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Development of E-Worksheet Based on Discovery Learning to Improve Students' Decision-Making Skill and Scientific Attitude

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Abstract: The goal of this study is to create an E-worksheet product based on discovery learning that will help students improve their decision-making skills and scientific attitudes. This E-worksheet was created using the 4D development methodology, which includes the processes of define, design, develop, and disseminate. Students in class XI science SMAN 6 Mataram served as test subjects for this study. The limited trial is taught in one lesson, while the wide trial is taught in two classes. The ANCOVA test, descriptive percentage techniques, and percentage of agreement were used to analyze the data. The practicality data analysis revealed that teachers and students responded with a percentage of 80 and 86.42 percent, respectively, showing that the E-worksheet evolved in the practical category. The results of the effectiveness test using the ANCOVA test obtained Fcount > Ftable (8.28 > 3.98) on decision-making skills and Fcount > Ftable (6.94 > 3.98) on scientific attitude with a significant level of 5%. The null hypothesis (H0) is rejected, which means that E-worksheet influences discovery learning to improve students' decision-making skills and scientific attitudes in grade-eleventh science students. The E-worksheet based on discovery learning is practical and successful for enhancing students' decision-making skills and scientific attitudes toward grade-eleventh science students, according to the research objectives and findings.

Keywords: E-Worksheet; Discovery Learning; Decision-Making Skills; Scientific Attitude.

Introduction

Education in this century is expected to offer collaborative learning activities, communication and problem solving, critical thinking, creativity, and innovation (Lase, 2019; Hadisaputra et al., 2020). Learning activities themselves are a process of joint activities between teachers and students to achieve a learning goal (Hidayah et al., 2020). Facilities and infrastructure strongly influence the learning objectives to support success in the learning process (Fatmawati et al., 2019).

One way to support success in learning is through teaching materials (Yuni et al., 2018; Ramdoniati et al., 2019; Zakaria et al., 2020). The student activity sheet (worksheet) is one type of educational material that can be employed in the learning process (Suryaningsih & Nurlita, 2021). Worksheets are a sort of printed instructional material that teachers frequently utilize in the classroom during the learning process (Dermawati et al., 2019). Worksheet can be developed in electronic form that is easily accessible and can attract students' attention. This e-worksheet can be developed using the Flip PDF Professional application, which includes videos, pictures, and interactive quizzes to attract students' attention (Soenarko et al., 2022).

Based on Maulana and Rochintaniawati (2021), as many as 17% of 30 students have decision-making skills with insufficient criteria. As many as 83% of other students have decision-making skills in weak criteria, meaning that students' decision-making skills have not been developed optimally. Competent decision-making necessitates a variety of abilities, including the ability to process information independently and consistently, as well as the ability to see relevance from a variety of

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perspectives (Ahmed & Omotunde, 2012; Gutierez, 2015; Adair, 2019).

Several studies conducted to improve decision-making skills have been carried out by Badarudin (2017), who implemented the Advance Organizer learning model in science learning in elementary schools. Other studies have also implemented worksheets with a reasoning-based guided inquiry strategy that can improve the decision-making skills of high school students on renewable energy materials (Maryani, 2018). However, that study still uses printed worksheets. Learning can be more joyful with a worksheet in digital form. Therefore, this study tries to equip the worksheet with quizzes, animation, and video.

According to the findings of Sakliressy et al. (2021), the average scientific attitude of students is 73 percent of the 35 students remained in the less category. Teachers have not used learning models and methods that can attract students to be actively involved. Scientific attitudes affect the attitude inherent in a person after studying science. A person's condition in responding, responding, and behaving based on scientific knowledge and ethics is recognized as true (Pitafi & Farooq, 2012; Olasehinde & Olatoye, 2014; Purwanti & Manurung, 2015; Yuliatin et al., 2021). A student with a strong scientific mindset will think fluently, therefore they will be constantly driven to excel and committed to obtaining success (Guritno et al., 2015).

Several studies have been conducted to improve students' scientific attitudes, including one by Nugraheny (2018), who applied life skill-based worksheets to chemistry learning in vocational high schools. The other research is that applying the guided inquiry learning model to chemistry material can improve students' scientific attitudes (Sa'adah & Kusasi, 2017). However, printed worksheets are still used in that study. A digitized version of a worksheet can make learning more enjoyable. As a result, this study aims to include quizzes, animation, and video to the worksheet.

Previous research has shown that worksheets with certain learning strategies can improve students' decision-making skills and scientific attitudes. Therefore, this research aims to develop an e-worksheet product based on discovery learning that is practical and effective in improving students' decision-making skills and scientific attitudes in eleventh-grade science.

Method

This study is about development (R & D). This study produced an e-worksheet based on discovery learning to improve the decision-making skills and scientific attitudes of class XI science students (Sugiyono, 2019). The results from the teacher response questionnaire and the student response questionnaire to the developed e-worksheet were used to conduct a practicality test of the e-worksheet. The average percentage of the data obtained will be calculated using the following equation (Arikunto, 2012):

$$Average\ (\%) = \frac{Total\ Score\ of\ Assessors}{Maximum\ Score}\ x\ 100\%. \quad (1)$$

The level of practicality of the learning tools developed can be seen in Table 1.

Table 1. Practical Criteria

Percentage Range (%)	Practicality Level
0-20	Very impractical
21-40	Less practical
41-60	Quite practical
61-80	Practical
81-100	Very practical

In the experimental and control classes, data from the decision-making skills and scientific attitudes questionnaire were used in the effectiveness test. The ANCOVA test will be used to analyze the findings of the data collected. Prerequisite tests in normality and homogeneity were performed before the ANCOVA test. The ANCOVA test will perform residual analysis on the regression line, comparing the residual variance between groups to the residual variance within the group. The significance test is conducted by comparing the price of Fcount with Ftable contained in the table of F values. If Fcount > Ftable, then H0 is rejected, indicating that e-worksheet influences discovery learning to improve students' decision-making skills and scientific attitudes in grade eleven science students. (Khudriyah, 2021).

Result and Discussion

Practicality Test

The data from the questionnaire responses of students and teachers to the discovery learning-based e-worksheet that was generated was used to analyze the practicality of the discovery learning-based e-worksheet that was developed. The appeal of discovery learning-based e-worksheet, ease of use of discovery learning-based e-worksheet, and role of discovery learning-based e-worksheet in the learning process all influenced student and teacher reactions.

The parcticality of a worksheet is determined by the responses of students to the developed worksheet, and the majority of the tasks in the lesson plan are completed during the learning process (Bierera & Muchlis, 2021). Other research uses teacher and student responses to the developed worksheet to find out the ease of using the developed worksheet (Izzatunnisa et al., 2019).

The student response questionnaire uses an e-worksheet based on discovery learning to determine the assessment and reactions of students to learning. After

the learning process was completed, the students were given a reaction questionnaire. The reactions of students to the e-worksheet based on discovery learning are positive, with an average of 86.42% of the three characteristics analyzed. It is confirmed by several responses written by students, including 1) the e-worksheet applied is quite interesting and fun, 2) can make it easier for us in thermochemistry lessons, 3) with the e-worksheet learning is very easy and also the contents easy to understand, 4) e-worksheet is very much needed at this time during the pandemic and allows students to learn online, 5) The worksheet presented is quite helpful and very easy to understand, because it has interesting pictures. However, there are still drawbacks that can be developed, such as making a version that can be accessed without an internet network. Figure 1 shows the results for each aspect.

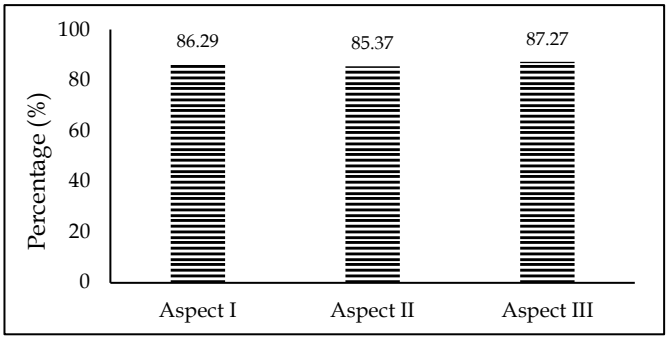

Figure 1. Aspects of Student Response to E-Worksheet

Information:
Aspect I : The Attractiveness of E-Worksheet
Aspect II : Ease of Use of E-Worksheet
Aspect III : The Role of E-Worksheet in the Learning Process

The purpose of the teacher response questionnaire is to find out how the teacher feels about the discovery learning-based e-worksheet that was created. The teacher's response to the e-worksheet based on discovery learning is positive, indicating that the e-worksheet is based on practical discovery learning for use in learning. It is confirmed by the average obtained, which is 80% of the three aspects assessed. Figure 2 shows the results for each aspect.

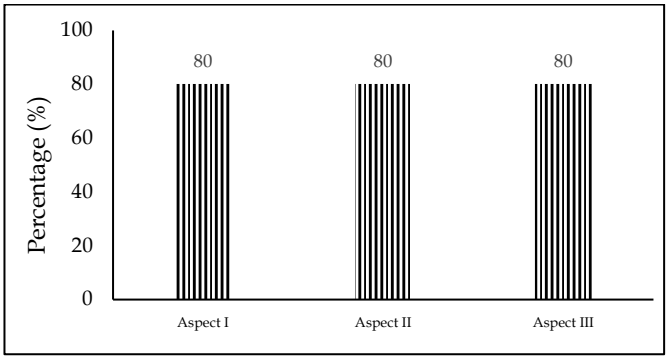

Figure 2. Aspects of Teacher Response to E-Worksheet

Information:
Aspect I : The Attractiveness of E-Worksheet
Aspect II : Ease of Use of E-Worksheet
Aspect III : The Role of E-Worksheet in the Learning Process

Effectiveness Test

The trial was conducted to see if a discovery learning-based e-worksheet could help students improve their decision-making skills and scientific attitudes. The experiment was carried out at SMAN 6 Mataram with two classes: XI MIPA 2 as the experimental class and XI MIPA 4 as the control class. For three meetings, the experimental class was given treatment by applying to learn using an e-worksheet based on discovery learning. Data on decision-making skills in the experimental and control classes are used to assess the effectiveness of an e-worksheet based on discovery learning.

This study employed an experimental class and a control class to compare the results of learning with a discovery-based e-worksheet designed by researchers in the experimental class to learning without a discovery-based e-worksheet in the control class. The efficiency of the data obtained was then evaluated. Effectiveness data were obtained through the ANCOVA test by comparing the residual variance between groups and the residual variance within the group (Khudriyah, 2021).

Testing the effectiveness of the Anacova test requires that the data to be analyzed is normally distributed and homogeneous. The research data met the standards for analysis using the ANCOVA test based on the findings of the homogeneity and normality tests. The statistical calculation results of the ANCOVA test obtained a Fcount of 8.277 for decision-making skills. Fcount of 6.931 on scientific attitudes was compared to the Ftable at a significant level of 5% with a df of 1:67 of 3.98. The null hypothesis (H0) is rejected if Fcount > Ftable, indicating that the discovery learning-based e-worksheet has an impact on improving students' decision-making skills and scientific attitudes in class XI science.

The students in the experimental class were enthusiastic about participating in learning utilizing the e-worksheet based on the given discovery learning during the lecture. Students are also actively discussing with their respective groups in doing the tasks contained in the e-worksheet. Because discovery learning stages are specified in e-worksheet activities in learning-based e-worksheets, students can be more involved in their learning. These findings are consistent with Salwan and Rahmatan's (2017) findings, which show that employing worksheets based on inquiry learning improves student learning outcomes. The application of learning-based worksheets to the experimental class has made it easier for students to comprehend the content being studied. The use of discovery learning-based worksheets has its characteristics, starting from how to formulate

hypotheses, solve problems, and finally get a decision from the problems at hand.

According to studies, using guided discovery-based worksheets in learning can assist students enhance their learning outcomes, according to Bahri et al. (2017). It is demonstrated by the experimental group's average score being greater than the average value in the experimental and control groups. The increase in student learning outcomes is caused by students learning with discovery learning which can increase students' motivation.

In this study, decision-making skills were assessed using a questionnaire that has been validated. There are four indicators of decision-making skills in this study, namely 1) defining the objective, 2) collecting relevant information, 3) generating feasible options, and 4) making the decision. The results of decision-making skills in the experimental class have an average percentage of 75.80%, and the control class has an average percentage of 69.11%. Both classes' decision-making skills are considered to be good.

The use of a discovery learning-based e-worksheet can help students enhance their decision-making skills. The results of the data analysis of students' decision-making skills between the experimental class, which received treatment using an e-worksheet based on discovery learning, and the control class, which received no treatment, demonstrate this. According to Maryani (2018), the experimental class's decision-making skills are better than the control class's because the e-worksheet affects the learning process. It is in line with Ridwan et al. (2020), which state that discovery-based worksheets help teachers facilitate students to gain knowledge, stimulate students' curiosity in understanding material concepts. Train students to solve problems in learning. On this basis, it can be concluded that discovery learning-based e-worksheets can help students improve their decision-making skills. Figure 3 illustrates the outcomes of decision-making skills.

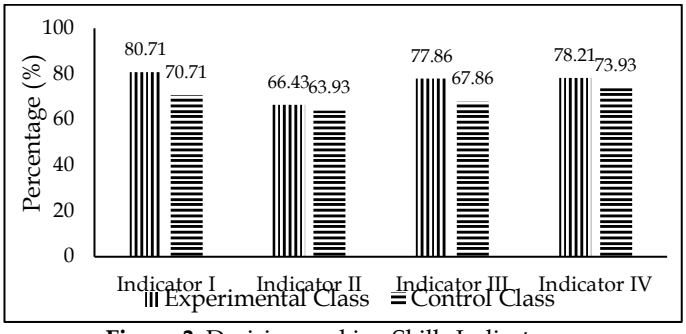

Figure 3. Decision-making Skills Indicators

Information:
Indicator I : Define The Objective
Indicator II : Collecting Relevant Information
Indicator III : Generate Feasible Options
Indicator IV : Make The Decision

For each indicator, the graph above indicates the difference in the overall average of students' decision-making skills. In the experimental class, the indicator for defining the target has the greatest average percentage of the other indicators, at 80.71%. It reveals that students in the experimental class are more capable of determining learning objectives than students in the control class, which scored an average of 70.71% on indications of goal definition. Students in the experimental class can identify issues offered in the form of learning videos in the let's discuss activities throughout learning so that they can determine the learning objectives.

Among the other indicators, the indicator of collecting relevant information has the lowest average percentage, at 66.43% in the experimental class and 63.93% in the control class. The indicator collects relevant information that falls into the "good" category. It shows that students in both classes are still not optimal in collecting relevant information, especially when asking the teacher. Students are still rarely done. During learning, students in the experimental class rarely ask questions related to learning to researchers. Students seek answers from only one source, namely blogs on the internet or looking for answers in let's read activities. Hence, students are not optimal in gathering relevant information about learning materials from various sources.

Scientific attitude in this study was measured using a questionnaire tested for validity. There are four indicators of scientific attitude in this study, namely 1) curiosity, 2) respect for facts, 3) critical thinking, and 4) open-mindedness. The result of scientific attitude in the experimental class has an average percentage of 78.13%, and the control class has an average percentage of 71.96%. It can be said that the scientific attitude in both classes is in a good category.

Students' scientific attitudes can be improved by using discovery learning-based e-worksheets. The results of the data analysis of the students' scientific attitudes in the experimental class, which received treatment using an e-worksheet based on discovery learning, and the control class, which received no treatment, demonstrate this. According to Puti and Jumadi (2015), students' scientific attitudes can be improved by studying utilizing teaching materials based on a certain strategy. It supports the findings of Widiadnyana et al. (2014), who found that the discovery learning paradigm had a greater average value on scientific attitudes than direct teaching. Students must construct their information in their thoughts throughout exploration learning. Based on this, students' scientific attitudes can be trained via discovery learning-based e-worksheets. Figure 4 shows the results of the scientific attitude test.

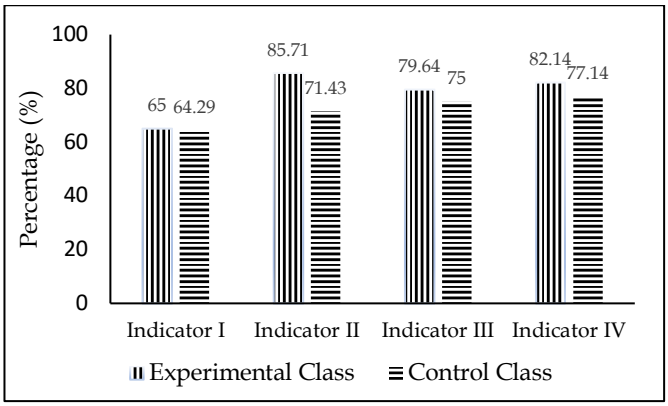

Figure 4. Scientific Attitude Indicators

Information:
Indicator I : Curiosity
Indicator II : Respect for Facts
Indicator III : Critical Thinking
Indicator IV : Open-mindedness

For each indicator, the graph above indicates the difference in the overall average of students' scientific attitudes. The indicator with the highest average percentage among the other indicators, 85.71% in the experimental class, is respect for facts. It reveals that students in the experimental class utilise the data and facts they get in accomplishing the assigned tasks more than students in the control class, with an average respect for facts indicator of 71.43%. During learning, students in the experimental class can use the data and facts gathered from the let's read, let's discuss, and let's find out activities to complete the learning material provided in the let's conclude activity.

Among the other indicators, the curiosity indicator has the lowest average percentage, with 65 percent in the experimental class and 64.29 percent in the control class. The indication of curiosity is in a good category. It shows that students in both classes are still not optimal in finding information that can help understand and solve an existing problem, especially when asking and hearing explanations from the teacher. Students still rarely do it. During the learning process, it is displayed. Students in the experimental class rarely offer researchers questions about learning. Students are also looking for answers from only one source. It can blog on the internet or look for answers from learning materials already available in the let's read activity in the e-worksheet. Students are not very good at gathering relevant information about learning materials from many sources to assist them in completing the teacher's tasks.

Conclusion

The discovery learning-based e-worksheet developed is practical and effective for improving students' decision-making skills and scientific attitudes in science class XI. It can be inferred from the research and discussion results. This e-worksheet can be used as a reference when studying thermochemical concepts in chemistry. Given that there were still issues with inconsistent internet connections in this study, the future research e-worksheet can be accessed using various devices without being online.

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