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Science Materials with Guided Discovery Methods to Increase Problem Solving Ability for Junior High Schools

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ABSTRAK

Pembelajaran Sains bertujuan agar cakap menyelesaikan masalah dan metode penemuan terbimbing sudah terbukti sebagai metode pembelajaran untuk meningkatan kemampuan penyelesaian masalah. Namun metode ini belum banyak dilakukan karena para guru mengalami kesulitan dalam merancang pembelajaran ini. Penelitian ini bertujuan untuk menghasilkan materi pembelajaran IPA dengan menggunakan metode The Guided Discovery untuk pembelajaran penyelesaian masalah bagi siswa sekolah menengah pertama dengan topik Cahaya. Subjek penelitian ini adalah siswa kelas VIII. Data dikumpulkan dengan kuesioner dan tes. Kuesioner digunakan untuk mendapatkan kelayakan produk, dan tes digunakan untuk mengukur efektivitas produk. Analisis data menggunakan persentase, paired t-test, dan one-way ANOVA. Hasil penelitian menunjukkan bahwa, produk pengembangan memenuhi kelayakan sebagai bahan pembelajaran yang efektif untuk membangun kemampuan penyelesaian masalah. Sehingga dapat dikatakan bahwa, produk untuk mata pelajaran IPA dengan menggunakan metode Guided Discovery layak dan efektif digunakan sebagai bahan ajar untuk mengembangkan kemampuan pemecahan masalah bagi siswa SMP, khususnya pada materi Cahaya. Implikasi dari penelitian ini menunjukkan bahwa produk bahan ajar IPA berbasis metode Guided Discovery sangat potensial untuk diterapkan di lingkungan pembelajaran SMP, terutama dalam topik Cahaya.

ABSTRACT

Science learning aims to improve problem-solving skills, and the guided discovery method has been proven to improve problem-solving skills. However, this method has not been widely practiced because teachers have difficulty designing this learning. This research aims to produce science learning materials using The Guided Discovery method for problem-solving learning for junior high school students on Light. The subjects of this study were VIII-grade students. Questionnaires and tests collected data. Questionnaires were used to obtain product feasibility, and tests were used to measure product effectiveness. Data analysis used percentages, paired t-tests, and one-way ANOVA. The results showed that, the development product meets the feasibility of being an effective learning material to build problem-solving skills. So, it can be said that products for science subjects using the Guided Discovery method are feasible and effective to be used as teaching materials to develop problem-solving skills for junior high school students, especially in the material of Light. The implication of this research shows that the product of science teaching materials based on the Guided Discovery method has the potential to be applied in the junior high school learning environment, especially in the topic of Light.

1. INTRODUCTION

Problem-solving skills are becoming the most important skill of the 21st century. This is due to the occurrence of very fast and non-linear changes that cause various problems with an increasingly complex level. This condition is inseparable from the influence of advances in communication technology, *the internet of things*, automation in various aspects of human life and the emergence of *Artificial Intelligence* (AI). The preparation of human resources to be able to face the challenges of this change is the ultimate goal of Education. The OECD conducts PISA (International Student Assessment) test in 2018 showed the low thinking ability of Indonesian students and placed Indonesia in 7th position from the

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bottom. The PISA measures the ability of 15-year-olds to use reading, mathematics and science knowledge and skills to face real life challenges and the average score of Indonesian students in 2022 will decrease compared to 2018 in the fields of mathematics, reading and science (Dilekçi & Karatay, 2023; PISA, 2023). This survey provides an illustration that on a global scale, Indonesian students' thinking abilities are very low. In science, the 2022 PISA survey also found that: Indonesian students 66% do not understand science. Achievement of mathematical understanding at levels 1 and 2 or classified as Low Order Thinking (LOT) skills. The achievement of math scores at a level that is classified as low-level thinking can be interpreted the same in aspects of science because these two aspects are closely related. The goal of teaching Math and science in school is to improve student's thinking abilities (Hillmayr et al., 2020; Huang et al., 2017; Thahir et al., 2021; Yudha et al., 2024).

Student learning outcomes are determined by several causes, among which the most important is the teaching method. HOT skills can be obtained when the learning methods used expose students to the context of finding and solving problems because this is how cognitive structures work. Building thinking skills in problem solving can only be done if teachers use teaching methods that provide the widest possible opportunity for students to find problems and interact with problems to find solutions. Science subject is oriented to students' ability to solve problems in real life because students can directly observe and discover various phenomena themselves by applying guided discovery learning methods or *guided discovery*. Discovery learning becomes more meaningful because the material learned in school is related to life situations and problems that occur in the student's environment. Discovery learning provides a focus on scientific processes such as observing, classifying, surmising, measuring, making inferences and communicating what is being done. Students' problem-solving skills can foster a sense of fun because the material learned in school can be found in students' lives. For example, the subject of light contains many concepts that must be understood in depth through discovery activities where Learning *guided discovery* In light reflection material can improve critical thinking skills (Cahyaningtyas et al., 2023; Hermayuni et al., 2022; Suryanti et al., 2020; Wang et al., 2020).

Teachers have difficulty using guided discovery methods and having difficulty applying it starting from understanding concepts, designing and preparing learning materials, evaluation and so on. The guided discovery method is a method that applies scientific processes so that teachers need to design learning materials so that in its implementation scientific process skills can be experienced by students (Afifah & Retnawati, 2019; Jauhariyah et al., 2021). The ability to design effective learning materials is a professional teacher skill that must continue to be developed. The design of problem-based science learning materials is a teacher's professional work that never stops in line with the development of knowledge and needs to be adjusted based on the characteristics of the content. Learning materials consist of: Lesson Plans, Student Textbooks, Student Activity Sheets and Problem-solving Ability Test Kits, which are developed oriented to the Guided Discovery method to improve problem-solving skills. A good learning process will not be separated from learning materials that are in accordance with the competencies developed. Research as an effort to provide solutions to the difficulties faced by teachers is by producing learning material with *guided discovery* that meets expert eligibility and effectiveness in the hope that educators can continue and become learning that can be developed (Darling-Hammond, 2021; Kurnianto & Sarwono, 2023). The preparation of teaching materials that use a scientific approach is very important (Hermayuni et al., 2022; Ryantini et al., 2022).

LOT skills are usually the result of learning with expository methods or better known as conventional methods. Meanwhile, HOTS learning objectives are sought from discovery learning and problem solving (Budiarto et al., 2022; Wati et al., 2019). Science subject naturally contains natural phenomena that require observation, discovery and research to find out existing phenomena so that methods that are problem discovery are direct implications of the characteristics of this field of study. If the results of learning science are classified as LOT, it can be suspected that school science teachers have not used learning strategies with discovery and problem-solving approaches. The teachers must continue to learn and practice to be professionals in teaching skills according to the characteristics of the subjects taught (Cao et al., 2023; Degeng & Degeng, 2018; Wang et al., 2020; Wati et al., 2019). One reason the method of teaching invention has not been implemented is because this method is difficult (Afifah & Retnawati, 2019; Cahyaningtyas et al., 2023). A preliminary study at SMP Negeri 17 Surabaya (this research) with the technique of distributing questionnaires to 6 science teachers found that: 1) There are 4 teachers who still often use the lecture method and 2 teachers for every 1 basic competence to carry out practicum activities in the laboratory; 2) Science teachers are only able to provide assessments from cognitive aspects and 3) Through the test of problem-solving ability tests given to grade VIII B students obtained an average score of 58.4. Junior high school students' understanding of science and problem-solving skills are still relatively low. The low problem-solving ability and the difficulty of teachers to apply the method of teaching discovery need to be found a solution. One solution is the availability of learning

materials that apply the concept of discovery methods and this is the main reason for the author to conduct this development research. From the explanation above, it can be said that, this research offers innovation by producing science teaching materials specifically designed using the *Guided Discovery* method for the topic of Light, which meets the criteria for feasibility and effectiveness as a teaching device.

The novelty of this research lies in the development of devices that not only facilitate guided discovery activities, but are also able to be implemented practically by teachers, answering the difficulties faced in teaching science. The urgency of this research is high, given the need for teaching tools that are in accordance with the characteristics of science materials and the target of improving students' problem solving skills. The purpose of this research is to develop and test the feasibility and effectiveness of *Guided Discovery-based* science teaching materials on Light material, which is expected to be a reference for learning and strengthening students' problem solving skills at the junior high school level. The implementation of this product can support efforts to improve the quality of science education in schools and assist teachers in designing effective learning despite experiencing obstacles in applying the guided discovery method.

2. METHOD

The development procedure followed the Kemp Model as follows: (1) identification of learning problems: the author distributed the survey to 6 science teachers and all of them have not used the guided discovery learning method, (2) analysis of user characteristics: the survey results found that students' problem-solving abilities were still low, (3) content identification and task component analysis; adjusted to curriculum guidelines and topic content Light (4) develop learning objectives: carried out in accordance with the existing curriculum (5) sort the content in each teaching unit; adjusted to the learning objective indicator on the topic of Light (6) designing teaching and learning; using the steps on the guided discovery method (7) planning instructional delivery methods in learning and teaching; adjust to content and indicators (8) develop evaluation instruments; The evaluation carried out in this section is a formative evaluation that aims to assess the feasibility of the product and the effectiveness of the product in improving students' problem-solving skills and (9) choosing media for learning activities: not done because the purpose of this research is to produce learning materials and this stage is carried out in separate learning activities. After the product is developed, expert assessments and trials are continued to students to measure the effectiveness of the product. The research method used is research and development (R&D) to produce learning materials using guided discovery methods consisting of: (1) Lesson Plans (RPP), (2) Student Textbooks (Buku Ajar Siswa or BAS), (3) Student Activity Sheets and (4) Problem-solving Ability Test Kits. The subject of this research was in junior high school science learning on the subject of Light. Small group trials (trial I) were conducted on 12 of grade VIII.I students. Learning trials or large groups (trial II) were carried out on grade VIII students as many as three classes of 27 students each. This research was carried out at SMP Negeri 17 Surabaya. The data needed to measure product feasibility and effectiveness are quantitative data collected by questionnaire and test distribution techniques. The variables observed in this study are: 1) Validity of learning materials: conceptual validity and readability of learning materials; 2) Practicality: Implementation of learning, student activities during the learning process and constraints and 3) Effectiveness: Tests of problem-solving ability and student responses to learning activities.

The instrumens such as: 1) Lesson Plans conceptual validity sheet: Lesson Plans validity sheet, student textbook validity sheet, student activity validity sheet, and test question validity sheet; 2) Readability Fill Sheet: This readability fill sheet is given to students who are then asked to complete certain words that have been prepared in advance by the researcher; 3) Lesson Plans Implementation Observation Sheet: this implementation sheet is given to two observers who observe the implementation of learning in class directly; 4) To find out the obstacles that arise during the teaching and learning process; 5) Student Activity Observation Sheet: This student activity observation sheet is filled in according to the activities carried out by students during the teaching and learning process; 6) Student Response Questionnaire Sheet: Student response questionnaire sheets are used to determine student responses to the teaching and learning process and the materials used during learning. This study includes several instruments to measure the effectiveness of learning and students' responses to the guided discovery method. First, the validation of the Learning Implementation Plan (RPP) was conducted through a validation sheet scored by experts, with a checklist mark (✓) in the available column, and the results were calculated by finding the average of the two validators. The validity of the readability of the Student Worksheet (LKS) and Student Teaching Book (BAS) was obtained through a test by filling in words that were deliberately omitted in the rumpang paragraph; this readability data was then calculated

by comparing the number of words that were correctly filled with the total words to be filled, multiplied by 100%.

The implementation of the lesson plan was measured through observation of learning activities by two observers, who also gave checklist marks (✓) and scores in the assessment column; the final score was obtained from the average of the two observers' assessments. Barriers in learning were identified through observation and analyzed descriptively. Students' activities were observed during the learning process, with observers giving checklist marks (✓) and scores in the assessment column to measure activeness. To test problem solving ability, pretest and post-test tests were used in the form of 10 description questions. Scores were given based on the level of logicality, systematicity, and coherence of the answer, from a score of 4 (perfect answer) to 0 (wrong answer or no answer), and this data was then analyzed to measure the improvement of problem solving ability. Finally, students' response to this learning method was measured using a questionnaire prepared by the researcher, and students were directed to fill in the questionnaire honestly and objectively, although this data did not affect the results of students' problem solving ability. Measurement of the effectiveness of learning materials in trials I and II with *one group pretest-and post-test design*, developed by Campbell and Stanley (Arikunto, 2010; Bajracharya, 2019),

3. RESULT AND DISCUSSION

Result

The following is an example of a lesson plan presented as follows. *Phase 2*: Orientation of learners to the problem. (1) The teacher explained in simple terms that the type of light reflection they observed depended on the type of surface of the reflecting plane. Showing an exposure about light reflection?. (2) The teacher divides the class into groups of 3-4 learners. (3) The teacher distributes LKS 0.1a to each group then explains the steps in the discovery activity that in activity 0.1a they read the exposure and observe the picture, then based on observation identify the problem and formulate the problem. *Phase 3*: Formulating hypotheses. The teacher guides and asks each group to discuss to formulate hypotheses, identify variables and design experiments in discovery activities in LKS 0.1a. *Phase 4*: Conduct discovery activities. (1) Teachers guide students to formulate problems, formulate hypotheses, identify variables, and design experiments; (2) Students are asked to prepare the necessary materials / materials and conduct experiments that have been designed on LKS 0.1a; (3) The teacher explains the materials that will be used in discovery activities as well as important things that must be considered. Among other things, learners must be careful in observation and experiment activities because there are some materials that can be damaged or broken. (4) The teacher guides the learners, conducts experiments, records the results of the experiments.and makes conclusions. The teacher distributes LKS 0.1b, then asks students to continue with Activity 0.1b. with steps as in LKS 0.1a. Guiding students to be able to formulate explanations related to light reflection.

Phase 5: Presenting the results of discovery activities. (1) Provide opportunities for students to represent their groups to present or present the results of their observations and other groups provide responses to write data and conclusions on the board, this aims to be discussed with other groups. The teacher guides the learners to formulate conclusions. Phase 6: Evalauding discovery activities. (1) The teacher guides students to re-reveal the process of discovery activities and the results of their discoveries. Provide opportunities for students to express or express opinions about the application of light reflection in everyday life. Provide questions related to concepts that have been learned. Phase 6: Evalauding discovery activities. (1) Summing up the learning that has been done and training students to solve problems really through real evidence so that students find their own solutions to the problems faced, and draw conclusions correctly. Give awards to groups that are best in conveying the results of group discussions. Provide advanced practice questions to train students in solving problems. **Sampple of Student Learning Materials; "**Pernahkah kamu merasa takut dengan bayangbayangmu sendiri? Pernahkah kamu membuat bayang-bayang di dinding dengan tanganmu? Mengapa bayang- bayang dapat terbentuk? Bayang-bayang terjadi sebagai akibat cahaya merambat pada garis lurus. **Bayang-bayang** merupakan suatu daerah gelap yang terbentuk pada saat sebuah benda menghalangi cahaya yang mengenai suatu permukaan.**"** After the products are developed, it were followed by a review by several experts and tested on the students. These werevdone to assess the feasibility of the product and the effectiveness of the product as a learning material. Data analysis for validation of learning materials is carried out by qualitative descriptive analysis, namely by averaging the scores of each component. The average score results of Lesson Plans validation can be seen in Table 1.

The result indicated that the science materials with the guided discovery method are feasible to use as instructional materials and the developer continue the step to measure the effectiveness of the

product in increasing Problem-Solving Ability in Junior High Schools by statistical test. The statistical tests were Normality Test, Homogeneity Test, paired t-test and one-way ANOVA test conducted using SPSS-Version 17.0 software. The feasibilyt of Student Worksheets are measure with observation during learning can be seen briefly in Table 2.

Table 1. Average validation score for Lesson Plans

No	Assessment aspect	Valuation		Mean	Ket.
		V1	V2		
I.	**Format**				
1.	Clarity of Material Division	4	4	4,00	Good
2.	Numbering system	4	5	4,50	Very Good
3.	Room/layout arrangement	4	4	4,00	Good
4.	Type and font size accordingly	4	5	4,50	Excellent
II. Contents					
1.	Write down Basic competencies.	4	5	4,50	Excellent
2.	Writing Indicators	3	4	3,50	Good
3.	Write down learning objectives	4	4	4,00	Good
4.	Accuracy between indicators and basic competencies	3	4	3,50	Good
5.	Accuracy between indicators and learning objectives	4	4	4,00	Good
6.	Correctness of content/material	4	4	4,00	Good
7.	Grouped in logical parts.	4	4	4,00	Good
8.	Compliance with 2013 curriculum competency standards	4	5	4,50	Excellent
9.	Strategy selection. The approach, methods and means of learning are carried out appropriately, allowing students to actively learn.	4	4	4,00	Good
10.	Teacher activities and student activities are clearly and operationally formulated, making it easy to implement in classroom learning.	4	4	4,00	Good
11.	Compatibility of the material with the Guided Discovery method to improve problem-solving skills	4	4	4,00	Good
12.	Compliance with the order of the material	4	4	4,00	Good
13.	Suitability of time allocation used	4	4	4,00	Good
14.	Feasibility as a learning tool with *guided discovery* learning methods to improve problem-solving skills	4	4	4,00	Good
III.	**Language**				
1.	Grammatical correctness	4	4	4,00	Good
2.	Simplicity of sentence structure	4	5	4,50	Very Good
3.	The language used is communicative	4	5	4,50	Excellent
Rata-rata		**82**	**90**	**4,01**	**Good**
Reliability Level				**91 %**	

Table 2. Results of Student Activity Observations

No	Observed activities	Classes			Mean
		VIII D	VIII E	VIII F	
1	Read and understand phenomena in LKS	16.20	16.29	16.12	16.20
2	Discuss/ask questions between friends	16.35	16.35	16.67	16.46
3	Formulate problems and Finding a way to solve	16.63	16.58	16.67	16.63
4	Design and conduct experiments	16.68	16.48	16.42	16.53
5	Analysed data	15.78	15.94	15.63	15.78
6	Drawing conclusions from procedures and concepts	14.12	14.42	14.32	14.29
7	Irrelevant activities	4.25	4.15	4.17	4.19
Average reliability				**94.86 %**	

After all materials meet the feasibility, the product is used as a learning material and its effectiveness is measured to improve problem-solving skills. The effectiveness of learning materials can be seen from: student activities, student responses, and student problem-solving ability tests. The results of student responses shown in Table 3 show an average score of 87.45% with a very good category.

Table 3. Student Response Result

No	Response Categories	Score			Mean	Category
		Class VIIID	Class VIIIE	Class VIIIF		
1	Students feel interested in the learning component (interest)	88.89	87.65	86.42	87.65	Excellent
2	Students feel new to the learning component (up-to-date)	89.51	88.27	88.89	89.30	Excellent
3	Students get ease in understanding the components of learning devices and activities (level of learning difficulty)	91.85	86.67	88.15	88.89	Excellent
4	Students give affirmative responses if the next subject uses the Guided Discovery method learning method (student interest in the learning method)	88.89	88.89	81.48	88.48	Excellent
5	Students are easy to accept learning (Easy in learning)	87,04	85.19	87.04	86.42	Excellent
6	Students easily solve problem-solving skills problems (Ease of problem-solving skills)	81.98	85.19	85.19	83.95	Excellent
				Mean	**87.45**	**Excellent**

Before conducting the pre-test and post-test, a normality test is carried out first. The results of test of the pre-test and post-test problem-solving skills is normal which means sample data from a normally distributed population. Furthermore, the results of Pre-test and Post-test scores of problem-solving abilities were analysed using paired t-tests to measure the significance of the impact of learning implementation with the Guided Discovery method on increasing problem-solving ability. The condition of the t-test is normally distributed data. The calculation of t-test values is carried out using the help of the SPSS-Version 17.0 program presented in Table 4.

Table 4. Paired t-test Pre-test and Post-test Problem-solving Skills

No	Class	t_{table}	$t_{calculate}$	df	Signis(2-tailed)	Signifies Taraf (α)
1	Pre-test Kelas D Post-test Class D	-1.703	-53.565	26	0.000	0.05
2	Pre-test Kelas E Post-test Kelas E	-1.703	-54.427	26	0.000	0.05
3	Pre-test Kelas F Post-test Kelas F	-1.703	-55.323	26	0.000	0.05

Based on Table 4, it indicated that $t_{count} < -t_{table}$ is -53.565 < -1.703 in t test pre-test and post-test class VIIID values, -54.427 < -1.703 in t test pre-test and post-test class VIIIE values, and -55.323 < -1.703 in t test pre-test and post-test value sclass VIIIF so it can be concluded that Ho was rejected which means that there are significant differences in pre-test and post-test scores of problem-solving skills in both classes VIIID, VIIIE, and VIIIF. This can mean that the value of the post-test score is higher than the pre-test. Based on the t-test that $t_{counts} < -t_{tables}$, it can be concluded that there is a significant increase in problem-solving ability at a significance level of 5%. The calculation of *N-Gain* carried out on indicators of students' problem-solving ability can be briefly shown in Table 5.

Each student experienced an increase in problem-solving skills with an average *N-gain* of VIIID = 0.79, VIIIE = 0.77 and VIIIF = 0.80, respectively, which is in the high category. Thus, the results of the analysis are as follows: 1) There is an increase in students' problem-solving skills on light material after applying the *guided discovery* model; 2). The average result *of the N-Gain* score of 0.79, then entered the range (> 0.7), it can be concluded that the learning carried out has a high gain. *One-Way ANOVA Test*

Result. The consistency of the effect of learning on improving problem-solving skills in the three classes can be seen from the results of *one-Way ANOVA* test by first meeting the prerequisites of normality and homogeneity of *N-Gain* values from the three classes obtained data as in Table 6.

Tabel 5. Achievement of Problem-Solving Indicators

No.	Indicators	N-gain			*N-gain Mean*	Category
		Class VIII D	Class VIII E	Class VIII F		
1	Understand the problem	0.80	0.77	0.78	0.78	High
2	Plan a breakdown	0.72	0.72	0.65	0.70	Averages
3	Implement strategies	0.80	0.78	0.80	0.79	High
4	Evaluate solutions	0.84	0.80	0.83	0.82	High

Tabel 6. Normality Test Results

Variable	Class	Kolmogorov Sminorv Z	Significant Level
N-Gain score	VIII D	0.108	0.200
	VIII E	0.121	0.200
	VIII F	0.199	0.009

Z-table at a significant rate of 5% = 0.254

Based on Table 6, since $Z_{count(kolmogorov\ Sminorv)} < Z_{table}$, it can be stated that the *N-Gain score data* of the three classes comes from a normally distributed population with a significant level of 5%. Based on the results of the N-Gain score test on students' problem-solving skills in classes VIII D, VIII E, and VIII F, a homogeneity test was carried out using the SPSS 17.0 program. Significant Degree is 0.351. Based on analysis data, since $T_{test} < F_{table}$, the variance of the three test classes is homogeneous at a significant level of 5%. So there is no difference in problem-solving ability between classes VIII D, VIII E, and VIII F. The variance test (one-way ANOVA *test*) using the SPSS 17 application program tool, obtained data as in **Table 7.** Based on Table 7, since $F_{test} < F_{table}$, it can be stated that there is no difference in average *N-Gain* between classes VIIID, VIIIE, and VIIIF at a significant level of 5%. This means that there is a consistent influence of learning on improving problem-solving skills in all three classes.

Tabel 7. Homogeneity Test Results

Source	Number of squares (JK)	Degrees of Freedom	Quadratic Mean	F_{test}
Group(K)	0.002	2	0.001	0.118
In (d)	0.575	78	0.007	
Group(K)	0.002	2	0.001	0.118
Total	0.575	80		

F-table (5% 2.78) = 3.11

Discussion

The results of this study indicate that a) The validity of product development is: Learning Implementation Plan (RPP) obtained an average score (4.01) in the good category with a reliability level of 96%; Student Teaching Book is very good (3.77) with a reliability level of 96.84%: Student Worksheet in the excellent category (4.30) with a reliability level of 95.35% and pretest or posttest questions on average valid. The high average validation score of 4.01 indicates that all aspects have good validation criteria. Furthermore, the reliability level of the assessment of the two validators was 91.11%, so that the lesson plans developed by researchers were categorized as valid and reliable and could be used for research. Good material. In order for there to be format suitability, the content aspects, especially between the clarity of learning activities and the suitability of problem solving indicators; b) Assessment of the validity of student textbooks that have been developed for three aspects of assessment, namely content feasibility, language and presentation, the average score obtained is 3.77, very good and has a reliability level of 96.84%, meaning that BAS is very valid/fit for use in research as a student learning resource. The material presented is arranged sequentially, taking into account the level of understanding of students, namely the material is presented from simple material to complex material. The results of the feasibility assessment of the student activity sheet obtained an average assessment of 4.30 which means the predicate is very good. And the reliability level is 95.35%. Student activity sheets based on these two data

can be interpreted as valid so that they are suitable for use as learning resources for students where the existence of student activity sheets has a considerable influence in the teaching and learning process, so that the preparation of student activity sheets must meet various requirements, namely didactic requirements, construction requirements, and technical requirements. c) The activities in the LKS are designed to assist students in improving problem solving skills. This student worksheet contains learning activities using guided discovery which refers to the scientific approach method (observing, questioning, trying, reasoning, and communicating). Thinking at this stage is increasingly logical and problem solving and scientific thinking which is included in the higher level of thinking (Gottschling et al., 2022; Harwati & Rokhmat, 2021).

Student achievement as measured by pretest-posttest questions is structured and developed based on 4 indicators. The four problem solving indicators used as a reference are (1) understanding the problem; (2) planning the solution; (3) performing calculations; (4) checking back/evaluating. The assessment conducted by the validator on this test question includes content and language validation categories. In content validation, the validation of question construction is also integrated, therefore only one of them is written. The pretest-posttest developed by the researcher after being revised and declared valid, understandable and without revision is suitable for research. The quality of the Student Teaching Book (BAS) and Student Worksheet (LKS) developed is not only seen based on the results of validation from experts, but also based on the level of readability. The readability of teaching materials greatly determines the success of achieving learning objectives. Therefore, students are expected to be able to understand learning materials without the help of others. In accordance with the Close test reference, it is known that the BAS and LKS developed are at a level suitable for learning if the percentage of readability or appropriate material for learning ranges from 40% to 60%. The average percentage of readability of BAS and LKS is 82.75% with a high category. This is in line with what is revealed that the vocabulary and sentences used in a reading passage greatly affect the level of readability. Another factor that also affects the readability level is the students' interest in the tools provided, both in terms of layout and attractive images are also very likely to make them happy to observe and read the tools distributed. The readability results obtained show that the vocabulary contained in the tools developed by the researcher can be read well by students and student textbooks are included in the category of materials suitable for learning (Dolmans et al., 2016; Suryanti et al., 2020). This instrument is categorized as good because it has an average reliability of 96.46%. Achievement of lesson plan implementation with this excellent category.

Strictly all students from 3 trial classes respond positively to learning materials with the Guided Discovery method to build problem-solving skills on the topic of Light. The learning process that has been followed is student-centered because the mental process of students is active with involvement in observation, measurement and data collection activities to draw a conclusion on their own discoveries in studying Light matter. This process the students find their own sense, in terms of building thingking ability. This positive student response shows enthusiasm for Learning through a process of inquiry and discovery, so that motivated students increase attention and engage in learning (Alhusban & Torki, 2021; Fata et al., 2022; Pramusinta et al., 2019; Purwaningsih et al., 2020). This research has the advantage of developing valid and reliable learning tools that consider students' readability and interest in the material. The Student Teaching Book (BAS) and LKS, which are designed in stages, from simple to complex material, and have an attractive layout, become an attraction that supports student involvement in learning.

This research provides learning tools to help students independently improve their problem-solving skills. Using the guided discovery approach in the LKS positively impacts the development of students' critical thinking skills by 21st-century education goals that emphasize higher-order thinking skills. This research emphasizes the importance of using valid, reliable, easy-to-understand learning tools to improve effectiveness. With feasible devices and high readability, teachers can encourage students to learn independently, improve concept understanding, and hone problem-solving skills. This success also opens up opportunities for developing similar tools in other subjects. This study has limitations in the scope of application, which is still limited to a few schools, and a short period for measuring the sustainability of the impact of using learning tools. Future researchers are advised to expand the implementation of this tool to other schools with various student backgrounds and conduct longitudinal studies to see the long-term impact of learning tools on students' problem-solving skills.

4. CONCLUSION

All classes whose learning used the guided discovery method showed an increase in problem solving ability. The achievement of the implementation of the lesson plan with a very good category is influenced by several factors, namely, first, it is well planned and systematic in accordance with the desired learning stages. Second, it is designed according to the conditions and circumstances of the

students. Third, the role of supportive students, who are enthusiastic about the learning carried out, this is in accordance with the results of the student response questionnaire on the implementation of the learning carried out. Finally, a conducive atmosphere, both in terms of materials, materials, and learning environment that supports the achievement of the lesson plan. This product development is indicated to be effectively used as learning materials to improve problem solving skills. The product development of science learning devices with the Guided Discovery method is feasible and effective to be used as teaching materials to develop problem solving skills for junior high school students, especially on the material of Light.

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