

## Research article

# E-module With Discovery Learning Model Based on Educational Games

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**Abstract.**

This study aimed to develop an e-module using a discovery learning model based on educational games, test the effectiveness of using e-modules in improving student learning outcomes, and determine student responses to the developed e-module. A 4D model was used, which had four stages: defining, designing, developing, and disseminating. Observations and interviews were used to collect the qualitative and quantitative data. Expert judgment determined that the developed e-module passed the validity test, with an average validation score of 3.43, which was categorized as very good. The average peer assessment score was 3.52, which was also categorized as very good. The findings showed that e-modules based on educational games can be effective in learning. The mean pretest value was 50.663 and the mean posttest value was 71.90, which indicated that student learning outcomes improved significantly. As a result, it can be concluded that the educational games-based discovery learning e-module can be effectively used in learning.

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**Keywords:** e-module discovery learning, educational games

## 1. Introduction

The goals of national education contained in the "Law No. 20 of 2003" aim to develop the potential of students to become human beings who believe and fear God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. So education is expected to enable students to develop their potential so that they can cope with all the changes that occur. Especially now that we are facing an era of disruption where developments are going so fast. The era of the industrial revolution 4.0 does not only have an impact on the social and economic aspects. The world of education today is also closely related to the development of information, communication, and technology. Therefore, teachers must be responsive to the current situation.

Teachers need to make reforms in the management of education to achieve these goals. The solution to solve this problem is to do the selection of appropriate models,

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media, teaching aids, learning resources. One important element in learning is the novelty of learning resources. Therefore, teachers are expected to develop teaching materials as learning resources. The availability of adequate teaching materials is important to support teaching and learning activities according to the 2013 curriculum. However, the development of teaching materials in schools has not been fully carried out by teachers to the fullest. It looks based on observations at SD Negeri 2 Kembang. The school is known to have minimal facilities, one of which is teaching materials and educational game tools, these problems become an obstacle in learning activities. Another influence is that learning is still done through contextual methods. Therefore, students have difficulty understanding the material, because the learning experience conveyed is only limited to listening to teacher lectures and something abstract so that it has an impact on student learning outcomes. Teachers and students need teaching materials that students can access independently, such as modules. The module is part of a comprehensive and systematic teaching material, where the module contains a set of learning experiences that are planned and designed to help achieve certain learning objectives.

In addition, the thing that teachers need to pay attention to in developing teaching materials is the accuracy in choosing a learning model. The learning model that is considered appropriate and by the 2013 curriculum is the discovery learning model. The discovery learning model directs students to be scientific and plays an active role in finding concepts that they have not previously discovered independently[1]. Thus, learning becomes more meaningful. Because students find concepts from their learning experiences. This fits the view[2].

The use of the discovery learning model has good effects and contributes positively to student learning. The Discovery learning model has a positive impact on improving students' cognitive and scientific attitude[3]. The results of this study are supported by [4] explained that "The discovery learning has greater have an effect on the scholars capacity to suppose creatively in getting to know of technology training in primary schools compared with getting to know using the expository method.

A similar opinion that found the effectiveness of the discovery learning model which can increase learning activities, activeness, creative thinking to high-level thinking students was also found by[5,6,7,8]. These results can be seen from the increase in student learning outcomes and test the effectiveness of the module.

Furthermore, in developing the module and also choosing the right learning model. Teachers can also provide variations of learning with games. This is based on the development of children who are more interested in learning and playing. This is

following the findings (9). Discovery-based learning materials using traditional games can dramatically improve students' multiplication and division skills. A similar opinion was also conveyed by [9], where teachers need to insert educational games in learning. One of the right games in the digital era is to use technology. This is supported by several studies on the use of technology that have been proven to be effective in increasing student learning motivation including, [10,11].

Based on the description above, it is necessary to develop an e-module of discovery learning based on educational games in the 4.0 era to improve the cognitive domain of students. This module can be an alternative to help teachers improve the quality of learning

## 1.1. Research Purposes

1. Developing E-module with Discovery Learning Model Based on Educational Games in the 4.0 Era to improve learning outcomes for the sixth grade Earth theme in elementary school
2. Analyzing the effectiveness of the discovery learning e-module based on educational games to improve learning outcomes for the sixth grade Earth theme in elementary school.
3. Knowing student responses to the use of discovery learning-based e-modules with educational games

## 2. Methodology

This type of research is research and development (Research and Development). Aims to develop a specific product and test the effectiveness of that product. The development procedure is carried out using the development steps according to the 4D model. 4D models include define, design, develop, and disseminate. The research subjects were fourth-grade students of SD 2 Kembang in the Jepara Regency. The collection techniques used were observation, interview, and test techniques. The tools used in this development research are questionnaires, observation sheets, and test questions. The test tool is used to determine students' understanding of the material being taught. The test was given twice in the experimental class and the control class, both posttest, and pretest. Questionnaires were used to obtain data on the feasibility of modules containing character education following developments in terms of material

and graphic aspects. Data processing in this study uses qualitative and quantitative analysis, including feasibility analysis and data analysis of learning test results.

## 2.1. Data Analysis Technique

The field trial used the Pre-Experimental Design method with the One Group Pretest-Posttest Design. The design of this research is as follows [12]:

O1 x O2

Information:

x: Discovery-based Integrated module usage

O1: pretest score

O2: posttest score

Data analysis of the effectiveness of the module was carried out by measuring the pre-test and post-test scores, the analysis to determine the effectiveness of the module in learning was using a normalized gain score (N-Gain). While the analysis to test the difference in learning outcomes scores before using the module (pretest) and after using the module (posttest) uses the T-Test. The statistical test technique (T-test) must go through prerequisite tests, especially the normality and homogeneity of the data. Normality test to determine whether the data is normally distributed or not. Normality test through Kolmogorov-Smirnov test using SPSS 18.0 for Windows program with a significance level of 0.05.

The test is to determine whether there is a difference in learning outcomes in the pre-test-post-test using a two-sample test related to the SPSS 18.0 for Windows program, namely the paired sample T-test with a significant level of 0.05.

### Results and Discussion

This research was conducted to develop an e-module discovery learning based on educational games in the 4.0 era to improve student learning outcomes. This development research refers to three quality requirements, namely valid, practical and effective as well as compiled and developed based on the Four D (4-D) development model [6]. This research consists of four stages, namely; the defining stage, the design stage, the development stage, and the disseminate stage. The following describes the results of the activities carried out.

## 2.2. Defining Stage (Define)

The definition stage in this research is a needs analysis which includes the following activities.

### 1. Pre Research (front end analysis)

The initial analysis carried out was to study and observe the literature and make observations. Literature study includes basic skills (KI), basic skills (KD), and time allocation contained in the curriculum. In addition, the literature study is useful for researching concepts related to the developed module

### 1. Student Needs Analysis

The results of the analysis show that some students have difficulty in learning thematic subjects. In addition, the teaching materials used in the teaching and learning process are less effective in achieving learning objectives. So that teaching materials must be specifically designed according to the needs and developments of the times

### 1. Material Analysis

At this stage, the results of daily tests and USBN results were analyzed to determine the material, then analyzed the KI and KD of grade VI in elementary school. The results of this analysis are used to develop appropriate teaching materials and are associated with the student's immediate environment

### 1. Learning objectives

Formula as learning objectives is used to develop the objectives contained in the curriculum and some relevant indicators for KI, KD, and indicators that will be used as a reference when developing modules. The learning objectives to be achieved in the module are the improvement of cognitive, psychomotor, and affective abilities.

## 2.3. The Design Phase and the Development Phase (Develop)

At this stage, the design of E-module with discovery learning model based on educational games in the 4.0 era in the 4.0 era was carried out on the theme of our earth for sixth grade elementary school. The activities carried out at this stage are designing the initial product of the learning module. The preparation of the learning module design can be seen in the following figure.

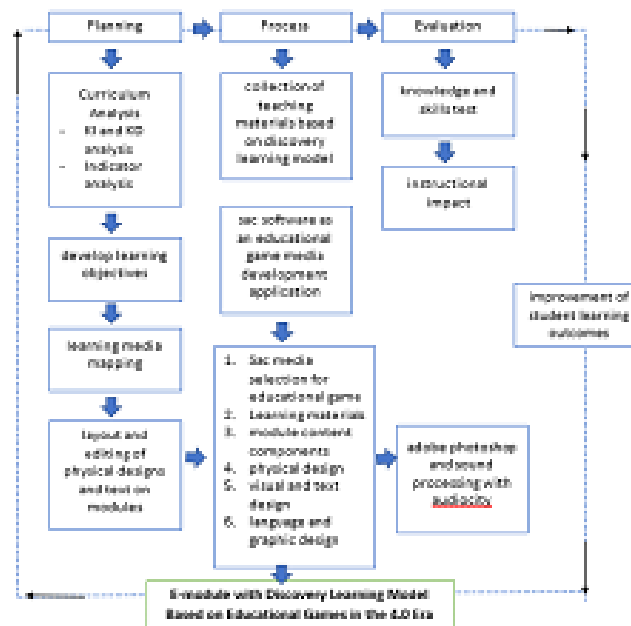


Figure 1: The develop of the learning module design.

Component-module with a discovery model based on educational games in the 4.0 era consists of the introduction, namely the introduction, table of contents, instructions for using the module, core competencies, basic competencies, indicators, learning objectives, links between subject matter, learning concept maps. While the contents of the discovery module contain a): learning activities, b) competency mapping, c) QR Barcode educational games 4.0, d). The learning steps in this module are adapted to the discovery learning syntax consisting of stimulation activities, problem statements, data collection, data processing, verification, and generalization. The next part of the module is e) student worksheets, f) closing

The next step is expert validation. Based on validation by material experts, media experts, and linguists, this learning module is suitable for use as teaching materials with an average score of 3.43 validation results with a very good category of expert judgment validator and 3.52 with a very good category of assessment peers. The validated e-module is then corrected according to the input from the validator. After the module is repaired according to the validator's suggestion, the module is ready to be tested. A small trial was conducted with sixth graders at SD Negeri 2 Kembang; this small trial was conducted to determine the feasibility and readability of the module. After carrying out learning activities and reading the module as a whole, students are asked to fill out a response questionnaire.

Overall, the average student response results 3.45 with very good category. Feedback from students in the "very good" category indicates that the discovery e-module based on educational games on the subject of "our earth" can be applied. Then the second test was carried out. After the second review is carried out based on student responses, it will then be compiled in Draft III to be implemented in Class VI of SD Negeri 2 Kembang.

### 2.4. Effectiveness Test

The effectiveness of the discovery module based on educational games can be studied significantly by conducting an analysis based on pre-test and post-test data. The pre-test and post-test data analysis were first carried out through the prerequisite test stage, namely normality and homogeneity checks. Normal and homogeneous, then a non-parametric test is performed. The results of the normality and homogeneity tests are shown below. Statistical analysis for normality test using Kolmogorov-Sminova test and homogeneity test using Lavene's test. The results of the analysis are presented in Table 1.

TABLE 1: Analysis of Pretest and Posttest Learning Outcomes.

No	Tested	Test Type	Sig	Decision
1	Normality	Kolmogorov-sminov	pretest = 0.001 posttest = 0.000	Ho = rejected
2	Homogeneity	Lavene's test	0.005	Ho = rejected
3	Pretest and posttest scores	Wilcoxon	0.000	Ho = rejected

Based on the results of the Kolmogorov-Sminova for the pretest value obtained a significance of 0.001 which means the significance value is less than 0.05. So that H0 is rejected, the conclusion is that the pretest value is not normally distributed. The posttest value obtained a significance of 0.000 which means the significance value is less than 0.05 so that Ho is rejected, the conclusion is that the posttest value is not normally distributed.

Furthermore, the data were tested non-parametric because the prerequisite test for the parametric test was not met. The non-parametric test used was the Wilcoxon test for the two dependent groups or in pairs on the pretest and posttest data.

The Wilcoxon test that has been carried out has a significance of 0.000 which is less than 0.05, then Ho is rejected, which means that there is a difference in test scores before and after using the discovery module based on educational games on the theme of our developed earth.

This means the effectiveness of the discovery module is based on educational games. This is relevant to the results of [8] states that discovery learning-based biology learning modules are effective in empowering learning outcomes.

## 2.5. Gain Data Analysis

Description of the gain and N-gain data based on the pretest and posttest values after the thematic learning on the theme of our earth uses an e-discovery module based on educational games with the discovery model on the theme of our earth is presented in table 4. 2

TABLE 2: Result N gain.

Test type	N	Min	Max	Average	Std Deviation
Gain	16	0	28	21,238	7,962
N Gain	16	0	1	0.575	0.248

The table above shows the normalized gain and gain (N-gain) data on the research subject, namely 16 students. Data gain and n-gain are used to determine the increase in learning outcomes after learning by using discovery-based e-modules based on educational games in learning. the minimum score is 0 and the maximum score is 28. The minimum score indicates that there are still students who do not experience an increase in score. In the normalized gain data, it is known that the minimum score is 0 in the low category and the maximum score is 1 in the high, medium, and high categories. While the overall increase is in the medium category.

## 2.6. Student Response Questionnaire Data

The results of the questionnaire to find out the answers after learning with the e-discovery module based on educational games. The general response results are in the following table 3.

The table above shows the average student response to the Discovery learning module of 3.56 with a very good category, the conclusions that can be drawn from the module are feasible for students to use in learning.



TABLE 3: Student Response Results.

Aspect	Average	Category
Content Aspect	3.60	Very good
Language Aspect	3.41	Very good
Graphic Aspect	3.49	Very good
Presentation Aspect	3.49	Very good
Aspects of Suitability with Discovery Learning	3.78	Very good
Amount	17.78	
Average	3.56	Very good

### 3. Discussion

This research is a type of research and development. The product developed is a discovery e-module based on an educational game on the theme of our earth-class VI. The development is following the Four D (4D) development model. Before testing the module, a feasibility test of the module is carried out, first a validation test will be carried out.

Based on the validation of material experts, media experts, and linguists, this learning module is suitable as teaching material with an average value of 3.43 with a very good assessment by expert judgment validators and 3.52 with a very good category by peers. From this, it can be concluded that the module developed is suitable for use in learning. The results of the feasibility of the module are supported by research [4,13,14] stated that the module that had been developed had to be tested for feasibility by validating the expert judgment. The results of the study also explained that the discovery-based module that was tested was feasible to be used in learning.

Furthermore, the module was revised based on input from the validator. It aims to refine and improve the module.

What makes this module unique is that the learning steps in this module are adapted to Discovery Activities or Model Discovery, and the use of the Discovery Learning Model in learning has been shown to improve student motivation, learning outcomes, and skills. This corresponds to [15] who said that implementation of Discovery Learning success extended pupil overall performance and retention. Research finds improvement of students' critical thinking skills through learning with discovery learning models. In line with this opinion, [16] disclose the studying substances primarily based on totally guided discovery studying with Batak Toba context advanced students' mathematical hassle fixing potential and self-efficacy significantly. A similar opinion was also conveyed by [12]. The students' gaining knowledge of teaching with the aid of using discovery gaining

knowledge of technique is higher than the effects of students' gaining knowledge of teaching with the aid of using expository.

More on research[4] finding that discovery learning also has a positive impact on grammar learning, "Discovery learning strategy succeeded in teaching grammatical rules in the development of skills beyond the knowledge of students.

The many advantages of the discovery learning model in learning are a consideration for researchers in developing discovery learning modules based on educational games. In addition, the results of the research conducted also prove that the modules developed are effectively applied in learning.

Gain value normalized showing low gain is 2 students with a percentage of 23%. Students who experienced an increase in the medium category were 8 students with a percentage of 42%. While students who achieved an increase in the high category were 6 students with a percentage of 35%, then discovery-based module learning could improve learning outcomes. These results are supported by [10] in their research revealed that the discovery learning model can improve student learning outcomes in Class VIII5 SMPN 4 Bengkulu City.

The results of the study also found that the application of discovery-based e-modules based on educational games was proven to be effective in improving student learning outcomes. This is evidenced by the cognitive learning outcomes of students showing an increase in the average value of gain. Learning with educational game-based discovery e-modules can increase activity in learning, make students more enthusiastic in learning and improve learning outcomes. This is in line with the findings [17], Discovery learning has a positive impact on students' mathematics learning outcomes on cognitive, affective, and psychomotor aspects. This research is also strengthened by research conducted by [18]the implementation of the discovery learning model is proven to be effective in improving students' critical thinking skills.

Whereas[19] found that Discovery learning-primarily based totally on the growth of the capacity of standard college students' trouble fixing skills. The effectiveness of the discovery learning model in improving learning outcomes, affective and psychomotor abilities was also explained by several researchers including[5, 20, 21].

The effectiveness of the model is also supported by the results of student responses which show an increase in the average score of student questionnaires on the small test from 3.6 to the average score of the student questionnaire on the large class test of 3.7. This means that the overall score is in the very good category. The positive response results from these students cannot be separated from the use of educational games embedded in the module which can be accessed via the barcode contained in the

module the use of alternative games makes students interested in using the module. This result is reinforced by Supriyono[22] that interactive learning media and educational games can increase students' interest in learning. Krouska[15] explain that Integrating the cellular era into training consists of fine pupil awareness, enables pupil focus, bendy get admission to academic substances services, and improves pupil abilities the usage of a cellular era for online learning. Based on several relevant studies above, it is proven that the use of technology in learning needs to be considered and applied by teachers to improve the quality of learning. This opinion is strengthened[3] said the implementation of technology with android in learning is proven to be effective in improving students' critical thinking skills.

#### 4. Conclusion

Conclusion on this research is Product which developed is E-Module Discovery learning based on educational games. Educational games embedded in QR Barcode assisted models which connect on the link which relevant use teaching materials which accessible students through their respective devices. The module which developed already through a validation test. By holistic obtained an average of 3.45 in the very good category. Response gain protege on the very good category can it is stated that the discovery e-module is based on educational games in our earth theme is validly implemented. The application of educational game-based discovery e-modules has proven to be effective raise output study protege. output or differences in learning outcomes use module significantly. the mean value of the pretest as much 50.663 & posttest score as much 71.90. N-gain calculation results according to pretest & posttest as much 0.575 on medium category. The increased score is seen through the gain value, namely, as much 21,238, while the highest increase is as much 28. This shows that learning using the Discovery e-module based on educational games is proven to be effective in improving student learning outcomes.

In addition, it is supported by student responses with an average student response to the Discovery learning module of 3.56 with a very good category, the conclusions that can be drawn from the module are feasible for students to use in learning.

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