledge competency in this study is in the form of a normalized gain score. The data for both the group that was taught using interactive worksheets based on Guided Discovery, and those that were taught conventionally were analyzed using the t-test. The description of the normalized score gain data is presented in Table 1.

Table 1. Description of Student Group Science Learning Outcomes

Group	n	Range	Skor Min	Skor Max	Sum	Mean	Std. Deviation	Variance
Experiment	31	0,89	0,11	1,00	13,35	0,43	0,20	0,04
Control	30	0,58	-0,13	0,46	4,70	0,16	0,13	0,02

Based on the data in Table 1, it can be seen that the number of students or $n=31$, the minimum/lowest score is 0.11, the maximum/highest score is 1.00. Furthermore, the Mean is 0.43, the standard Deviation is 0.20 and the Variance is 0.04. Based on these results, by comparing the average percentage of the normalized gain score obtained by the experimental group, namely 0.44, then with the classification interpretation of the normalized score gain, the average number of 0.43 is in the 0.3 category $<g < 0.7$. So it can be concluded that the average criterion of normalized score gain of science knowledge competence in the experimental group with Guided Discovery-based interactive worksheets is classified as **moderate**. Meanwhile, based on the results of comparing the average percentage gain, the normalized score obtained by the conventionally taught group is 0.16. Then with the classification of gain interpretation the normalized score average score of 0.16 is in the category $g < 0.3$. So it can be concluded that the average criterion of normalized score gain in the science learning outcomes of the control group is **low**.

Normality Test Results

The normality test was carried out to determine the distribution of the frequency of scores, to test the data on science learning outcomes for groups of students who were taught interactive worksheets based on Guided Discovery and Conventional using the Kolmogorov-Smirnov test. The normality test results are presented in Table 2.

Tabel 2. Hasil Uji Normalitas

Statistic	df	Sig.	Conclusion
0.106	31	0.200	Normal
0.114	30	0.200	

Variance Homogeneity Test Results

Testing the homogeneity of variance between groups is intended to ensure that differences in hypothesis testing actually occur not due to differences within the groups, but due to differences in variance between groups. The results of the variant homogeneity test are presented in Table 3.

Tabel 3. Hasil Uji Normalitas

Levene Statistic	df1	df2	Sig.	Conclusion
3,203	1	59	0.079	Homogen

Based on the results of the homogeneity test of variance, $\text{Sig } 0.079 > 0.05$ means that the data on science learning outcomes using Guided Discovery-based interactive worksheets is used in **homogeneous learning**.

Hypothesis test

The hypothesis tested in this study is the null hypothesis (H0), namely; There is no significant difference in science learning outcomes between groups of students who are taught using Guided Discovery-based interactive worksheets and conventional. Based on the results of the normality and homogeneity tests, it can be seen that the data obtained from the experimental group and the control group are normally distributed and have a homogeneous variance. The testing data met the prerequisites, the hypothesis testing was carried out using t-test analysis, there were two averages in this study. The results of calculating the hypothesis test are presented in [Table 4](#).

Table 4. Hypothesis Test Results

Group	N	Mean	T _{count}	Sig (2-tailed)	df
Exsperiment	31	0,43	6,260	0,00	59
Control	30	0,16			

Based on the results of the analysis that has been carried out, the results of the two-way difference test using the independent sample t-test on the n-Gain average of science knowledge of students in the experimental class and control class show a sig (2-tailed) value of $0.00 < 0.05$ and $t_{count} = 6.260 > t_{table} = 2.052$ so H0 is rejected. This means that there are significant differences in science learning outcomes between groups of students who are taught using Guided Discovery-based interactive worksheets and conventional ones. To determine the magnitude of the effectiveness of Guided Discovery-based interactive worksheets on science learning outcomes, the Effect Size (ES) test was used. Based on the calculation results of the Effect Size test, the result is 0.87. To interpret, the results are converted to a table of effectiveness criteria. The results obtained are in the range of $0.80 < ES$ with high effectiveness criteria. So it can be concluded that learning using Guided Discovery-based interactive worksheets is effective in improving science learning outcomes for fifth grade students of SD No. 2 Tibubeneng.

Discussion

Based on the research results, it was found that there were significant differences in science learning outcomes between groups of students who were taught using interactive Guided Discovery-based worksheets with conventional ones as indicated by a sig (2-tailed) value of $0.00 < 0.05$ and $t_{count} = 6.260 > t_{table} 2.052$ at a significance level of 5% ($\alpha = 0.05$) with 59 degrees of freedom. Thus the null hypothesis (H0) is rejected, which means there is a significant difference. These results are in accordance with the results of the study which showed that there were significant differences between students who took part in guided discovery learning and students who took conventional learning ([Dewi et al., 2017](#); [Fitriani et al., 2018](#)).

The success of rejecting the null hypothesis (H0) in this study was due to the advantages of using Guided Discovery-based interactive worksheets in the learning process. In its application, students are fully involved in the process of discovering and reformulating the concept they are aiming for, with the teacher remaining as their guide. This LKPD has several advantages including interactive LKPD, has an attractive appearance, contains Guided Discovery model steps that can help students understand concepts and find their own concepts, feedback that students feel is very fast and of course can motivate students in the learning process. Accuracy in the selection of learning models and how to apply them is also one of the things that causes the success of the research results obtained. This is in line with the opinion which suggests that in developing a LKPD that can guide students to understand a concept, a learning model is needed, for example the guided discovery model and at each step this learning model must be carried out in an orderly and precise manner ([Norsanty & Chairani, 2016](#); [Syamsu, 2020](#)). Errors in its application resulted in learning being hampered. This is also reinforced by the statement which suggests that a mature learning planning process can facilitate both teachers and students so that the learning process can be carried out optimally and evaluation is useful to find out student understanding ([Lukum, 2015](#); [Norsanty & Chairani, 2016](#)). In line with this statement, in a learning process, appropriate steps are needed in guiding students to carry out learning activities which include activities to find out and discover a concept ([Sari & Dwikoranto, 2019](#)).

Referring to the results of the calculation of the effect size test, the result is 0.87. Located in the range of $0.80 < ES$ with high effectiveness criteria, it can be concluded that the use of Guided Discovery-based interactive worksheets in learning has proven to be effective in improving science learning outcomes for fifth grade students of elementary school No. 2 Tibubeneng. The results of this study are in line with research showing that Guided Discovery-based worksheets are effective in mastering student learning material ([Kartika et al., 2017](#); [Nurjanah et al., 2020](#)). Another research that is in line is research

which found that learning using the Guided Discovery model had an effect of 31.33% on improving student learning outcomes with an effect size test result of 0.89 which showed effectiveness in the high category (Berliana et al., 2018). This means that the Guided Discovery model is effective in improving student learning outcomes.

The success of the Guided Discovery learning model in the learning process has been proven by research showing that the critical thinking skills of students who use the Guided Discovery model in the learning process are significantly better than students who are taught conventionally (Syamsulrizal, 2020). Learning with the Guided Discovery model not only improves students' thinking skills but problem solving abilities can also increase significantly (Ningru et al., 2020). This is reinforced by research which suggests that the guided discovery learning model can have a positive impact on students by providing opportunities for students to be more active in the learning process so that student learning outcomes can increase (Eka Lestari et al., 2017). The combination of interactive LKPD based on Guided Discovery can further assist students in developing their problem solving abilities through systematic problem solving. This is reinforced by the statement that learning using Guided Discovery-based worksheets causes learning to be more structured and arouses students' curiosity to construct knowledge in students' cognitive dimensions (Dedonno, 2016; Salwan, S. & Rahmatan, 2017). The results of the findings and discussion in this study contribute to scientific development that Guided Discovery-based LKPD can be used as an alternative in improving the quality of learning, especially at the elementary school level. The limitations in this study lie in the limited number of samples. Therefore, it is recommended that in future studies implement Guided Discovery-based worksheets on a wider sample, as well as in a wider scope of material and levels.

4. CONCLUSION

There are significant differences in science learning outcomes between groups of students who are taught using Guided Discovery-based interactive worksheets and conventional ones. In addition, Guided Discovery-based interactive worksheets are also effectively used in learning as evidenced by the effect size test results which are in the high effectiveness category. This means that learning using Guided Discovery-based interactive worksheets is effective in improving students' science learning outcomes. Learning by using Guided Discovery-based LKPD causes learning to be more structured and arouses students' curiosity to construct knowledge in students' cognitive dimensions.

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