Developing Interactive Learning Media of "Venn Gram" to Improve Conceptual Understanding of Set Operations

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Abstract

This research aimed at discovering the validity and effectiveness of the interactive media of "Venn Gram" to improve the conceptual understanding of the set operations. This research was a development research (*research and development*). The research subjects were the students of 7th grade who consisted of nine students. The data collection techniques were in the form of a validation questionnaire and test. The subjects were in the form of *pre-test* and *post-test* questions which later the answer sheets were used as an increase of students' conceptual understanding before and after using the media. The validation questionnaire results showed that 84% of the media were very valid, 83% of the material was very valid, and 82% of the test questions were very valid. The test results found that seven students experienced an increase in the *pre-test* and *post-test* scores. Meanwhile, two other students experienced a decrease. The results of students who had increased showed that the ability of students in understanding the concept of set operations was included in the high criteria before and after using the media. The media of the Venn Gram can be used to improve the conceptual understanding of set operations.

Keywords: Media; Venn Gram; Understanding; Concepts.

INTRODUCTION

The world of information technology is currently growing rapidly due to the increasing use of computers. The world of education requires their educators to master an IT. The use of computers in learning will continue the individual learning process to foster an independent learning. Therefore, the students will experience a process that is more difficult than a conventional learning (Rusman, 2011).

The relationship between technology and learning is that the students have good qualities such as attitude and creative. This can attract the students so that it creates a fun learning. In the Regulation Number 20 about National Education System Article 40 states that the teacher is obliged to provide a learning, of which learning is fun, enjoyable, creative, dynamic, and dialogic. Mathematics learning with meaningful understanding will make the students feel the benefits in daily life.

Conceptual understanding is the result of learning which higher than knowledge (Agustina, 2016). Thus, it needs meaningful, fun, creative, dynamic, and dialogic learning atmospheres to realize the students' development.

The students' understanding cannot be satisfactorily, in which it is seen from the low learning outcomes; moreover, it causes an interpersonal intelligence to be lacking. Therefore, interpersonal intelligence is the ability to understand and cooperate with others (Darmansyah, 2011 in the journal of Kamelia, 2017).

This fact causes many students whose level of understanding of the concept is very unsatisfactory. The mathematical conceptual understanding is the basic capital for a student in obtaining more meaningful learning, solving the mathematical problems, and obtaining satisfying learning outcomes (Wulandari, 2015). From the statements of expert, the researcher can conclude that conceptual understanding is the relationship between various factors or elements depicted in an abstract thought, idea, and something that has general characteristics such as it can help the process of reasoning, connecting, communicating, representing, problem-solving and obtain high learning outcomes so that it is easier to work on mathematics problems using many formulas.

The learning media are used by the teacher to help in the teaching and learning process. The important role of media in learning is that the media used as a message intermediary of the material conveyed by the teacher so that the students understand the lessons delivered by the teacher. The use and selection of one particular media has consequences for the use of the appropriate type of material. According to Wibowo (2013), learning media is an information media for teaching and learning activities so that it can provide an effectiveness and interactivity in the learning.

The learning media can be said to be an intermediary technology for delivering messages that have benefits for the needs of the learning process (Maryani, 2014). The interactive explanation relating to the two-way communication or more than communication components is including relations between humans (product users) to the computers (applications / products). Therefore, the implementation used in the media aims to achieve the desired learning by the educators.

According to Ali (2009), the development of instructional media will greatly assist in the learning process as well as the delivery of material. Hence, it can be concluded from the theory that the development of instructional media will be very helpful in the learning process as well as the delivery of material. This can help the students to improve their understanding by using the learning media. Therefore, the development of media in the world of education is very dependent on the objectives and the teaching materials in order to make it easier to get the media that is in accordance with the expertise of educators.

Venn gram is *Adobe Flash Cs 5*-based media which can be used as an interactive learning media. *Adobe Flash Cs 5* is a software that used to produce various media, namely sound, moving animation, and images. This device is a software to create an interactive learning media. The device also has *ActionScript* (programming language) features. This can be used as an animation setting contained therein.

Departing from the facts in the field, the teacher explained the material at the beginning of the lesson of the students at Junior High School (*SMP)* of Muhammadiyah 4 Malang, in which the teacher focused on paying attention. During the middle of learning, many students began not paying attention to the teacher's explanation because they were busy with other students. The material presented were not well understood. When the teacher asked the student representative to recount the discussion that was delivered before, the student was confused because he/she did not understand the discussion that had been explained by the teacher. After the teacher helped to explain the discussion that had been delivered previously, the students were given exercises in order to help the students in understanding the concepts.

Based on the results of previous study (Samosir, 2012) which states that some of the students consider that mathematics learning is very difficult in their learning and using many formulas that function as mathematical problem-solving and only find the results of the answers sought. Therefore, it can make the students bored and less interested in mathematics, especially in the set operation material. It is supported by previous research (Hasibuan, 2016), in which the research aims to determine whether there is a contribution from the conceptual understanding of arithmetic operations on the set operations at the students of State Senior High School (*SMAN)* of 1 Hamparan Perak. The results of the research show that there are 41 students who have a positive contribution between mastery of arithmetic operations to set operations.

Based on those explanation, the researcher interested to develop the *Adobe Flash Cs 5* learning media as a tool in the learning process; therefore, the research conducts a research entitle "The Development of Interactive Learning Media of Venn Gram to Improve the Conceptual Understanding of the Set Operations". This has been described in the background above, so that the researcher draws a research problem namely: What is the valid and effective level of the development of interactive learning media of "Venn gram" to improve the conceptual understanding of the set operation material. This research aims to determine the valid level of interactive learning media development of "Venn gram" and determine the effective level of interactive learning media development of "Venn gram".

RESEARCH METHODS

This research was a *Research and Development*. Research and were stages to develop an existing product and then refine an existing one or renew an existing product so that it became more effective and efficient in the learning. A development research conducted by consisted of four stages, namely, defining (*define)*, designing (*design)*, developing (*develop)*, and disseminating (*disseminate)*. Meanwhile, the *disseminate* stage was not carried out, due to the time and cost limitations in this research. The development research used three stages, in which it was adopted from the 4D model.

This research was conducted in the even semester of the academic year of 2018/2019.The research subjects were all students in the 7th grade at Junior High School of Muhammadiyah 4 Malang, in which it consisted of 9 students. The reason for doing research at this school was because of the lack of interactive media used which based on *Adobe Flash Cs 5* on the set operation material. As a result, this interactive media would certainly be very helpful in the learning process.

This research used a validation questionnaire and tests as the data collection techniques. The test used in this research was a type of description question contained in the *pre-test* and *post-test*. Therefore, there were quantitative data on the two evaluations of the feasibility of the material and the validity of the media.

RESULT AND DISCUSSIONS

1. The Development Results

The development of interactive learning media of "Venn Gram" used the *Adobe Flash Cs 5* as an interactive learning media for Junior High School students on the set operation material, which included of slices, combinations, complements, and differences. The interactive learning media produced consisted of instructions, profiles, material, exercises, and quizzes. The interactive media of "Venn Gram" consisted of several components, namely:

a. Cover

Figure 1. The Initial Cover of the Interactive Media of "Venn Gram"

b. Home

Figure 2. The Home of the Interactive Media of "Venn Gram"

c. Instruction
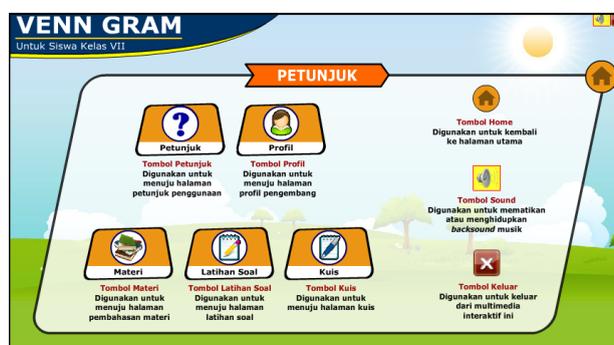
Figure 3. The Instruction of the Interactive Media of "Venn Gram"

d. Profile

Figure 4. The Profile of the Interactive Media of "Venn Gram"

e. Material

Figure 5. The Material of the Interactive Media of "Venn Gram"

f. Exercises

Figure 6. The Exercises of the Interactive Media of "Venn Gram"

g. Quiz
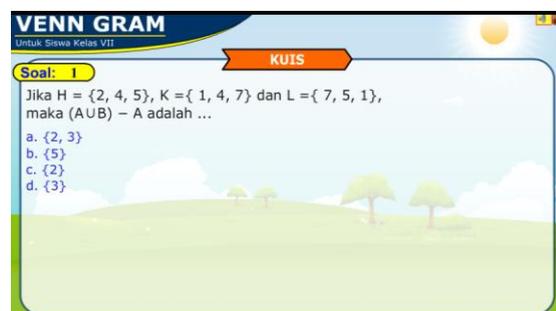
Figure 7. The Quiz of the Interactive Media of "Venn Gram"

2. The Results of Product Trial

The *Adobe Flash Cs 5*-based interactive media of "Venn Gram" based was validated by two validators. The validation results were that 84% showed the results of the media validator, while 83% showed the results of the material validator, in which it was categorized as very valid category. Then, the validation results of the test questions validator were 82%, in which it included on the very valid category. The results of the assessment of the media validator, material and test questions could be seen in the table below:

Table 1. The Assessment Results of Media Validators

No	Questions	Validator 1	Validator 2	Percentages (%)
1.	The media combination was interesting	4	4	100%
2.	The colors were not disturbing the material	4	4	100%
3.	The language used was according to enhanced spelling (*EYD)*	3	4	63%
4.	The language used was easy to be understood	4	3	88%
5.	The language used was consistent	4	4	100%
6.	Balanced page layout	4	4	100%
7.	Readability of the letters used	4	4	100%
8.	Readability of the font size used	4	4	100%
9.	The writing on each page was not dense	3	3	75%
10.	The font size used on interactive media was very clear	4	4	100%
11.	The material display of the interactive media was clear	1	2	38%
12.	The animation used of interactive media was easy to be understood	3	2	64%
13.	The commands in the program were simple and easy	2	3	64%
14.	The use of sound effect in the media was interesting	4	4	100%
15.	The display design of the media was original	2	2	50%
16.	The interactive media display was interesting	4	3	88%
17.	This interactive media could be used as the alternative on learning	3	4	64%
18.	The interactive media was easy to be used	4	3	88%
19.	The interactive media was safe to be used	4	4	100%
20.	The interactive media was strong and not easily to be broken	4	4	100%
	The Total Averages			**84%**

The average percentages of the validator assessment were 84%, in which it meant that based on the Table 4 (validation criteria) of the "Venn Gram" interactive media was very valid and feasible to be used without revision.

Table 2. The Assessment Results of the Material Validator

No.	Questions	Validator	Percentages (%)
1.	The program could be used as an individual learning, small group, and class	3	75%
2.	The approach of interactive media program was displayed clearly on the program	2	50%
3.	The program was relevant to the material that should be learnt by the students	4	100%
4.	The program was appropriate based on the applicable curriculum	3	75%
5.	The material contents had correct and proper concepts	2	50%
6.	The material contents referred to the material program	4	100%

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7.	The material contents were in accordance with the Basic Competence (*KD*)	4	100%
8.	The program was easy to be operated through the menu that there was an interaction	4	100%
9.	Feedback was positive and did not make the user bored to use the media	3	75%
10	In the exercises, the program encouraged the students to get the correct answers	4	100%
	The Total Averages		**83%**

The average percentages of the validator assessment were 83%, in which it meant that based on the Table 4 (validation criteria) was very valid and feasible to be used without revision.

Table 3. The Assessment Results of the Test Items Validator

No.	Questions	Validator	Percentages (%)
1.	The suitability of the questions with the concept understanding indicators: a. Presenting in the form of a Venn diagram b. Explaining the answers with mathematical models	4	100%
2.	The clarity of the meaning of problem which represented the material contents	3	75%
3.	The suitability of the items to the material delivered	3	75%
4.	The clarity of items content toward the material understanding	4	100%
5.	The clarity of formulation of instruction/commands to work on the items	2	50%
6.	The sentences of items did not lead to double interpretation	3	75%
7.	The suitability of language that used in the items, so that it could draw the material contents	4	100%
	The Total Averages		**82%**

The average percentages of the validator assessment were 82%, in which it meant that based on the Table 4 (validation criteria) the test to improve the students' conceptual understanding was very valid and feasible to be used without revision.

The trial was conducted in 7th grade of Junior High School of 4 Muhammadiyah Malang. The results of students' learning outcomes were in the form of *pre-test* and *post-test* to improve the conceptual understanding of the set operations before and after using the interactive media. The results of the *pre-test* and *post-test* were as follow:

Table 4. The Students' Assessment for the *Pre-Test* and *Post Test*

No.	Name of Students	Pre-Test	Post-Test
1.	AA	70	80
2.	ANS	65	95
3.	AZN	65	85
4.	DTL	65	80
5.	UAL	35	65
6.	LTY	80	95
7.	DF	0	0
8.	RR	60	55
9.	RSS	35	90
	Averages	**66%**	**88%**
	The Total Averages		**77%**

After testing on a small scale, it produced the *pre-test* and *post-test* scores by showing the results of each student was different, when doing the *pre-test,* one of students'

grades was good, but the results of the *post-test* were decreased. Meanwhile, the other students experienced an increase before and after using the media.

The discussion that would be discussed from this research was the results of the assessment of the quality of media that had been developed and tested. The products designed and compiled by the researcher had been tested for the quality with several aspects, namely the validity and effectiveness aspects to assess the quality of the interactive media of "Venn Gram" that had been developed.

The first aspect was the validity aspect, which was taken from the results of the validation of the media, material, and test. The results obtained from the validator stated that the interactive media product "Venn Gram" was "very valid" based on the table 4 (validation criteria) with an average total scores of 84%. While the average percentages of material validator assessment were 83% which meant that based on the Table 4 (validation criteria), the material was very valid and feasible to be used without revision. Finally for the test itself, the average percentages of validator assessment were 82%, which meant that based on the Table 4 (validation criteria), the test to improve the students' conceptual understanding was very valid and feasible to be used without revision.

Based on the results obtained for the aspect of effectiveness, which stated to be effective if the percentage with completeness criteria was sufficient, it could be said to be effective if it showed an increase of conceptual understanding before and after the test. The average *pre-test* scores were 66%. Meanwhile, the average *post-test* scores were 88%. The results of the average total scores of 77% based on the table 5 (academic skills assessment criteria) were in the high criteria.

In the classroom situation, it was found that 7 people experienced an increase in the *pre-test* and *post-test* scores. Meanwhile, 2 other people namely DF got a score of 0 on the *pre-test* and the *post-test* results, because they were absent from the beginning of entering school to the research took place. Then AR got a *pre-test* score of 60 and *post-test* score of 55. It was seen that AR had decreased by 5 points in the *post-test*, because AR only worked on 3 questions out of the 5 questions given.

The media used in this research was the interactive media of "Venn Gram" which was developed by the researcher from the manipulative media of "Magram Venn". The advantages and disadvantages of the interactive media of "Venn Gram" were that (1) this media could be developed for further research; (2) the users could use this media on a laptop or PC by simply having an *adobe player* application; (3) this media could be used as learning delivery material of the teacher; and (4) this media could be used as an evaluation tool for the students. Then the shortcomings of this media were that (1) this media was not yet based on *android* or *iPhone;* (2) this media only provided an explanation of the material for the set operation; and (3) this media had not facilitated the users with games.

Previous research on developing the multimedia based on *Adobe flash* was often done along with advancing technology. The *Adobe flash*-based learning media on tube material was developed using 3D models, in which it had been feasible to be used as a learning media. The effectiveness results were obtained that the evaluation scores of students were in the good category. Hence, the trial got the benefits from the use of *Adobe flash* toward the conceptual understanding, in which it was in the good category (Khairani & Febrinal 2016).

The statement of Purwanto & Rizki (2015) which said that the products from the results of developing the teaching materials and learning videos could be used well along with the media, methods, and strategies according to the character of students in each school. In this term, this product showed that the results obtained an average of 82%. Therefore, the development of teaching materials could be said to be feasible to help the students in learning. Hence, the statements of Khairani & Febrinal (2016) and Purwanto & Rizki (2015) with a research conducted by the researcher said that the learning media using *Adobe flash* was effectively developed to be used.

CONCLUSION

Based on research from the development of interactive media of "Venn Gram" on the set operation material to improve the conceptual understanding of the students at Junior High School of Muhammadiyah 4 Malang and the discussion, it can be concluded from the results of the research that the results of media validation are categorized as very valid, in which the results of the validation test get a score of 84%. The results are said to be effective seen from the results of the pre-test conducted on the students of Junior High School of Muhammadiyah 4 Malang; moreover, those are 66% of the class get grades above the KKM (Minimum Completeness Criteria). While the results of the post-test of Junior High School of Muhammadiyah 4 Malang show that 88% of students get scores above the KKM (Minimum Completeness Criteria). This indicates that the total percentage of pre-test and post-test are 77%, in which it is in the high category. Thus, the use of the Venn Gram media toward the increase of conceptual understanding is said to be valid and effective

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