

Development of Edugame Mathematics Learning Media with Innovative Expository Methods in Ar Raudah Bandar Lampung Elementary School

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Abstract: *This research is a research development that aims to obtain computer-based multimedia edugame delivered with expository methods so as to improve mathematics learning outcomes of fifth grade elementary school students. The population of this research is the fifth grade students of Ar Raudah Elementary School in 2019/2020. This research procedure refers to the Borg and Gall Research and Development development procedure. Research data obtained through learning outcomes tests. Data analysis techniques using the t test. This test was conducted to determine the comparison of learning outcomes using edugame media and those not using media. The results of the preliminary study indicate the need for the development of multimedia in the form of edugame. Multimedia validation results indicate that the multimedia is included in good categories. Average posttest results on multimedia learning show learning outcomes using Edugame better than learning outcomes that do not use Edugame.*

Keywords: Multimedia, Edugame, Expository, Elementary School

1. Introduction

Student learning outcomes on material with the basic competency of adding and subtracting two fractions with different denominators many still get grades below the minimum passing grade standard. This affects the learning outcomes of the next basic competencies, because the understanding of concepts in the previous basic competencies is very influential on the continuation of the understanding of the next basic concepts, and also affects the student learning outcomes. Efforts to improve the understanding of concepts of mathematical material can be done with the help of instructional media. The continued use of assistance (media) in mathematics learning in elementary schools can provide satisfactory results on student learning outcomes. Current technological advances present so many learning media that can be utilized by teachers, including the use of computer-based media. This is supported by the opinion of Bellamy & Mativo (2010) quoted by Turqut & Temur (2017: 1) which states that “*with the development of technology, the computer games have been involved in children's game world and the educators started using technology and technology-assisted games in the learning process*”.

The selection of the right media will help teachers and students experience a real learning process and can achieve learning goals well. The choice of media must be adjusted to the conditions that develop in the school. One of them is the availability of school facilities and infrastructure where the teacher will develop learning media that will be used. Observation results show that Ar Raudah Elementary School as one of the elementary schools with excellent facilities and infrastructure has the potential to develop computer-based learning media. This school has a computer laboratory which is quite adequate. Starting from grade 1 students already introduced to computers through the subjects of Technology and Communication Studies (ICT). But the use of computers has not been integrated with other lessons. This is interesting to study, considering that computer

technology can help teachers teach complex concepts such as mathematics.

The use of appropriate learning methods and in accordance with the media used will also help improve student mathematics learning outcomes. One of them is expository method which is integrated with edugame media so that it becomes innovative learning. So that research will be conducted in developing computer-based learning media with expository methods in mathematics subjects in class V SD Ar Raudah so that learning becomes more innovative and can improve student learning outcomes. The purpose of this research itself is to see the effectiveness of the use of media in improving student learning outcomes.

2. Literature

2.1 Characteristics of Learning Mathematics in Elementary School

According to Piaget (Karwono & Mularsih, 2017: 89), the stages of development in elementary school students aged 7 - 11 years are the stages of concrete operations. In this case, the child can draw conclusions based on logic, although it is still limited to concrete objects. Children cannot solve abstract problems. The opinions of these experts refer to learning theories that are grounded in the cognitive view. Karwono (2017: 84) mentions learning according to cognitive learning theory is a process that involves mental activities in humans as a result of the process of active interaction with the environment to obtain changes in the form of knowledge, understanding, behavior, skills and attitudes that behave in relative and trace. This theory emphasizes that learning is not just an interaction between stimulus and response but also involves other psychological aspects such as mental, emotional, and perception.

The learning tendency of children in primary school age forms its own characteristics for students. Sumantri (2016: 154) further explained that the characteristics of elementary

school students are happy playing, happy moving, happy working in groups, and happy to feel or do / demonstrate something directly. Stages of student development affect the tendency to think so as to create student character in learning. This also applies when students learn mathematics, where understanding mathematical concepts for elementary students must start from something real, step by step and will be better if it is associated with daily life. Some expert opinions about the characteristics of learning mathematics in elementary school and supported by learning theories that influence mathematics learning become the foundation in developing the process of learning mathematics in accordance with the characteristics and tendencies of thinking of elementary school students so that learning objectives can be achieved.

2.2 Computer-Based Learning Media

The development of ICT (Information and Communication Technology) led to the increasing use of technology-based media in learning, education and training. One form of technological progress is the use of computers as learning media. The role of computers in learning according to Robert Taylor in Nurama (2012: 17), namely as a tool (tool) and as a tutor. The computer as a tool means that the computer is a tool in the learning process, while the computer as a tutor means that the computer replaces the teacher's role in teaching, presenting information, testing through questions and giving feedback such as in learning games or involving students in simulations and games.

Learning using a computer that is closest to the characteristics of elementary school age students is learning models Education Games (Edugames) or Instructional Games. According to Rusman (2009: 300), computer-based learning with game models has fun characters and challenges for students. Edugames himself according to Rusman (2009: 301) has several characteristics that must be fulfilled as learning media, namely: having learning objectives that are identical to achieving scores at the end of the game, having clear rules, being competitive, and there are challenges that trigger students to get the best result.

The selection of computer-based learning media in the form of instructional games (Edugames) is expected to be in accordance with the characteristics of elementary school student learning, which is a fun game developed and developed in the way of thinking students are still in the game of thinking on real and interesting things. Edugames presentations that are packaged attractively are expected to increase students' learning, students can easily improve the mathematical concepts they learn and ultimately can improve student learning outcomes.

2.3 Expository Learning Method

One of the learning methods that can be chosen in learning mathematics for elementary students is the expository method. According to Sumantri (2016: 69) the expository method is usually used in ready-made subject matter, such as data or facts, certain concepts that must be memorized so that they do not require students to recite.

Essentially the expository method is a learning step that is used to provide information in advance the definitions, principles and concepts of subject matter and provide examples of problem solving exercises in the form of lectures, demonstrations, questions and answers, and assignments. Students follow the pattern of the teacher carefully (Sumantri, 2016: 61).

The steps of implementing the expository method according to Sumantri (2016: 67) are:

(a) Preparation

Some things that must be done in the preparation step include giving positive suggestions avoiding the negative ones, starting with expressing the objectives to be achieved, luring students to be active in thinking. The purpose of this preparation is to arouse students' motivation and enthusiasm for learning, arouse curiosity, and create an open learning atmosphere and climate.

(b) Presentation

Important things that must be considered in presenting material include language use, voice intonation, maintaining eye contact with students, using humor that is refreshing and educative.

(c) Correlation

This step is carried out to connect the material with the experience of students or with other things that enable students to capture the connection in the structure of knowledge they already have.

(d) Summing up (Generalization)

This stage is done to understand the substance of the subject matter that has been presented.

(e) Apply (Application)

In this step, students demonstrate the ability of the material they have learned at that time. The teacher collects information about mastery and understanding of the material by students. Techniques that can be carried out at this stage include making assignments relevant to the material presented or by providing tests that are consistent with the subject matter that has been presented.

The design and implementation of learning will be adjusted to the characteristics of student learning in elementary schools and integrated with computer-based learning media. Some stages of the implementation of learning by the expository method will be presented on a computer screen in the form of an education game. The stages in question are the presentation stage, the correlation stage, and applying so that the teacher's role will be more utilized to monitor the progress of each student.

3. Research Methodology

The research model that will be carried out in this research is research and development. Research and development is a research process used to develop and validate educational products. Research and development emphasizes the process of developing an education and learning process to produce

a learning product, learning system, and so on (Hasyim, 2016: 43)

The research method used in research and development that will be used in this study is a mixed method (mixed method). Survey or descriptive research in the preliminary stage (qualitative), experimental research or action research for the development and evaluation or final stage of the experiment to measure the effectiveness of a product (quantitative).

Broadly speaking, research and development consists of three stages, namely:

- 1) Preliminary studies or needs analysis include library studies, curriculum studies, and field studies.
- 2) Planning and product / product development include product design planning, product design, product validation by experts, product revision of validation results and limited product trials.
- 3) Product evaluation includes field trials and product revisions.

This research is only to find out the effectiveness of the product that will be produced in this study, namely Edugame for mathematics subjects in Elementary Class V Odd Semester 2019/2020 academic year with innovative expository learning methods.

The stages that will be carried out in this study are as:

1) The initial data collection stage, the activities carried out are:

- a) Needs assessment, carried out through questionnaires and observations. The results of the need assessment indicate that the potential possessed in this study is that students' interest in mathematics is quite good. In addition, the school has laboratory facilities that are sufficient to support the learning process and students start using computers since sitting in first grade, so that computers are not foreign to students. From the data on the passing grade of subjects, for the achievement of the basic competencies of addition and subtraction of fractions with different denominators, more than 50% of students have grades below the KKM so that this problem has the potential for conducting research development.
- b) Literature study is carried out to find concepts and theoretical foundations that are consistent with the research to be conducted. This activity can be carried out among others by reviewing relevant research journals, gathering information about learning media that have been used in schools, exploring forms of learning media that are sold on the market or that are developing on the internet widely, as well as learning methods that are appropriate to support the learning process for the better. The results obtained from the collection of information indicate that there will be research to develop computer-based mathematics learning media in the form of instructional games (Education Games) using innovative expository methods for fifth grade elementary school students

2) The planning stage

Acquisition of information obtained in the initial data collection information is used for product development planning to overcome problems that occur at Ar Raudah Elementary School in Bandar Lampung. At this stage activities are carried out:

- a) Analyzing Core Competencies and Basic Competencies
- b) Formulating Competency Achievement Indicators
- c) Make a story board for the preparation of education games to be developed
- d) Compiling syllabus and Learning Implementation Plan

3) Design the initial product

In the next stage, planning the development of learning media which is the result of the potential and problem stages as well as the information gathering stage, will be used as a reference for product design. The result of this product design is called **Prototype 1**, which is in the form of an Educational Game.

4) Test the initial product

- a) Provide Prototype 1 to two experts, namely media experts and material experts.
- b) Conducting one-on-one limited trials on 3 students in grade VI and 3 teachers at Ar Raudah Elementary School Bandar Lampung
- c) Conducting a small group trial on 10 grade VI students of Ar Raudah Elementary School Bandar Lampung

5) Design revisions

- a) Revise and improve **Prototype 1** that has been made based on the results of input and suggestions from experts and users (students).
- b) The results of the revised **Prototype 1** are named as **Prototype 2**.

6) Main field trials

- a) To test the effectiveness of using Education Games (**Prototype 2**) products in the learning process.
- b) Implementation of product trials in limited classes and broad classes using the Posttest-Only Control Design experimental research model.
- c) The purpose of this stage is to determine whether the product being developed has shown performance as specified criteria or not. Consists of testing the effectiveness of the use of the product being developed

7) Revision of the final product

- a) Conduct a final revision of the Education Game product based on the notes on the main field trial results
- b) Make a final finalization or comprehensive refinement that the Education Game product is ready to use.

The product that has been developed was tested using the Intact - Group Comparison Design design, where in this design what was done was to compare the posttest values of the experimental and control classes.

In actual research, the effect of treatment is analyzed by different tests using *t-test* statistics. If there is a significant difference between the experimental group and the control group, the treatment given has a significant effect.

Initial analysis and evaluation of the product was carried out by this expert team after conducting a trial of Edugame Fractional products on aspects of product technical quality, aspects of content quality and objectives and instructional quality aspects.

Data analysis technique used in this study is to use descriptive statistics by presenting tabular data. The data to be processed is quantitative data obtained from the learning achievement test (posttest).

The form of the test used in collecting data is a test with a description form of 10 questions. The test instrument used to see the learning outcomes of students who received learning took the form of using Edugame Math media (experimental class) and those who did not receive training (control class). The effect of treatment (evaluation) was analyzed by different tests, using t-test statistics. If there is a significant difference between the experimental group and the control group, then the assistance is given the proven significance of the benefits.

The hypothesis used in this t-test is as follows:

Ho: $\mu_1 = \mu_2$ (The average mastery value of student learning outcomes using Education Games learning media with innovative expository methods is the same as the average value of student learning outcomes without using Education Games with innovative expository methods)

H1: $\mu_1 > \mu_2$ (The average value of student learning outcomes using the Education Game learning media with innovative expository methods is higher than the average value of learning outcomes without using Education Games with innovative expository methods).

The results of calculations using SPSS, can be seen in the column "Equal Variances Assumed" if the value of Sig. (2-tailed) < 0.05 ; then it can be concluded that Reject Ho and Accept H1. If the results of the t-test are accepted H1 then the effectiveness test shows positive results, so the products used are quite effective in improving student learning outcomes.

4. Results and Discussion

4.1 The Results of Expert Validation on Edugame Products

The results of expert validation on Edugame product development are described in Table 1 :

Table 1: Product Validation Results by Experts

Expert	Result	Category
Theory	83,81%	Very Good
Media	76,67 %	Very Good

Table 1 explains that, the results of the validation calculations performed by material experts on the developed edugame products in terms of content quality and objectives as well as instructional quality aspects amounted to 83.81% which showed very good results. The results of the validation calculations performed by media experts from the technical quality aspect of the product were 76.67% which showed very good results.

The validation results show that edugame products are eligible to be tested on fifth grade elementary school students with the addition and subtraction material fractions that have different denominators.

4.2 Learning Outcomes

Student learning outcomes can be seen from the results of the posttest given to students at the end of learning. The minimum value a student must obtain to pass this material is 71. Table 2 illustrates the results of the acquisition of student learning tests in the experimental class (using Edugame) and the control class (not using Edugame):

Table 2: Student Learning Outcomes

Class	Total Students	Posttest Score	Percentage
Experiment	22	< 71	27,27%
		> 71	72,72%
Control	22	< 71	45,45%
		> 71	54,54%

Table 2 explains that students in the experimental class who obtained a posttest score > 71 were 72.72%, while students in the control class were 54.54%. This shows that students who studied addition and subtraction on fractions with different denominators using Edugame scored > 71 more than students who did not use edugame.

4.3 Edugame Product Effectiveness Test Results

The effectiveness of the use of Edugame learning media can be seen from the results of the t-test using student posttest scores. Table 3 shows the results of the t-test using the SPSS 17.0 program

Table 3: t-test Results

Class	N	Mean	t-test For Equality of Means Sig.(2-tailed)
Experiment	22	78,68	0,046
Controll	22	72,73	

Table 3 shows that the results of the t-test were 0.046 < 0.05 . This means accepting the H_1 hypothesis and rejecting H_0 so that Edugame products are quite effective in improving student learning outcomes.

4.4 Discussion

The development of Mathematics Edugame learning media on the addition and subtraction of fractions with different denominators shows very good results. The results of media and material validation conducted by experts also showed very good results. This learning media is also quite effective in improving student learning outcomes. Edugame learning media is used when students learn mathematics with expository learning methods. The use of Edugame learning media makes expository learning methods become more innovative so that they are no longer a reason for failure in the learning process.

The selection of learning methods and media that are tailored to the characteristics of students and subjects is expected to improve student learning outcomes and make the learning process more interesting and innovative so that

the desired learning objectives can be achieved. This has been proven through edugame learning media used in the learning process by using innovative expository methods.

5. Conclusion

Mathematics learning in class V at Ar Raudah Bandar Lampung Elementary School on addition and subtraction material on fractions with different denominators using computer-based Edugame learning media delivered with innovative expository methods can improve student learning outcomes. This can be seen from the acquisition of the posttest value of students who are superior compared to classes that study without the help of Edugame media.

A teacher's creativity is needed to develop learning methods and media used in the classroom so that learning goals can be achieved with excellent results.

6. Future Scope

Development of computer-based Edugame learning media can be done on other mathematical materials. Edugame can also be developed on technology devices other than computers, for example like on an Android-based cellular phone so that it can make it easier for students to use it. The selection of learning methods in the use of Edugame can be adjusted to the subject matter, the level of student thinking and student learning styles.

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