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Development of integrated science teaching materials using autoplay-based discovery learning model at SMP Negeri 3 Satap Lembean Timur

Alfani Yosua Tambuwun[1], Meytij Jeanne Rampe[2], Rolles N Palilingan[2]
[1] Student, Study Program of Natural Sciences Education, Postgraduate Program, Manado State University, Indonesia
[2] Postgraduate Program, Manado State University, Indonesia

Abstract
The scientific approach to learning becomes more meaningful and interesting, students become more enthusiastic and enthusiastic in learning. The target population is all students at SMP Negeri 3 Satap Lembean Timur, the affordable population is all class VIII students at SMP Negeri 3 Satap Lembean Timur, and the sample is 20 class students. The instruments used for measurement in the sample are 1) Expert response questionnaires (expert) and notes/suggestions from expert lecturers/supervisors, 2) Student response questionnaires to learning using integrated science teaching materials using Autoplay-based discovery learning model, 3) Result test learn students. The analytical technique used in this research is descriptive analysis and the average difference test (comparison). The mean difference test was conducted to test the research hypothesis. The results showed: 1) Integrated science teaching materials using an Autoplay-based discovery learning model were good and suitable for use in the learning process, 2) Integrated science teaching materials using an Autoplay-based discovery learning model could improve student learning outcomes, 3) Science teaching materials using an integrated discovery learning model based on Autoplay can improve the teaching and learning process effectively and efficiently.

Keywords: discovery learning, autoplay, teaching materials, learning outcomes

Introduction

The 2013 curriculum learning process emphasizes the modern pedagogic dimension, namely using a scientific approach (Scientific Approach) which in learning includes observing, asking, trying, reasoning, and communicating [1]. The scientific approach to learning becomes more meaningful and interesting, students become more enthusiastic and enthusiastic in learning [2]. The 2013 curriculum uses direct and indirect learning modes. Learning model is a form of learning that has names, characteristics, syntax, settings and culture, for example Discovery Learning, Project-Based Learning, Problem-Based Learning, Inquiry Learning.

Bruner uses a method he calls Discovery Learning, in which students organize the material being studied in a final form [3]. The Discovery Learning method is to understand the concept of meaning, and relationship, through an intuitive process to finally arrive at a conclusion [4]. Discovery occurs when individuals are involved, especially in the use of their mental processes to find some concepts and principles. Discovery is done through observation, classification, measurement, prediction, determination and inference. The process is called the cognitive process while discovery itself is the mental process of assimilating concepts and principles in the mind [5].

As a learning strategy, Discovery Learning has the same principles as inquiry and problem solving. There is no principal difference in these three terms, discovery learning emphasizes finding concepts or principles that were previously unknown. The difference with discovery is that in discovery the problem faced by students is a kind of problem engineered by the teacher, while in inquiry the problem is not the result of engineering so that students must mobilize all their minds and skills to get the findings in the problem through the research process. According to Nabila Yuliana (2018), the application of the discovery learning model is very helpful in teacher efforts to improve student learning outcomes [6]. Not only that, this model also helps in increasing the activity of teachers and students, students' self-confidence, and the ability to work independently in problem solving.

The characteristics of abstract physics learning materials in integrated science require the ability to master and manage changes between different representations simultaneously. In learning physics, a mature understanding of concepts is needed so that students can solve a problem in the field of physics well. Understanding the concept provides an understanding that the material taught to students is not just rote but more than that. If students do not have a good understanding of concepts, these students do not understand the concepts of materials in physics, so that students cannot solve problems properly.

Seeing these problems, the authors make teaching materials that present complex material with various stimulants so that students can understand integrated science learning well. With current technological advances, it has a positive impact on learning where multimedia technology that can be used in the learning process makes it easier

for teachers to explain abstract concepts and help students better understand the material being taught. Creating a more optimal learning process in learning can use learning multimedia. Multimedia learning can be supported by software that can be used in making videos, animations, images, sounds and so on using Autoplay. Autoplay is software that helps make presentations of material equipped with pictures, animations, videos, music which are usually done for weeks can be completed in a shorter time and this software helps teachers in teaching to students and can assist teachers in making materials teach. AutoPlay studio 8 has many facilities for creating teaching materials such as: fast interactive response, use of data bases in the program, scoring at the end of the program, display of use [7]. According to Khairun N, Mustika W, and Mahardika A.I (2017) teaching media developed using the Autoplay application are feasible to use and very effective in terms of the level of completeness of student learning outcomes (8).

According to Isnarto et al. (2017) the ability to develop and use learning media is one of the important things that teachers must have [9]. The application of innovative teacher learning methods has an impact on students' enthusiasm for learning. Creating a learning process that is able to develop maximum student learning outcomes and can improve the quality of education is the task and obligation of educators [10].

The development of integrated science teaching materials through multimedia software can improve the learning process where students can find their own problems and solutions from the material being studied. The use of time will also be more effective and efficient because it uses multimedia that is arranged systematically, briefly and clearly and makes teachers more effective in achieving competencies and learning objectives. The development of information and communication technology can improve the quality of education by providing teaching materials that are easy to obtain, easy to understand, easy to use at any time and attract the interest of readers. According to Nugroho et al (2017) the progress of science and technology requires that we be able to master information and knowledge technology [11].

Based on a preliminary study conducted in schools, the curriculum used is the 2013 curriculum, adjusting to the emergency curriculum during the pandemic. The learning method that is often used in science learning is the question and answer method or discussion via Facebook and WhatsApp. The learning media used are books, internet, cellphones and chromebooks. Class VIII's activity in this learning method has not followed fully or not yet 100%, it can be said that only about 50% have followed the learning well. The biggest obstacle faced is an unstable internet network, insufficient internet quota, as well as cellphones and laptops and also the completeness of student learning outcomes 55% - 60% has not been maximized or has not reached the Minimum Completeness Criteria (KKM = 70) so that students are required to follow remedial. Then learning using an Autoplay-based discovery learning model in this case Autoplay has never been used in SMP Negeri 3 Satap Lembean Timur, especially in class VIII.

Research Methods

A. Type of Research

This study aims to produce learning media products in the form of integrated science teaching materials using an Autoplay-based discovery learning model. The method used in this research is research and development (R & D) following the stages of research on the development of four-D-models (4D model) according to Thiagarajan, and Semmel [12]. The 4-D model consists of four stages of development, namely Define (definition or tracking), design (design), develop (development) and disseminate (disseminate or disseminate). The stages of this research are as described in the following figure:

B. Data Collection Techniques

1. Research and Development Procedure
2. Stages of Defining (Define)

At this stage the researcher examines the problems and potentials that exist in the school, as a background reference through initial observations. Observations were carried out by conducting a preliminary study or giving a questionnaire to the science teacher and several students. Some of the things that need to be studied are as follows:

- Analyze the curriculum used in schools.
- Identify the number of students.
- Identify the needs of students
- Identify learning resources for students
- Identify integrated science materials
- Identify integrated science materials that can use the discovery learning model
- Analyzing each component that will be used in the manufacture of teaching materials.
- Develop a research framework that includes integrated science teaching materials using an Autoplay-based discovery learning model (images, animations, and flash simulations, videos, and material content) to be applied to integrated science learning by considering relevant research in the field of using multimedia technology for learning in schools that can prove to be useful to apply and build on the theories learned.

3. Stages of Design (Design)

At this stage the researcher makes a product design in the form of integrated science teaching using an Autoplay-based discovery learning model which begins with preparing the necessary tools and materials in the form of a

laptop, autoplay, and the contents of teaching materials. Preparation of instruments and criteria for evaluating the design and prototype of integrated science teaching materials using an Autoplay-based discovery learning model. Furthermore, discussions and consultations with supervisors and expert lecturers in the integrated science field and experts in the field of IT utilization were completed as design validation by experts using a questionnaire instrument with a Likert scale of 5-1.

Learning Material Expert Validation

Evaluation by material experts was carried out to validate the teaching materials used in this study by a team of material expert lecturers prior to field trials. After obtaining data from the material expert evaluation instrument, the percentage will be calculated by comparing the total score achieved with the maximum score multiplied by 100% with the interpretation of the score and the following formula (13):

$$\frac{Total\ score\ achieved}{maximum\ score} \times 100\%$$

(Total score achieved)/(Total score maximum) ×100% [13]

Number 0%-20% = Very weak
Number 21%-40% = Weak
Number 41%-60% = Enough
Number 61%-80% = Strong
Number 81%-100% = Very strong

On a continuum, the following categories can be made:

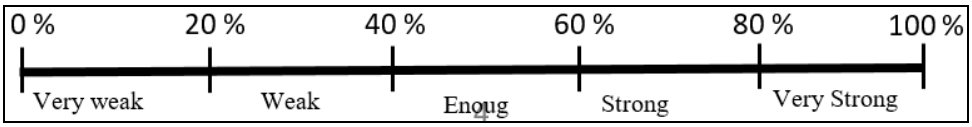

Fig 1: Continuous evaluation of material experts on Autoplay-based teaching materials

a. Media Expert Validation

Media expert validation was carried out to evaluate integrated science teaching materials using an Autoplay-based discovery learning model before field trials were carried out by learning expert lecturers.
The data obtained will be calculated as a percentage by comparing the total score achieved with the maximum number multiplied by 100% by the formula and interpretation of the score as follows [13]:

$$\frac{Total\ score\ achieved}{maximum\ score} \times 100\%$$

on a continuum the following categories can be made:

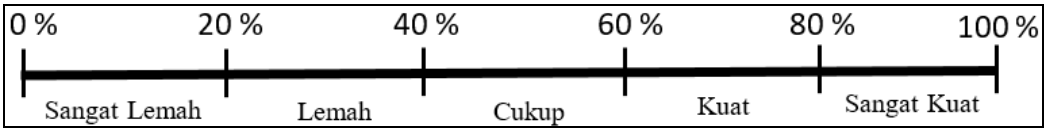

Fig 2: Continuous evaluation by media experts of Autoplay teaching materials

Number 0%-20% = Very weak
Number 21%-40% = Weak
Number 41%-60% = Enough
Number 61%-80% = Strong
Number 81%-100% = Very strong

Stages of Development (Development)

At this stage the researcher consulted with media experts in terms of improving integrated science teaching materials using an Autoplay-based discovery learning model which was then made a prototype of integrated science teaching materials with a scientific approach to the discovery learning model with various materials that had been prepared and referring to the research design that made. Furthermore, an initial trial was carried out in small groups.

a. Repair of Autoplay-based teaching materials

After evaluation from media experts and material experts, of course there are several items that must be completed and must be revised according to the suggestions and criticisms given.

b. Small group initial trial

The initial small group trial was taken from several students at random. This small group test was conducted to determine the quality of the product display and material presented in this teaching material. In this activity, students provide feedback, criticism and input regarding the shortage of teaching material products made using research questionnaires given to each student. The questionnaire was made containing the assessment criteria both in terms of material and in terms of media appearance. The data obtained will be calculated as the percentage of each indicator item is calculated by comparing the number of scores achieved with the maximum number multiplied by 100% and will obtain an interpretation of the achievement score in the range of 0%-100%. With the following formula [13]:

$$\frac{Total\ score\ achieved}{maximum\ score} \times 100\%$$

On a continuum, the following categories can be made:

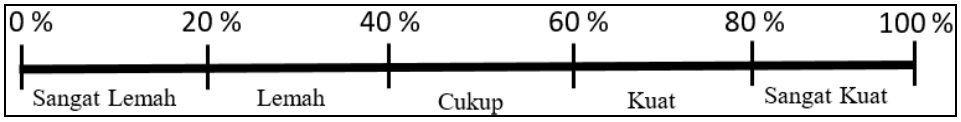

Fig 3: Continuous evaluation of student responses to Autoplay teaching materials

Number 0 - 20% = Very weak
Number 21 - 40% = Weak
Number 41 - 60% = Enough
Number 61- 80% = Strong
Number 81 - 100% = Very strong

a. Field Trial

At this stage, a field test of the product that has been made is carried out, namely integrated science teaching materials using an Autoplay-based discovery learning model. Then, an empirical test is then carried out to test the research hypothesis using the value of student learning outcomes in period 1 and period 2 with a test of student learning outcomes using instruments that have gone through a series of tests, namely validity and reliability tests.

1. Test the Validity and Reliability of Learning Outcome Test Instruments

The test questions for student learning outcomes are arranged in the form of objective questions with a score of 0-1, a biserial correlation coefficient is used between the score of the questions and the scores of the test items with the equation:

$$r_{bis} = \frac{Xi - Xt}{St}\sqrt{\frac{p_i}{q_i}}$$

The test criteria are as follows: If tcount > ttable it means valid, or if tcount ttable means invalid. Calculation of validity and reliability was carried out with the help of SPSS 25. Furthermore, the coefficient of reliability was calculated using the Kuder Richardson equation (KR-20) (14):

$$r_{ii} = \frac{k}{(k-1)}\left\{1 - \frac{\Sigma piqi}{s_t^2}\right\}$$

1. Learning Procedure

In learning the discovery learning model using integrated science teaching materials based on Autoplay, it is carried out with the learning syntax of the discovery learning model where the learning process is carried out in 4 meetings. he ongoing learning process needs to be analyzed to determine the development of students who utilize teaching materials using the Autoplay-based discovery learning model designed in this study. This assessment is carried out by analyzing the performance of each individual on the activities of students in their respective groups which includes the positive responses of students during the learning process.

2. Empirical Test at the Field Trial Stage

At the field trial stage, empirical tests were conducted to test the validity of the product hypothesis. In this study, the empirical test was carried out using a quasi-experimental method. The quasi-experimental design has a control group that cannot fully function to control external variables that affect the implementation of the experiment.
In this study, the same subject design was used (Colton, 1985; Dimitrov & Rumrill; Hudock, 2005) (12) which can be described as in Figure 7.

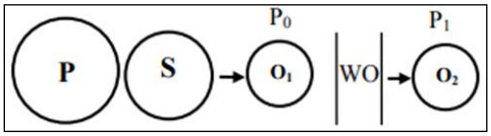

Fig 4: Design with Subject

Information
P: Population
S: Sample
O1: Observation before intervention
P0: learning activities before intervention
WO: washing out (time to remove the effects of activity before intervention) for 1 week
P1: learning activities with intervention
O2: final observation with intervention

Population and Research Sample
The target population is all students at SMP Negeri 3 Satap Lembean Timur, the affordable population is all class VIII students at SMP Negeri 3 Satap Lembean Timur, and the sample is 20 students from class VIII.
Research Variables and Conceptual Definitions, Operational Definitions Conceptual and Operational Definitions Learning outcomes are abilities possessed by students after receiving their learning experiences. Learning Model Discovery Learning is a learning model that is used to pay attention to the syntax of discovery learning.
Integrated science teaching materials using an Autoplay-based discovery learning model are used to simplify the learning process.
Learning outcomes are abilities possessed by students after receiving the learning process using integrated science teaching materials using an Autoplay-based discovery learning model that can be measured and expressed by scores.

Research Instruments
The instruments used for measurements on the sample are
Expert response questionnaire (expert) and notes/suggestions from expert lecturers/supervisors. Questionnaire of students' responses to learning by using integrated science teaching materials using the Autoplay-based discovery learning model. Student learning outcomes test. Stages of Dissemination (Disseminate) At this stage the product that has been tested and declared suitable for use can be disseminated to be used as integrated science teaching materials using an Autoplay-based discovery learning model that makes a positive contribution to the world of education in general.

Data analysis technique
The analytical technique used in this research is descriptive analysis and the average difference test (comparison). The mean difference test was conducted to test the research hypothesis.

Research Statistical Hypothesis
To test the research hypothesis, the statistical by subject paired-samples T-test was used. As a hypothesis testing criteria: reject H0 if $t < t\alpha$ with = 0.05.
H0 = 1 2: "The average learning outcomes of students taught using integrated science teaching materials using the Autoplay-based discovery learning model are lower or equal to the learning outcomes of students taught using conventional models".

H1 = 1 > 2: "The average learning outcomes of students taught using integrated science teaching materials using an Autoplay-based discovery learning model are higher than the learning outcomes of students taught using conventional models".

Results and Discussion
Defining Stage (Define)
The definition stage at SMP Negeri 3 Satap Lembean Timur already has adequate learning facilities such as LCD projectors and the use of the 2013 curriculum which is equipped with syllabus and lesson plans in each lesson. So in the stage of defining the materials used are business materials and simple machines using an Autoplay-based discovery learning model. Autoplay media is suitable for use in this material due to the characteristics of Autoplay which are able to integrate various media such as text, audio, video, music, animation and so on. Developing integrated science teaching materials using an Autoplay-based discovery learning model does not require expensive costs and is easy to use by users, both students and teachers. Information technology that is developing very rapidly at this time, especially the development of educational technology, has contributed to the development of this autoplay-based learning concept [15].

Stage of Design (Design)

The validity and reliability tests of the instrument were analyzed with the help of the Microsoft Excel 2019 and SPSS 25 programs which can be seen in Appendix 8. The validity of the media expert questionnaire as many as 20 statement items was declared valid with the criteria r_count>r_table with the reliability coefficient value obtained, namely r11=0.846>0,6. This shows that the statement items used are valid and reliable. Below is shown Table 4.1 of the media expert questionnaire of teaching materials along with the results of the analysis. The assessment of teaching material media experts indicated by the continuum line is very strong, which is at 93%, meaning that science teaching materials using an Autoplay-based discovery learning model received a very strong assessment and were feasible to use.

The validity and reliability tests of the instrument were analyzed with the help of the Microsoft Excel 2019 and SPSS 25 programs which can be seen in Appendix 10. The validity of the material experts as many as 15 statement items was declared valid with the criteria r_count>r_table with the value of the reliability coefficient obtained, namely r11=0.847>0.6. This means that the instrument used is valid and reliable. Below is shown in Table 2 the expert questionnaire of teaching materials along with the results of the analysis.

The assessment of material experts indicated by the continuum line is very strong, which is at 94.67%, meaning that integrated science teaching materials using an Autoplay-based discovery learning model received a very strong assessment and deserved to be used.

Discovery learning learning model is the right choice where students are actively involved in discovering the main problems they face during the learning process. The application of discovery learning learning models using a scientific approach can improve critical thinking skills and improve student learning outcomes, besides that discovery learning models have a very good influence on students' generalization abilities [16].

Development Phase (Development)

At this stage of development, the instrument used for testing has been tested for validity and reliability with the help of the Microsoft Excel 2019 and SPSS 25 programs for both multiple choice questions and student response questionnaires. The validity test of multiple choice questions with 25 questions to be used is said to be valid according to the criteria r_count> r_table, and the value of the reliability coefficient obtained is r11 = 0.899> 0.6. This means that the multiple-choice instrument used is valid and reliable.

Furthermore, the student response questionnaires were also tested for validity and reliability. The test of the validity of the student response questionnaire instrument with 10 statement items is said to be valid according to the criteria r_count> r_table, and the value of the reliability coefficient obtained is r11 = 0.726> 0.6. This means that the student response questionnaire instrument used is valid and reliable.

At the development stage, initial trials have been carried out in small groups consisting of 5 students of class VIII at SMP Negeri 3 Satap Lembean Timur. This group trial really helps researchers so that researchers can find out the quality in terms of product appearance and material presented in this teaching material. Student response questionnaires in small groups can be seen in Table 1. along with the results of the analysis.

Data Analysis Prerequisite Test (Normality Test)

The normality test is used as a criterion for hypothesis testing carried out in this study, namely the paired sample t-test where the data used are normally distributed. The normality test was used to determine whether the sample data came from a normally distributed population or not, in this study using Saphiro Wilk with the help of SPSS 25

If the significance value obtained is > 0.05, then the sample comes from a population that is normally distributed, if the significance value obtained is <, then the sample comes from a population that is not normally distributed. Based on Table 2 testing using Saphiro Wilk (sample <30), it can be seen that the significance value of the data obtained before the intervention and after the intervention is greater than 0.05 so that it can be taken a decision that the student learning outcomes data before and after the intervention are normally distributed. can be continued with the next test, namely the paired sample t-test.

Hypothesis Testing

The hypothesis testing proposed in this study uses the paired sample t-test, which is an analysis by comparing the difference between the two means of two paired samples with normally distributed data that has been previously tested using the normality test. The results of hypothesis testing using SPSS 25 can be seen in Table 1. below.

Table 1: Analysis Results of Paired Sample t-test

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre - Post	-51.200	5.597	1.252	-53.819	-48.581	-40.910	19	.000

Based on the results in Table 1, it is found that the significance value (2-tailed) of student learning outcomes obtained is smaller than 0.025 (a significance level of 0.025 is used for the two-tailed test), then H0 is rejected and H1 is accepted. This means that the average learning outcomes of students who are taught with integrated

science teaching materials using an Autoplay-based discovery learning model are higher than the learning outcomes of students who are taught using conventional models.

Discovery learning learning model using integrated science teaching materials based on Autoplay was applied to two different treatments but on the same subject, namely class VIII of SMP Negeri 3 Satap Lembean Timur. These two treatments are called period 1, namely in the learning process students are taught with conventional learning models using existing media or books and period 2, namely students are taught with integrated science teaching materials, business materials and simple machines using discovery learning models based on Autoplay. The instrument used has been through a feasibility test, namely the analysis of the validity and reliability of the items to measure student learning outcomes. Based on the data from the evaluation by media experts, material experts and student responses to the product produced using a Likert-scale questionnaire, integrated science teaching materials using an Autoplay-based discovery learning model were declared feasible to be used for trials in real classes. The results of this study have been tested theoretically and empirically with the help of SPSS 25 where the hypothesis is accepted that the average learning outcomes of students taught with integrated science teaching materials using an Autoplay-based discovery learning model are higher than students taught using conventional models.

Based on the research results, the teaching and learning process is getting better by using integrated science teaching materials using an Autoplay-based discovery learning model. The influence of teaching materials on the learning process provides several advantages, including:

1. The development of students' intellectual abilities in understanding the material independently so that students become learning centers and teachers become facilitators.
2. Overcoming the limitations of facilities and infrastructure in schools.
3. Overcoming the limitations of learning time so that the learning objectives achieved are maximized.
4. The material presented is more interactive, accompanied by simulations that can stimulate students' motor skills and is equipped with practice questions and explanations in the form of interactive quizzes so that students understand the business material and simple machines that are learned faster.

Through integrated science teaching materials using an Autoplay-based discovery learning model, students are more enthusiastic in learning activities because learning begins with the provision of stimuli/stimulus by the teacher by displaying pictures and animations, which then encourages students to think critically with existing problems, then students collect data, process data, do evidence and are able to draw conclusions.

Stage of Dissemination (Disseminate)

The results of this learning product development will be presented at scientific meetings. The development products that have been produced by researchers have had a positive impact on the development of the quality of learning including the implementation of the resulting development products that can improve student learning outcomes, the teaching and learning process using the resulting product makes the learning process more effective and efficient, and the resulting product helps teachers in teaching and learning process in the classroom and can encourage teachers to be creative to develop better teaching materials.

Conclusion

Based on the results of the study, it can be concluded that:

1. Integrated science teaching materials using an Autoplay-based discovery learning model that are produced are good and suitable for use in the learning process.
2. Integrated science teaching materials using an Autoplay-based discovery learning model can improve student learning outcomes.
3. Integrated science teaching materials using an Autoplay-based discovery learning model can improve the teaching and learning process effectively and efficiently.

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