



Scientific Approach-Based Student Worksheets on Light and Its Properties to Enhance Learning Outcomes of Fifth Grade Elementary Students

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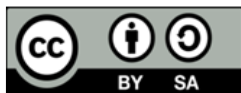
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ABSTRAK

Kurangnya media pembelajaran yang mampu merangsang kemampuan berpikir kritis siswa menyebabkan hasil belajar siswa rendah. Penelitian ini bertujuan untuk menganalisis efektivitas LKPD berbasis pendekatan saintifik pada materi cahaya dan sifatnya untuk meningkatkan hasil belajar siswa di kelas V. Jenis penelitian ini adalah penelitian pengembangan dengan menggunakan model ADDIE (analyze, design, development, implementation, evaluation). Subjek penelitian yakni siswa kelas V sebanyak 14 siswa. Pengumpulan data dalam penelitian ini menggunakan metode observasi, wawancara, angket/kuisisioner. Instrumen yang digunakan yakni lembar kuisisioner dan tes pilihan ganda. Teknik analisis data menggunakan analisis deskriptif kualitatif, analisis deskriptif kuantitatif, dan analisis statistik inferensial uji-t. Hasil penelitian menunjukkan uji efektivitas media LKPD berbasis pendekatan saintifik menunjukkan hasil signifikan (2-tailed) sebesar 0,000, yang menyatakan H_0 ditolak dan H_1 diterima. Dapat disimpulkan bahwa, terdapat perbedaan yang signifikan hasil belajar sebelum dan sesudah menggunakan LKPD berbasis pendekatan saintifik dalam pembelajaran khususnya pada materi cahaya dan sifatnya. Inovasi LKPD berpendekatan saintifik pada materi cahaya dan sifatnya memiliki implikasi sebagai contoh bagi guru dalam melaksanakan pembelajaran berbasis pendekatan saintifik di sekolah dasar.

ABSTRACT

The lack of instructional media that stimulate students' critical thinking skills has resulted in low learning outcomes. This study aims to analyze the effectiveness of scientific approach-based student worksheets (LKPD) on the topic of light and its properties in improving the learning outcomes of fifth-grade elementary students. This research employed a development design using the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). The subjects of the study were 14 fifth-grade students. Data collection methods included observation, interviews, and questionnaires, with instruments such as questionnaire sheets and multiple-choice tests. Data analysis techniques involved qualitative descriptive analysis, quantitative descriptive analysis, and inferential statistical analysis using the t-test. The findings revealed that the effectiveness test of the scientific approach-based LKPD yielded a significant result (2-tailed) of 0.000, indicating that H_0 was rejected and H_1 was accepted. This concludes that there is a significant difference in learning outcomes before and after using the scientific approach-based LKPD, particularly on the topic of light and its properties. The innovation of LKPD with a scientific approach to the material of light and its properties has implications as an example for teachers in implementing learning based on a scientific approach in elementary schools.

1. INTRODUCTION

The problem currently facing the world of education in Indonesia is the weakness of the active and creative learning process, resulting in low quality education (Mawati et al., 2023; Suryaningsih & Nurlita, 2021). The worrying quality of education can be seen from the role of teachers in carrying out teaching activities, in carrying out their duties as the progress of the nation. This has an impact on low student learning outcomes. Learning that is not centered on students makes students quickly bored in learning (Rohaeni, 2020; Safitri & Kabiba, 2020). In improving the quality of education, the Indonesian government has made many changes, both in the form of the education system, which concerns the curriculum structure

and the learning patterns implemented. The use of appropriate teaching materials is a very important factor in improving students' ability to understand and remember learning materials (Nurhasanah et al., 2019; Suwastini et al., 2022).

Based on this, teaching materials are needed that are in accordance with the needs of students. Based on the results of interviews conducted with the homeroom teacher of grade V of SD Negeri 2 Banjar Bali, it was found that students need interesting teaching materials. The characteristics of these teaching materials are teaching materials with short, concise, and clear material accompanied by the use of language that is easy to understand, has supporting images in explaining the material, and additional external information related to the material. Teachers must try to make something clear to students so that they are skilled in solving problems. Teachers must have good knowledge of the various potentials and characteristics of students in order to design good learning (Maskur, 2023; Magdalena et al., 2021). A good learning design is a learning that is able to optimize brain capacity while increasing students' learning motivation, thus providing a positive impact on their learning outcomes. This problem is also experienced by teachers at SD Negeri 2 Banjar Bali. Teachers expressed that it is difficult to apply learning with a scientific approach because of the limited guidance on the steps of simple experimental activities. Based on previous experience, teachers tend to still make LKPD by referring to the questions in the book. Teachers still rarely use LKPD and have not applied a scientific approach because some learning tools are still in the form of worksheets containing a summary of the material and a collection of questions in the book. The LKPD used has not been able to help in constructing students' knowledge in solving problems. The questions listed in the LKPD only require students to answer without going through a discovery process or a series of scientific activities. Therefore, not all students actively participate in the learning process.

Student Worksheets (LKPD) are teaching materials that contain a summary of materials and activities that must be done by students. The use of LKPD can help improve students' critical thinking skills and understanding of lesson materials through activities so that students can practice their problem-solving skills (Herlyana et al., 2022; Ichsan, 2021). Student worksheets (LKPD) are a means to help and facilitate teaching and learning activities so that effective interactions are formed between students and educators, which can increase student learning activities and achievements (Marzuki & Silvia, 2023; Arief, 2015). Currently, Indonesia is actively conducting socialization efforts in a number of schools. The main striking feature is the application of a scientific approach in every learning process on every theme at the elementary school level. Elementary school has several subjects, one of which is science. Learning science requires the skills of a teacher so that students can easily understand the material presented by the teacher. Science aims to provide experience in the form of scientific work to students, so that they can form a scientific attitude and can increase students' responsibility towards the natural environment and the natural resources in the surrounding environment (Prasetya et al., 2022). If teachers do not master teaching strategies, then students will find it difficult to receive the lesson material perfectly. Teachers are required to innovate in learning so that student learning outcomes are satisfactory. As facilitators, teachers are expected to be able to modify or apply new methods that students like to increase their activeness. One of the most important roles of teachers is to be able to educate and prepare students for the future through creative, open, and enjoyable learning activities (Angga et al., 2022). The development of LKPD based on a scientific approach to science learning is intended to increase creativity and the ability to think systematically, logically, and critically for students in accordance with the implementation of the Independent Curriculum (Utariadi et al., 2021; Widiyanti & Nisa, 2021). Science learning at the elementary school level cannot be separated from scientific characteristics that are based on a scientific approach. Students' skills in constructing a concept through scientific activities will not be achieved by themselves without efforts and supporting facilities (Pebriani et al., 2022; Wahono et al., 2022). Innovation that can be applied in writing LKPD is by combining Student Worksheets (LKPD) with the concept of learning based on a scientific approach. The existence of learning tasks in LKPD can help students train their reasoning and problem-solving skills in everyday life (Febriandi et al., 2020).

The urgency of this research is The lack of learning media that can stimulate students' critical thinking skills results in low student learning outcomes. Therefore, this study aims to analyzing the effectiveness of LKPD based on a scientific approach to the material of light and its properties to improve student learning outcomes in grade V. The novelty of this research is that the LKPD created contains scientific approach steps, which are able to stimulate students' critical thinking skills and problem-solving skills. This research is expected to be able to help teachers in implementing scientific approach steps in learning, especially in science subjects.

2. METHOD

This type of research is development research. In this development research, the researcher uses the ADDIE model. This model consists of five steps, namely analysis, design, development, implementation,

and evaluation. The subjects of the effectiveness test of this research were 14 fifth grade students. At the product trial stage, it must be carried out to find out whether the product being developed is valid or not before carrying out the product effectiveness test stage. The data collection methods used were observation, questionnaires, and tests. The instruments used were questionnaire sheets and multiple-choice tests. Before the instrument can be used, a grid is first made. The grid of material experts can be seen in [Table 1](#), media expert grid on [Table 2](#), teacher response grid on [Table 3](#), student response grid on [Table 4](#), and the effectiveness test grid on [Table 5](#).

Table 1. The Grid of Material Expert Research Instruments

No.	Aspect	Indicator
1.	Curriculum	1. Suitability of material with basic competencies 2. Suitability of materials to learning objectives
2.	Material	3. Truth of the material 4. Material luck 5. Coverage of material 6. The importance of material 7. The material is supported by appropriate media 8. The concepts presented can be clearly explained logically. 9. Easy to understand material
3.	Grammar	10. Use of appropriate and consistent language 11. The language used is appropriate to the characteristics of the students

Source: [Suarthama \(2016\)](#) with modification

Table 2. The Media Expert Research Instrument Grid

No.	Aspect	Indicator
1.	Cover Design	1. The Attraction of LKPD 2. Image clarity 3. Easy to read writing 4. The attraction of color
2.	Appearance	5. Clarity of writing 6. Placement of titles, subtitles, and illustrations is correct 7. Color Matching 8. Correct use of letters 9. Layout according to 10. Image size is appropriate 11. Harmonious color composition 12. Combination of text and images 13. Presentation of LKPD based on scientific approach

Source: [Suarthama \(2016\)](#) with modification

Table 3. The Teacher Response Instrument Grid

No.	Aspect	Indicator
1.	Objective	1. Clarity of learning objectives 2. Consistency between material objectives and evaluation
2.	Strategy	3. The delivery of the material provides logical and systematic steps. 4. Delivery of material follows an effective learning design 5. Helps to remind previous skills and knowledge 6. Learning activities can motivate students 7. Provide students with opportunities for independent learning 8. Providing study instructions
3.	Evaluation	9. Provide practice questions for conceptual understanding 10. Clarity of product instructions for completing questions

Table 4. The Student Response Instrument Grid

No.	Aspect	Indicator
1.	Content/Material	1. Ease of understanding the material 2. Clarity of material content
2.	Appearance	3. The Attraction of LKPD

No.	Aspect	Indicator
		4. Image clarity and color attractiveness
		5. The writing can be read easily
3.	Motivation	6. LKPD can provide enthusiasm in learning
4.	Operation	7. Ease of use of LKPD
		8. Fluency in using LKPD
5.	Evaluation	9. Clarity of instructions for questions
		10. Effective in providing feedback

Table 5. The Multiple Choice Test Instrument Grid

Learning Outcomes	Material	Question Indicator
Students are able to explain light and the properties of light through simple experiments.	Properties of Light	Analyze the source of vision Choosing the correct properties of Light Identifying the properties of light that occur in an image Analyzing experiments on the properties of light Observing the occurrence of body shadows can change Analyzing the process of shadow formation in humans Analyzing the properties of light that occurs Selecting the correct properties of light for the question statement Analyzing why trees can be seen from the window Choose the properties of light that match the question statement
Students can recognize the types of mirrors	Getting to know the types of mirrors	Choosing the type of mirror Choosing the right mirror properties for a plane mirror image Choosing the right mirror properties for convex mirror images Identify the type of mirror in the image Choosing the type of mirror based on the type of mirror

In research on the development of learning media This scientific approach-based LKPD on the material of Light and Its Properties uses three data analysis techniques, including qualitative descriptive analysis techniques, quantitative descriptive analysis techniques, inferential analysis techniques (t-test). Qualitative descriptive analysis techniques are used to manage data from expert trials on subjects, learning design experts, learning media experts and students. This analysis technique is carried out by concluding data on the findings of the research results. The data produced is in the form of input, suggestions and criticisms for improvement from the results of the questionnaire and interviews. The data from the analysis will be used to revise the product to be developed. Quantitative descriptive analysis in this study is used to process data that has been obtained through questionnaires in the form of a Likert scale on a data processor using a four-scale assessment.

Inferential statistical analysis aims to determine the level of product effectiveness on student learning outcomes before and after using the developed learning media development product. Student trial data was obtained through pre-test and post-test. From the results of the pre-test and post-test obtained, a t-test analysis will be carried out which aims to determine the difference between the pre-test and post-test results. In conducting a hypothesis test (dependent sample t-test) the first step is the prerequisite test (normality). After going through the normality test, the next stage is the hypothesis test. The analysis technique used for hypothesis testing is the dependent sample t-test technique. This study will test the effectiveness of LKPD teaching materials based on a scientific approach before and after using the product in one group.

3. RESULT AND DISCUSSION

Result

This research was conducted in class V of SD Negeri 2 Banjar Bali. The subjects in this study were all 14 students of class V. The development of LKPD based on a scientific approach in the subject of science was carried out using the ADDIE model which includes several stages, namely analysis, design, development, implementation, and evaluation. The activities carried out by researchers at each stage of development are. In the first stage, namely analysis which aims to find out the problems faced and the

appropriate solutions to find out the problems. The problem that arises is the boredom of students in participating in learning activities that only use textbooks.

The second stage is the analysis stage which is carried out by adjusting the media development that has been made, namely LKPD which uses a scientific approach. The third stage is the design stage, which is based on the results of the analysis that has been carried out previously. The media design is adjusted to the learning objectives to be achieved. At this stage, the format or concept design is carried out for the product developed based on the results of the analysis such as determining the main material and learning objectives, as well as determining the media to be developed and making a storyboard.

The next stage is the development stage which is carried out by developing or creating a product that has been designed previously. At this stage, the components that will be used in developing media, creating material designs, media using the help of the Canva application are made. The purpose of this development stage is for the guidance process and revised by experts, both media and material experts. The level of practicality of the media is carried out by one teacher and 13 fifth grade students at SD Negeri 2 Banjar Bali. The expert validation stage is carried out using a questionnaire given to experts who will obtain values and input from experts and will then be revised to improve an instrument and product to be developed. The appearance of the media that has been developed can be presented on Figure 1.



Figure 1. Display of LKPD Media Based on A Scientific Approach

The implementation stage involves the use of media that has been validated by experts and tested on teachers and students, then applied to 13 fifth grade students at SD Negeri 2 Banjar Bali. The trial was conducted using a Pretest and Posttest research design using an initial test given before the start of the treatment and conducting a final test after using the scientific approach-based LKPD media. The scientific approach-based LKPD media was validated by lecturers who are experts in their fields. Product assessment uses an instrument in the form of a questionnaire. The results obtained that the score of 80% is in the qualification of feasible, so that the scientific approach-based LKPD product in terms of material has good quality. The results obtained from media experts showed that the score of 91% is in the qualification of very feasible, so that the scientific approach-based LKPD product in terms of learning media has very good quality.

The product practicality test was assessed by one teacher, Mrs. Salamah, S.Pd. as the homeroom teacher of grade V of SD Negeri 2 Banjar Bali to obtain teacher responses. The calculation result of 100% is in the very practical qualification and can be used without revision. The product practicality test was also conducted by 13 grade V students at SD Negeri 2 Banjar Bali to obtain student responses. The data obtained based on the media practicality test is presented in the form of scores on each instrument item. The results of the media practicality test by 13 grade V students showed a percentage of 94%. This percentage was then converted using the media practicality category table. After conversion, the value of 94% was included in the very practical qualification and was stated to be usable without revision.

Effectiveness testing was conducted on fifth grade students of SD Negeri 2 Banjar Bali. Effectiveness testing was conducted by implementing development products in the form of learning media into the learning process. Effectiveness testing was conducted to analyze the effect of media use on student learning outcomes. The prerequisite tests conducted in this study included data distribution normality tests and variance homogeneity tests. Based on the results of the data distribution normality test using the IBM SPSS

version 25 for Windows application, the Shapiro-Wilk test results obtained sig. value for pretest data of 0.066 and sig. value for posttest data of 0.114. Because the sig. value for pretest data and posttest data > 0.05, it can be concluded that the data is normally distributed.

Based on the results of the homogeneity test of data distribution using the IBM SPSS version 25 for Windows application, the pretest and posttest data obtained a sig. value of 0.522 > 0.05. So it can be concluded that the pretest and posttest data have homogeneous variance. All analysis prerequisites related to the paired sample t-test analysis / correlated sample t-test have been met. Therefore, the paired sample t-test analysis / correlated sample t-test can be used to test the hypothesis of this study. The results of the hypothesis testing in this study using the paired sample t-test / correlated sample t-test. Based on the results of the paired sample t-test analysis / correlated sample t-test using the assistance of the IBM SPSS 25 for Windows assistance program, a significance value (sig. 2-tailed) of 0.000 < 0.05 was obtained, H_0 was rejected and H_1 was accepted. So it can be concluded that there is a significant difference in student learning outcomes on the material of light and its properties before and after the use of LKPD based on a scientific approach.

The final stage of media development is the evaluation stage. In this activity, the product was tested on 13 fifth grade students of SD Negeri 2 Banjar Bali. After the trial before the provision of scientific approach-based LKPD media treatment, students' understanding of light and its properties got an average of 66.6, while the trial after the provision of scientific approach-based LKPD media treatment got an average value of 82.3. In this case, this scientific approach-based LKPD media is suitable for use in improving student learning outcomes on light and its properties.

Discussion

The results of data analysis on the development of LKPD based on a scientific approach to the material of light and its properties aim to help students improve their understanding of the material related to light and its properties. In addition, the LKPD media based on a scientific approach is designed attractively and equipped with steps for its use, so that it can increase students' enthusiasm and creativity in participating in learning activities. Learning is an effort by a teacher to teach their students. Learning and teaching are very important things for humans, in learning a student can improve their knowledge and problem-solving skills (Putra & Rezania, 2023; Wulandari et al., 2023). To support these activities, adequate learning tools are needed that are appropriate to the needs.

Good learning tools will determine the quality of learning. To support this learning, what can be developed is a scientific-based LKPD for the material of Light and the Properties of Light at SD Negeri 2 Banjar Bali, considering the rapid development of technology in accordance with the progress of the times. Thus, learning can be created creatively and innovatively by utilizing technology. Student Worksheets (LKPD) as teaching materials are not developed enough for students, so students are given assignments through oral assignments and assignments in student textbooks (Sosramaiton & Erita, 2022; Muslimah, 2020). If teaching and learning activities still tend to be passive, students will have difficulty understanding the material, especially in the Natural Sciences subject on the material Light and its properties.

One of the most needed teaching materials for teachers and students in the learning process is LKPD. The advantage of LKPD is that it can simplify and understand learning so that learning becomes more effective. In general, LKPD is a learning tool as a complement or supporting tool for implementing learning plans (Nabela & Bayu, 2022; Komarudin & Permana, 2019). LKPD can be in the form of sheets containing assignments that are done by students. Activity sheets are in the form of instructions, steps in the learning process, and also contain assignments and must be done by the students themselves. LKPD is one of the sources or teaching materials consisting of several sheets which contain learning materials, summaries, or instructions for learning and implementation of assignments and must be done by students referring to the indicators that must be achieved (Ruci et al., 2023; Panesti et al., 2022).

The scientific approach is a learning process that has been designed in such a way that students can actively build concepts or principles through the stages of observing, formulating problems, formulating hypotheses, collecting data using various techniques, analyzing data, drawing conclusions and communicating the concepts or principles that are discovered (Utariadi et al., 2021; Rohmah & Abdullah, 2020). Learning with a scientific approach is learning that requires students to think systematically and critically in solving problems whose solutions are not easily seen.

The scientific model is a learning model based on a scientific approach that aims to develop students' ability to solve problems through inquiry activities that develop critical, creative, and communication thinking skills (Pebriani et al., 2022; Prasetya et al., 2022). The characteristics of LKPD using a scientific approach are, centered on students, involving science process skills in building concepts, laws or principles, involving cognitive processes that have the potential to stimulate intellectual development,

especially students' high-level thinking skills, and can develop students' character (Herlyana et al., 2022; Nabela & Bayu, 2022).

Based on the description, a scientific approach-based LKPD was developed on the material of Light and Its Properties in Grade V of Elementary School to support the active learning process of students. The IPS material in schools emphasizes more on students' learning experiences so that they can develop competencies in understanding nature scientifically. IPS is related to everyday life and can be applied in solving problems in life. The scientific approach is in line with the IPS material, because learning with a scientific approach in providing a learning process in the form of experience to students so that students actively carry out activities in learning. The existence of a scientific approach-based LKPD, especially on the material of light and its properties, students will not feel bored and of course can arouse students' enthusiasm for learning with interesting learning and activate students. Students' enthusiasm for learning can make it easier for them to understand the material and help achieve good grades.

Innovative Student Worksheets are very important in supporting the 21st century learning process. This is in line with previous research which revealed that the development of innovative LKPD is very important to meet the demands of 21st century learning as teaching materials, practical work, reasons for boredom, technological developments, and the impact of the pandemic (Suryaningsih & Nurlita, 2021; Safitri & Kabiba, 2020). The results of this study are expected to be used in the development of innovative LKPD in the science learning process. Other studies also state that the use of LKPD in learning greatly influences student learning outcomes, namely making students more active and happy to follow learning (Putra & Rezania, 2023; Magdalena et al., 2021).

The novelty of this LKPD is that it contains scientific approach steps that can help stimulate students' critical thinking skills and problem-solving skills. The implications of this study are that the development of LKPD media based on a scientific approach is stated to have good quality and is effective for use as a learning medium, especially in the subject of Science on the material of light and its properties. Thus, teachers can have additional sources that can be used as learning media. Students of grade V of SD Negeri 2 Banjar Bali can use LKPD media based on a scientific approach that has been developed to get fun and meaningful learning activities. This study can increase teacher motivation and insight to be more creative and innovative in utilizing technology as a learning medium and increase the variety of learning media availability in schools that are suitable for use in the learning process.

Although this research has been successfully conducted, it is undeniable that this research has several limitations. The limitation of this research is the development of student worksheet media (LKPD) based on a scientific approach is based on a needs analysis in class V of SD Negeri 2 Banjar Bali, so that the student worksheet media (LKPD) developed is in accordance with the conditions in the field. The development of student worksheets (LKPD) based on a scientific approach is limited to science learning on the material of light and its properties, so that other learning that wants to be developed needs to be adjusted. Based on these limitations, it is hoped that other studies can develop LKPD with a deeper problem analysis and broader research subjects.

4. CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the innovation of LKPD based on the scientific approach that was developed has proven to be effective in improving the learning outcomes of grade V students of SD Negeri 2 Banjar Bali. The development of LKPD media based on the scientific approach is stated to have good quality and is effective for use as a learning medium, especially in the Science subject on the material of light and its properties. Thus, teachers can have additional sources that can be used as learning media.

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