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Development of physical teaching materials based on mind map concept with multimedia to improve student learning results

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Abstract
Development of Physics Teaching Materials Based on Mind Maps with Multimedia Concepts to Improve Student Learning Outcomes. This study aims to 1) Develop teaching materials based on mind maps with multimedia that are feasible to use. 2) Learning materials with a concept (mind map) with multimedia can improve student learning outcomes. The research method used is the research and development method (Research and Development). The subject of the research trial consisted of theoretical trials and empirical trials. The theoretical trial consists of 2 people divided into 1 person as an expert on design & learning and 1 person as a theorist in the field of physics. For the empirical test consisted of 10 people for the small group test, 20 people for the field trial and 30 people for the operational test. The instruments used in this study were questionnaires and test results. Data on student learning test results from 2 groups were analyzed by the experimental method pretest-posttest control group design. The data were analyzed descriptively and the mean difference test. In accordance with the testing criteria, namely if the significance value or sign (2 tailed)> 0.05 then H0 is accepted and H1 is rejected and if the significance value or sign (2 tailed) <0.05 then H0 is rejected and Ha is accepted. Then based on processing data obtained a significance value of 0.009 <0.05. So that it can be concluded that, the average learning outcomes using multimedia-based mindmap teaching materials is higher than conventional teaching and learning materials.

Keywords: Teaching materials, mind maps, multimedia, learning outcomes

1. Introduction
Learning is a system that aims to help student learning activities designed in such a way as to support and influence the learning process. In order to achieve the learning objectives, there needs to be an effort to create conducive learning situations and conditions, namely by applying the right learning strategies. Learning needed by students (Warsita, 2008) is learning that can change student behavior (cognitive, affective and motoric aspects).

Competence in developing teaching materials should ideally be mastered by the teacher well, but in reality there are still many teachers who have not mastered it, so there are still many conventional learning processes. The impact of conventional learning, among others, is that teacher activities are more dominant and conversely students are less active because they are more likely to be listeners. Besides that the learning that is done is also less interesting because learning is less varied.

According to observations made by researchers to students of 20 Bitung Christian High School students through questionnaires, there were 80% who said Physics lessons were boring, 85% had difficulty remembering Physics material and formulas, 25% had complete records to study at home, there were only 15% who are interested in learning Physics, 90% of students answer that teachers lack innovation in learning Physics. Furthermore, on the results of the Mid Semester exam in semester = odd school year 2015/2016 which I got for class Xa with 38 students, only 3 students achieved the KKM score. For class XI IPA with 20 students, only 5 students achieved the KKM score.

Based on the facts above and the results of observations at Bitung Christian High School, I was motivated to be able to compile teaching materials with the concept of Mind Map which is expected to be able to improve students' abilities in Physics learning at school.

1.1. Research purposes
This research was conducted with the aim of
1. Develop teaching materials based on mind maps with multimedia that are suitable for use
2. Teaching materials with a concept (mind map) with multimedia can improve student learning outcomes

1.3 Problem Formulation
Based on the background of the problem, identification of the problem and the limitations of the problem, the formulation of the problem in this study are as follows:
1. How to develop teaching materials based on mind maps with Multimedia?
2. Does using teaching materials based on the concept map of mind (mind map) with Multimedia can improve student learning outcomes

Research methods
This research was conducted at Bitung Christian High School and in the even semester of the 2015/2016 academic year. The research method used is the research and development method (Research and Development).

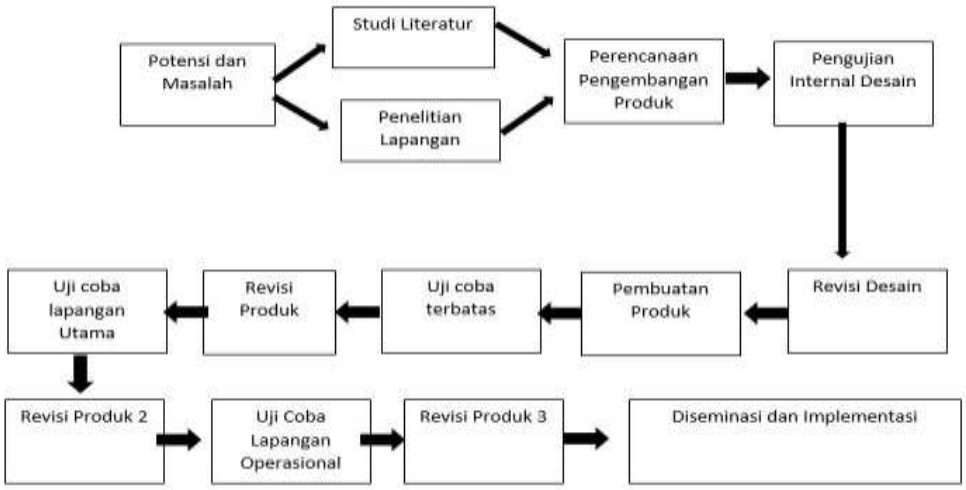

Fig 1: Stage of research and development (Sugiyono, 2015)

The main field testing is carried out using revised I products in real conditions. Tested using the experimental method using pretest posttest control group design. Matters relating to this experimental test:

1. Research subjects (population and sample)
The study population was all Bitung Christian High School students by taking samples in class X.

2. Research Variables
The variables identified in this study are
Independent variable: Learning with Multimedia-based Mind Map
Dependent variable: As the dependent variable is student learning outcomes

3. Research instruments
The research instrument used in the large group test is a learning outcome test in the form of multiple choice questions that have been tested for validity.

4. Data Analysis Techniques
There are 2 types of data analysis carried out, namely qualitative data analysis (validation questionnaire and student response questionnaire in small group test & main trial) and and quantitative data analysis (pretest and posttest data). After the results of the questionnaire data are obtained, the next is analyzing the data. This research data was analyzed by descriptive percentage system using the formula:
= percentage subvariable
S = number of scores for each variable
N = maximum score

From the percentage that has been obtained, it is transformed into a table so that the reader of the research results becomes easy.
To determine the qualitative criteria is done by:

a. Determine the ideal percentage score (maximum score) = 100%
b. Determine the lowest percentage score (minimum score) = 100%
c. Determine the range = 100-0 = 100
d. Determine the desired interval = 4 (good, enough. Less and not good)
e. Determine the width of the interval (100/4 = 25)

Based on the calculation above, the percentage range can be specified in the following table

Table 3.1: Range of percentages and qualitative criteria

Percentage	Categories
76%<skor<100%	Good
51%<skor<75%	Good enough
26%<skor<50%	Poor
0%<skor<25%	Not good

Data hasil tes belajar siswa dari 2 kelas dianalisis dengan metode eksperimen *pretes-postest control grup design*.

Table 2: Research Design

R	O_1	X	O_2
R	O_3		O_4

In this design, there were two groups randomly selected, then given a pretest to find out the initial condition, was there a difference between the experimental group and the control group (Sugiyono, 2015). The pretest results were good if the experimental group values were not significantly different. experiments and then posttest for both groups.
The t-test statistics were performed with the SPSS application to examine the average difference between the 2 study groups with the conventional method as a control class and by using the multimedia-based mind map concept as an experimental class with the hypothesis hypothesis:
: the average learning outcomes of groups of students given treatment using Multimedia-based Mind Map learning materials lower or equal to the learning outcomes of groups that were not treated (conventional models)
: the average learning outcomes of the group of students who were treated using learning materials based on Multimedia Mind Map was higher than the learning outcomes of groups of students who were not treated (conventional models)
With testing criteria, if the significance value or sign (2 tailed)> 0.05 then H0 is accepted and Ha is rejected and if the significance value or sign (2 tailed) <0.05 then H0 is rejected and Ha is accepted.

Results and Discussion

Planning:

Study of literature

At this stage the material was collected as the initial step in the research. Literature studies are carried out on teaching material (Dynamic Electricity) and mind map based learning and the preparation of syllabus and lesson plans used.

Field Observation

Field observations were carried out on September 21-25 2015. The researcher conducted observations at the school where the research was conducted and identified estimates of needs, school conditions, problems faced by students, analysis of school learning and facilities and infrastructure at the research location.

Product design plan

Teaching materials with mindmap are made with the Imindmap 7.0 application and presented with autoplay 7.0. The initial appearance can be seen in the following picture:

Fig 1: Cover teaching material

Teaching materials are prepared based on the curriculum implemented in the school, namely KTSP. The material made is taken from several books and adapted to the learning objectives to be achieved.

Internal Test (expert validation)

Expert validation 1 Design & learning media

The following are data from the expert review.

Table 2: Summary of interviews with reviewers

Reviewer comments for product parts that need to be revised	Note the suitability of the image, the color and material displayed must match.
Recommendation	appropriate and can be given to students, but first corrected according to the correction given.

Expert Validation 2 Material in Physics

After taking the questionnaire data from the reviewer, the researcher also received an evaluation from the reviewer directly. The following is an overall summary.

Table 4: Summary of interviews with Material Experts in the field of Physics

Reviewer comments for product parts that need to be revised	Pay attention to the order in which the material is presented. For electrical measuring material, a practicum is held to train student interaction with physical measuring instruments
Rekomendasi	This material is appropriate and can be given to students, but is corrected according to the corrections given.

Revision Based on Validation

Based on expert validation carried out, revisions were made to the teaching materials that had been made.

Making Teaching Materials

Teaching materials are prepared according to the recommendations of the reviews.

1. Write down the subject matter of learning as the main idea in the concept map
2. Write down the branches of sub-material and additional explanations according to the material
3. After that the mind map created is input into autoplay which also contains Syllabus, RPP, learning material for 3 meetings.

Limited Trials (Test Small Groups)

In this initial trial, the product is ready to be tested on 10 students. This is done to find out the weaknesses and shortcomings of the product. After the teaching material is presented by the researcher, students are given a research questionnaire to assess the teaching material that has been made.

From the questionnaire results data in the small group test, the teaching materials used were very good as seen from the achievement of each question given, namely 93.27%.

Revisions

Data that has been obtained based on field trials from students and reviewers, is useful for improving teaching materials. Testing this group, helps in making teaching materials to be better when they will carry out large group tests.

Pilot Field Test (Large Group Test)

In this initial trial, the product was ready to be tested to 20 students. This is done to find out the weaknesses and shortcomings of the product in the actual situation. After the teaching material is presented by the researcher, students are given a research questionnaire to assess the teaching material that has been made.

From the questionnaire results data in the large group test, the teaching materials used were very good as seen from the achievement of each question given which was 97.18%.

Revisions

Data that has been obtained based on the main field trials of students, is useful for improving teaching materials. This

group test, helps in making teaching materials to be better when going to carry out operational field tests.

1.5 Testing of the Operational field

This trial was carried out to test the research hypothesis. Operational trials were carried out using the experimental method with the control group design. The study was conducted in the classroom and used 2 classes for the experimental group and the control group with the number of each class, which was 30 people.

Before conducting the study, initial tests were given for both groups. This is done to see the similarity of knowledge from both groups. Then, the initial test data of the two groups (pretest) were tested for normal data and the similarity of the data in the two groups as a prerequisite test in both groups. The following is a table of normality and homogeneity of data analyzed using the SPSS version 17.0 application.

Table 7: Test the normality of the data pretest control class and experimental class

One-Sample Kolmogorov-Smirnov Test			
		Eks	**Kontrol**
N		30	30
Normal Parameters[a,,b]	Mean	34.77	33.82
	Std. Deviation	16.62	15.67
Most Extreme Differences	Absolute	.191	.197
	Positive	.191	.197
	Negative	-.187	-.152
Kolmogorov-Smirnov Z		1.045	1.080
Asymp. Sig. (2-tailed)		.224	.194

a. Test distribution is Normal.
b. Calculated from data.

Berdasarkan tabel diatas dapat disimpulkan pada data kelompok control dan kelompok dan kelas eksperimen berdistribusi normal karena nilai signifikannya lebih besar dari 0.05 yaitu untuk kelompok control 0,224>0.05 dan untuk kelompok eksperimen 0.194>0.05.

Table 8: Test homogeneity of experimental and control groups

Kontrol – Eksperimen	**Mean**	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**		**T**	**df**	**Sig. (2-tailed)**
				Lower	Upper			
	-8.3	16.2	2.9	-14.3	-2.2	-2.8	29	.009

Test of Homogeneity of Variances			
Levene Statistic	**df1**	**df2**	**Sig.**
1.584	3	26	.217

Based on the table above, it can be concluded from the experimental and control group data, the two groups have similarities because the significance is 0.217> 0.05 both groups are considered homogeneous.

Then the experimental class was given treatment using instructional materials that had been developed and control classes with learning as usual (not given treatment). The learning process is carried out on 3 occasions face-to-face for Dynamic Electricity learning and at the fourth meeting Postes.

Then t test is done to test the hypothesis with the data as follows.

In accordance with the testing criteria, namely if the significance value or sign (2 tailed)> 0.05 then H0 is accepted and H1 is rejected and if the significance value or sign (2 tailed) <0.05 then H0 is rejected and Ha is accepted. then based on processing data obtained a significance value of 0.009 <0.05. So that it can be concluded that rejecting Ho and accept H1, that is, the average learning outcomes using multimedia-based mindmap teaching materials is higher than conventional teaching and learning materials.

1.1 Desimination

This teaching material is presented at a scientific meeting. Based on the results of the study, it turns out that this development product has advantages, namely:

a. Provide an increase in average learning outcomes for students, so that learning outcomes increase.
b. Helping teachers in classroom learning activities, because teaching materials are complete along with the material packaged in Mindmap presentations.

1.2 Discussion of Research Results

After analyzing the normal test and similarity in the two groups, then the study was conducted in the experimental group. In the learning activities the experimental group used the multimedia mindmap teaching material and the control group carried out conventional learning. The study was conducted for 1 month in 3 x meetings in class for control and experimental groups. After the material is finished the next meeting is a test of learning outcomes.

Development of teaching materials with multimedia-based Mindmapp was made to improve the learning outcomes of physics, especially in class X Dynamic Electricity material. The results of calculations based on student learning results showed that there were differences in average physics learning outcomes group development of learning devices using multimedia-based mind mapp teaching materials namely groups experiment with control groups. The experimental group got higher average learning outcomes than the control group. This means that the development of this device can be used specifically on the material of Dynamic Electricity to improve the learning outcomes of physics.

This research is relevant to the research conducted by Weni Arianingtyas Uji Lestari with the title Use of Mind Map to improve learning outcomes for Purworejo and Arisdea tri Putra state MTs students with the title Mind Map-Based Multimedia Effect on student learning outcomes and retention on Hydrocarbon material. each of these studies is an increase in student learning outcomes using Mind mapp. However, what is different from these studies is the research that has been done, namely researchers combine the development of mind map teaching materials with multimedia presentations. This product also helps teachers

in classroom learning because it is practically used without having to bring many books into the classroom and can also be shared with students in the form of learning videos so students can learn anywhere.

Conclusion

The results of the research on the development of teaching materials based on the mindmap concept with multimedia to improve Physics learning outcomes, have been carried out in accordance with R & D research, it can be concluded that the results of this study are as follows

a. Teaching materials with this multimedia-based mind map concept can improve student learning outcomes in class X of Bitung Christian High School
b. Teaching materials with multimedia mind map based on this are good and effective to be used in the learning process in class X of Bitung Christian High School

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