
Development of Interactive Computer Based Media for Learning Mathematics on Greatest Common Divisor (GCD) and Least Common Multiple (LCM) Topics

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Abstract: The purpose of research is to make an interactive computer based media for learning mathematics on GCD and LCM topics which is can be used by the teachers and students because this interactive computer based media is using the fun animation corresponded to the thinking stage of the elementary school student is on concrete stage. This research is development research with these following steps : 1. Analysis, including a) interview with fourth grade elementary school teacher about learning of mathematics, b) analyze the syllabus of the fourth grade mathematics subject, c) analyze the book text of the mathematics, d) review the literature of teaching materials. 2. prototype phase, including a) validation, b) practicality , doing a trial to Babussalam Elementary School Pekanbaru. 3. Assesment, evaluate if the prototype can be used as expected and effective to increase the quality of learning. The results show that the interactive computer based media for learning mathematic on GCD and LCM topics is valid. The trials to the fourth grade students of Babussalam Elementary School result show that the interactive computer based media for learning mathematics on GCD and LCM topics is practice, proven by the description and the data analysis can be conclude that the learning materials is effective to make the students learning activities and make the students learning independently and fun.

1. Introduction

Mathematics learning is a learning which is including the count operation. Mathematics is branch of science that is very important in daily life because it can grow the human thought. According to the model theory that explores the philosophy of mathematical concepts agree that all mathematical concepts universally exist in the mind of everyone. So, what is learned in mathematics are various symbols and expressions to communicate. For this reason thinking skills are needed for students to solve problems in mathematical operations. There are many opinions from students who think that mathematics is a scourge in teaching and learning activities in schools, even though the level of difficulty of a type or branch of mathematics is not caused by the type or branch of mathematics itself, but is caused by the difficulty and complexity of the phenomenon of communication, / investigated by the formulation use this type / branch of mathematics

In elementary schools the difficulties faced by students are often seen in GCD and LCM. This difficulty comes not only from the students themselves but from outside the students themselves including how to deliver material by the teacher.

The problems faced by the teachers and students in learning mathematics are :Teacher's teaching ability is lacking; The unavailability of facilities and infrastructure, such as teaching materials, learning media and media storage; Student's motivation is relatively low and parent's attention is also slow; The teacher is less creative in making/ creating learning media. Although some teachers already have laptops, they never been used to present learning materials; The monotonous learning process is the teacher conveys material without using media, giving examples of problems and discussing question (teacher-centered).

From the facts obtained, the research team tried to provide solutions to these problems appropriately by developing computer based interactive learning materials/media. The purposes is to improve the learning process, especially learning mathematics by using computer devices. Computer technology can be used to design interactive mathematics teaching materials/media. According to (HS Wandu, 2012) computers provide features to present topics (material) of mathematics to be interesting and fun for students. From this computer media can bring the atmosphere of learning discussion and students can also learn by themselves.

This computer learning media is interactive, teaching materials can also be studied by students outside school hours like at home. So that it helps students learn on their own. This computer based interactive teaching material can present GCD and LCM material with more interesting and fun animations. Teaching materials are presented visually and do not require much preparation and can save time.

This improvement was carried out based on the characteristics of elementary school students, namely: basically elementary school students aged between 6 or 7, to 12 or 13 years old. According to Piaget (in Heruman, 2008), they are in a concrete operational phase. The ability that appears in this phase is the ability in the process of thinking to operate the rules of logic, even though it is tied to concrete objects. So they are faster at capturing lessons from concrete things that are combined with animation because it suits to the age of elementary students.

2. Methodology

The form of research carried out is development research with the term Research and Development (R & D). The development model used is the procedural development model, which is a descriptive model, outlining the steps that must be followed to produce a product. The author focuses on developing computer-based mathematics learning media for FPB and KPK material in the form of books and CDs. According to Sugiyono (2007) steps of developing this research (1) literature study and data collection (initial analysis); (2) Conduct planning (design of props and supporting devices); (3) Develop initial products (expert validation and revision); (4) Conducting limited trials

a. Development Procedure

i. Literature study and data collection (initial analysis)

In the initial stage to get an overview of the field conditions (stage of needs analysis) to get the data the steps taken are as follow:

- 1) Conduct interviews with elementary school teachers aiming to find out what problems, obstacles or phenomena are encountered in learning mathematics, especially on GCD and LCM material.

- 2) Analyzing syllabus, RPP of mathematics subjects, especially GCD and LCM material. Aiming to find out what is taught according to the competency standards and basic competencies in the 2013 curriculum for KI and KD (Core Competencies and Basic Competencies)
- 3) Analyzing mathematics text books used to aim at viewing the contents of the book, the steps of presentation, practice questions and the tasks listed in the book are in accordance with the curriculum or syllabus of the subjects.
- 4) Reviewing literature on mathematics teaching materials as references or references on how to make good media to deliver GCD and LCM material in accordance with the characteristics of fourth grade elementary school students.

ii. Conduct planning (design of props and supporting devices)

The results of the initial analysis (needs) are used to design a prototype of a computer based interactive mathematical media model on GCD and LCM material which aims to be able to create computer based media that is in accordance with the characteristics of elementary students.

iii. Develop initial products (expert validation and revision)

This activity aims to get the results of products in the form of media in accordance with the needs of validation (assessment) conducted by experts, whether the media that has been designed is in accordance with the syllabus of mathematics subjects.

iv. ProductAssesment

a. Trials

The trial was conducted to obtain data used as a basic for revising the product. Before being tested, the product was evaluated by several experts. Small group trials of products will be held at one elementary school in Pekanbaru. Field trials are carried out after obtaining validation from experts and the input obtained is used as a basic for revising the product. The purpose of product testing is to find out the feasibility of the developed learning media. Furthermore, referring to the limitations and criteria of good teaching materials and media, the aspects the become an assessment to test the validation in this study are listed in table 1 below

Table 1. Assessment aspect of teaching materials and learning media

Item	Assessment Aspect
Teaching Materials	<ol style="list-style-type: none"> 1. Format, Systematics of presentation, readability, clarity/design of objects 2. Contents in accordance with the order of presentation in the curriculum, contains sufficient training and according to the concept, structure of presentation of concepts.
Media	<ol style="list-style-type: none"> 1. Compliance with the curriculum 2. Compliance with the concept 3. Compliance with the characteristics of elementary school students 4. Easy to use 5. Clarity of media image objects

b. Try Out Subject

The subject of limited trials was conducted on fourth grade students of SD Babussalam Pekanbaru.

c. Data Type

- 1) Qualitative Data. This data was obtained based on responses and suggestions regarding the development of instructional media products from media experts and material experts.
- 2) Quantitative Data. This data was obtained based on questionnaire evaluation of learning media by elementary mathematics teachers and student response sheets

d. Data Collection Instrument

Data collection instruments in the study were validation questionnaires. The research data was collected by asking the validator to provide an assessment of each aspect of the assessment contained in the validation sheet. The validation questionnaire used in the study was a media validation questionnaire by media experts, a material validation questionnaire by the teacher, and a student response questionnaire.

Using a scale of 1 to 4, the learning product assessment criteria are listed in table 2 and 3 below.

Table 2. Assessment Criteria For Teaching Material

Rated aspect	ASSESSMENT							
	VS	S	LS	NS	VG	G	LG	NG
	4	3	2	1	4	3	2	1
Suitable with the curriculum								
Suitable with the concept								
Contains enough training and suitable with the concept								
Concept presentation structure								
Systematic presentation of concept								
Legibility								
Interesting object design								

Ket: VS: Very Suitable, S: Suitable, LS: Less Suitable NS: Not Suitable, VG: Very Good, G: Good, LG: Less Good, NG: Not Good.

Table 3. Assessment Criteria For Learning Media

Rated aspect	ASSESSMENT							
	VS	S	LS	NS	VG	G	LG	NG
	4	3	2	1	4	3	2	1
Suitable with the curriculum								
Suitable with the concept								
Suitable with the strategy								
Easy to use								
Clarity of media image objects								

(adapted from Sehatta, 2015)

2.2 Data Collection Techniques

a) Literature

Literature is used as a reference or as a reinforcement of research data.

b) Questionnaire

The evaluation questionnaire consists of four types, namely evaluation questionnaire by media experts, materials experts, teachers and student responses questionnaire .

2.3 Data Processing and Analysis Techniques

Data analysis techniques were carried out to determine how valid and practical the computer based interactive mathematics learning media was on GCD and LCM material for elementary students.

$$\bar{M}_v = \frac{\sum_{i=1}^n \bar{V}_i}{n}$$

(adapted from Sudijono, 2011)

Keterangan:

\bar{M}_v : average total validity

\bar{V}_i : average validation of the i-validator

n : total validators

Determination of the range can be known through the highest score minus the lowest score divided by the highest score. Based on the determination of the range obtained a range 0.75. the validity criteria of the average analysis used can be seen in the following table.

Interval	Category
$3,25 \leq \bar{x} < 4$	Very valid
$2,50 \leq \bar{x} < 3,25$	Valid
$1,75 \leq \bar{x} < 2,50$	Less Valid
$1,00 \leq \bar{x} < 1,75$	Invalid

3. Result and Discussion

The purpose of this study was to make a valid and practical GCD and computer based interactive GCD learning media and to increase student activity in learning.

- Validity of computer based interactive GCD and LCM taching materials

The results of the description of the validator indicate that the GCD and computer based interactive teaching materials for GCD are valid by making improvements according to the validator’s suggestion. The results can be seen in Table 4.1 below

Table 4.1 Learning Media Validation Results

No	Validator	total	average	Information
1.	Validator 1	90	3.3	Very valid
2.	Validator 2	96	3.7	Very Valid
3.	Validator 3	100	3.7	Very Valid

The results of the validation of computer based learning media model interactive tutorials on GCD and LCM topic that have been declared valid by the validator. The results of the validation

of the learning media from the three validators were obtained by an average of 3.6 with the information very valid, the validators of the record to be tested with the rotation conditions:

- a. Learning objectives must be in the user guide
- b. Using consistent terms

Based on the suggestion and opinions of the validator, the following revisions were made.

- a. In the user guide plus learning objectives (as well as those on the CD)
- b. Using consistent (special) terms and symbols

The contents of teaching materials are in accordance with the learning material in the textbooks and syllabus of elementary school mathematics in grade IV. This can indeed be ascertained because in the preparation of teaching materials, the material refers to textbooks used by teachers and elementary school mathematics learning curriculum grade IV. Characteristics of teaching materials are also in accordance with interactive teaching materials, which can respond and feedback to students in learning. This interactive based media makes students learn independently because they can explore innovative ideas in learning, so that the learning process is student-centered.

- Practicality of computer based interactive GCD and LCM material teaching
From the results of interviews and student response sheets, as well as observations of the implementation of learning that is about computer-based GCD and computer-based interactive LCM teaching materials, it can be concluded that the computer-based GCD and LCM interactive teaching materials are practical, proven by:
 - a. The results of observations on computer-based interactive GCD and LCM learning material from the first meeting to the fourth meeting found that the teaching-learning process always increases students' enthusiasm in participating in learning (students are excited and happy) can be seen in students' behavior and can be shown based on the data, namely each meeting students can complete learning on time (some people are late). This computer-based teaching material really helps students learn independently.
 - b. The results of interviews and student response sheets on the use of computer-based interactive mathematics learning media on GCD and LCM material, the average student answers are:
 - 1) Learning with the computer based media for GCD and LCM topics is very interesting and fun so it is easy to understand in learning
 - 2) Learning with computer media makes students more active than learning with the media that teachers have used so far
 - 3) Learning with computer media makes them learn independently
 - 4) Learning with computer media makes them master math quickly
 - 5) Design of interesting teaching materials, so that the time used is in accordance with what has been determined by the teacher.

From the results of interviews and student response sheets it can be concluded that the use of computer-based interactive mathematics teaching materials for GCD and LCM materials has been practically seen in the students' responses and interview results.
- Effectiveness Of Computer Based Mathematics Teaching Materials
Student activities during the FPB and computer-based interactive KPK learning processes observed by observers are:

Table 4.2.Observer Observation Data on Student Activity in GCD and LCM Computer Based Interactive Learning

No	Observed aspects	Meet				Average
		I	II	III	IV	
1	Starting the activity	75	80	85	80	86,25
2	Student's creativity in the learning process	80	85	95	95	88,75
3	Seeing the images / animations used in learning	85	90	95	95	91,25
4	Seeing the relationship between the concept and the work done	85	95	90	90	90
5	Discussing with friends	80	60	45	50	58,75
6	Chatting out of the topics	0	0	0	0	
7	Complete the learning on time	90	95	95	100	95

From the results of observation sheets seen during learning shows teaching materials can bring positive activities for students (fun). Activities that often appear in the learning process are students observing / observing images / animations used in learning. In other words, the benefits of using computers in learning can improve the quality of the display so that students can see a more perfect concept that allows students to explore brilliant ideas. Student activity that is very prominent is the time to look at the relationship between the concept and the questions that are done so that it makes them creative in solving the questions correctly.

4. Conclusions

Teaching materials/computer based interactive mathematics learning media on GCD and LCM material for elementary students have been studied and concluded with the following results

1. The validation results of the validators show that computer based interactive mathematics teaching materials on GCD and LCM material for grade IV elementary students are valid. This means that the teaching material is in accordance with what has been expected
2. The results of trials conducted in the fourth grade of SD BabussalamPekanbaru showed that computer based interactive teaching materials for students on GCD and LCM are practical
3. Based on the description of data analysis from interviews and student responses sheets it can be concluded that teaching materials are effective in generating student learning activities

Recommendations

1. Computer-based interactive mathematics teaching materials on FPB and KPK materials can be used to assist learning in grade IV elementary school, especially at BabussalamPekanbaru Elementary School.
2. Computer-based interactive mathematics teaching materials on FPB and KPK materials can be used to help students learn independently at school or at home.
3. Computer-based interactive mathematics teaching materials on GCD and LCM material can be used as examples for developing interactive teaching materials for other mathematical materials.

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