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Developing Interactive Learning Multimedia for Mathematics Subject in Junior High School Grade VIII Student East Lombok

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ABSTRACT

This study aims to: (1) produce interactive multimedia products for Mathematics Subject in SMP Grade VIII students (2) find out the quality of the product. This research was a research and development approach (R & D) by adapting Alessi and Trollip development model that is planning, design, and development. The validation process for the product is done by the *alpha* test stage, beta test, and product trial. The results of the research show that: (1) the developed product is interactive learning multimedia on mathematics subjects in the form of application with * .swf format. and * .exe, (2) Interactive learning multimedia developed is feasible to be used as a supporter of learning with an average score of 3.31 from media experts with the category of "good", 3.6 from material experts with the category of "very good", and 3.8 from users with the category "very good".

INTRODUCTION

The era of globalization is the 21st Century full of challenges in various fields of life, including education. We are faced with demands for the importance of quality human resources and being able to compete. (Gravemeijer et al., 2017) State that quality Human Resources (HR) can understand their knowledge, apply that knowledge in life and benefit themselves and the surrounding community and have more creative, critical, and professional abilities. The right effort to prepare quality human resources and the only place that plays an important role in building high-quality human resources in education. One of the sciences that underlie the development of technology in mathematics. Mathematics is one of the compulsory subjects in Junior High Schools. Mathematics plays a very important role in the field of education. Mathematics is very supportive and greatly contributes to the achievement of educational goals in general (Yeh et al., 2019). So that mastery of mathematics can be said as one of the key success factors in one's life. As in the (National Council of Teachers of Mathematics (NCTM) 1998); (Gravemeijer et al., 2017), this states that to open

various kinds of opportunities, the key is to master mathematics.

The statement above was also strengthened by (Aharoni, Charbit, and Howard, 2015); (Li and Schoenfeld, 2019); (Rach and Ufer 2020) this shows that mathematical knowledge is a key factor needed in every field of science (especially science). Likewise, (Siagian, 2016) also emphasized that mathematics is the main key of other knowledge learned in school. This means that by mastering mathematics, students will find it easier to learn the material in other subjects.

Mastery of mathematics will provide benefits for individuals, both in personal life and society. The benefits can be felt include: (1) can open various employment opportunities and promotion of positions (National Council of Teachers of Mathematics (NCTM) 1998), and (2) able to make the right decision to solve every life problem (National Council of Teachers of Mathematics (NCTM) 1998). Likewise, (Miranda and Wimbari, 2012) also said, mathematics is a subject that needs to be mastered by students from elementary school to tertiary level to make it easier for them to understand other subjects.

The description of the importance and benefits obtained when mastering mathematics should be able to be realized by the public, especially the educated. It should also be used as motivation to pay greater attention to mathematics. But how will people get the most out of learning mathematics, if their views still consider mathematics as a difficult, less interesting, and dizzying subject. In fact, according to them, mathematics is a “scary” lesson (Grootenboer and Marshman, 2016). These negative views result in the low quality of mathematics education, especially in Indonesia.

Data from the International Statistics Center for Education survey of 48 countries in mathematics learning, Indonesia ranks 36th below Iran and Bahrain (Mullis and Martin, 2019). This fact provides a clear picture that the quality of education in Indonesia is still low, especially in mathematics. Then various efforts are needed to improve the quality of education in Indonesia, especially in mathematics. The effort must certainly involve all parties involved (such as schools, local governments, central government).

Lamb et al. (2012) state that many factors determine student success in learning mathematics. In general, students' mathematics learning outcomes are influenced by two factors, namely students' internal factors and external factors. Referring to (Haryudo et al., 2019), internal factors come from students themselves, including from physical and psychological aspects. Physiological aspects are aspects that concern the physical condition of students. Psychological aspects are aspects that include the level of intelligence, interests, talents, attitudes, motivation, and students' perceptions of mathematics learning. External factors are factors that originate from outside students themselves which include social and non-social environmental factors. Social environmental factors are related to the quality of interaction with teachers, administrative staff, and classmates. Non-social factors are factors related to the strategies and methods used in learning mathematics.

The success of the teaching process is not only determined by the role of the teacher in implementing the learning process, but various other elements also have a role in shaping the quality of educational outcomes, these elements include the use of information technology as a learning tool. Information and communication

technology has been widely used in teaching and learning so that the quality of education goes hand in hand with technological developments.

Based on temporary observations at SMP Negeri 3 Selong, the learning process carried out by the teacher during the mathematics lesson was mostly found as some facts as follows: (1) students find it difficult to understand concrete mathematics material; (2) teachers rarely use tools or media that can clarify students' descriptions of concrete material; (3) students are not actively participating in the learning process; (4) the implementation of learning is only centered on the teacher; (5) students only record material given by the teacher; (6) the teacher lacks encouragement and motivation for students to learn; (7) learning resources that are used are still lacking namely only using textbooks and student worksheets.

From the description above it can be concluded that the teacher in carrying out mathematics learning is often carried out by only transmitting knowledge or only providing information through word of mouth. This means that the teacher is very active here, while the students only passively take notes and listen so that the activity and creativity of the students are less visible (Nugraha, Supriadi, and Anwar, 2014). This method does not attract the attention of students and causes boredom in students, so the need for innovative learning media in mathematics. That is because students are quite difficult to understand if the teacher only uses the lecture learning model so that students can only imagine and imagine the subject matter without knowing the actual conditions.

To overcome these problems, teachers need to develop new learning strategies to promote students to learn mathematics. Facilitating student learning is the main task of the teacher. Therefore, teachers are not only required to create a comfortable and interesting learning atmosphere and create learning methods suitable for each student's situation, but also need to find relevant, effective, and efficient learning media. Therefore, the methods and methods adopted will truly conform to the development of students who have become educational themes and objects in the future.

Research shows that the use of computer technology in this case interactive learning multimedia - both online and offline - has a positive

effect to increase learning interest, understanding, and learning outcomes of students in mathematics (Kannan, Sivapragasam, and Senthilkumar, 2015). The positive influence is not only for mathematics, but also affects other subjects, such as; English (Ampa et al., 2013), history (Putra, 2013); deaf primary school students (Ampuch et al., 2014); computer networks (Fuad and Ghufroon, 2014), and English (Susanti et al., 2020). The use of computer technology is one solution that is feasible to be implemented to improve students' cognitive abilities which in turn will improve their learning outcomes.

Although many studies show the positive effect of using multimedia learning on learning activities, other studies show that the use of multimedia learning does not affect the interests, understanding, and learning outcomes of students (Susanti et al., 2020) (Vilardi and Rice, 2014). So it can be stated that the use of learning multimedia will not automatically benefit learning activities (Schnotz and Rasch, 2005), depending on how the learning multimedia is developed and who uses it (Schnotz and Rasch, 2005). The application of multimedia learning will be effective if in its development using guidelines in designing designs (Yuksel Arslan, 2012) and requires a correct understanding of how the principles of people in learning (Yuksel Arslan, 2012) (Alessi and Trollip, 2001).

In this manner, instructors should utilize learning media that makes the learning interaction fascinating, yet in addition, gives space to understudies to be imaginative and effectively included all through the learning cycle (Brown and Green 2016) (Kholisho, Marfuatun, and Lutfi, 2020). So intellectual, emotional, and psychomotor parts of understudies can grow ideally at the same time without misshaping one of them. Among the intriguing learning media that can be utilized by educators in the homeroom for learning math is Intuitive Sight and sound. The word mixed media is identified with the utilization of composing, pictures, slides, sound, and different types of visual items in giving messages to PC clients (Alessi and Trollip, 2001).

The advancement of learning multimedia innovation has guaranteed tremendous potential in changing the way a person learns, obtains data, transforms data, etc. Multimedia also gives teachers

the freedom to create learning strategies to get maximum results. Especially for students, with the media, they are demanded that it is easier to get data because it is not focused on the content of the book.

With the presence of multimedia humans can interact with computers through media images, text, audio, animation, and video. These multimedia components that produce a multimedia work, they are received by users through a computer (Hanum, 2013). Interactive is the interaction between multimedia itself and the user (user). So, the presence of interactive multimedia learning is expected to spur student learning outcomes. In addition to instructional media, another factor that can encourage children to improve their learning outcomes is the existence of internal motivating factors within students, known as learning motivation. Self-learning motivation according to (Khan and Masood, 2015) is the overall driving force within students that lead to learning activities, which ensures continuity of learning activities and which gives direction to learning activities, so that the desired goals of the learning subject can be achieved (Arief and Isnain, 2020). So, with the motivation to learn students have the stimulation and drive to continue to spur their achievement and compete in a class with their fellow friends.

Based on the description of the mathematics learning problems above and the development of technology that has not been used optimally in the world of education, research needs to be held to create a learning media that contains mathematics material for eighth-grade junior high school students which is then implemented in a study entitled "Development of Interactive Learning Multimedia in Mathematics Subjects for Class VIII Middle School Students" which will be trialed to Selong 3 Middle School students as a sample. This learning media aims to improve students' understanding of mathematics subject matter.

METHODS

The research and development model is adapted from the multimedia for learning development model of Alessi and Trollip. Version of (Alessi and Trollip, 2001) is a multimedia development model oriented to learning software. The development procedure adopted from the model of (Alessi and Trollip, 2001) consists of 3 stages, namely planning, design, and development.

Evaluation is carried out in 3 stages, namely (1) alpha testing, which aims to validate products developed by material experts and instructional media experts, (2) beta testing, which is rainy to find out the responses of students as users of the developed learning multimedia. The product is the result of the development process that has been carried out and tested with the following stages:

Alpha Testing

Alpha testing in this study was conducted on experts in 3 fields, namely testing of research instruments, media experts, and material experts. Instrument testing serves to assess the feasibility of the instrument before it is used in research data collection. Media expert testing functions to assess the feasibility of the media. That is in terms of the appearance and running of the program. Material expert testing functions to provide a media assessment of the material contained in the media.

Beta Testing

Beta testing aims to test software, this will be tested on a group of users without any control from the developer. Beta testing is conducted on 8th-grade students of SMP Negeri 3 Selong. This trial was conducted on 28 students to find out the quality of media or products. The data analysis technique used is to analyze data collected quantitatively and qualitatively, namely: (1) data obtained from questionnaires are analyzed quantitatively and qualitatively.

Quantitative data obtained from the questionnaire were analyzed and converted to qualitative data on a scale of 1-4 (Likert scale), then described to determine the quality of the media being developed. Scores obtained from the Likert scale are analyzed and converted to four criteria by reference cited by the Ministry of National Education, as presented in Table 1.

Table 1. Convert the Likert scale to four criteria

No	Score Interval	Criteria
1	$M_i + 1,5SD_i \leq \bar{M} \leq M_i + 3,0SD_i$	Very good
2	$M_i + 0SD_i \leq \bar{M} \leq M_i + 1,5SD_i$	Good
3	$M_i - 1,5SD_i \leq \bar{M} \leq M_i + 0SD_i$	Enough
4	$M_i - 3,0SD_i \leq \bar{M} \leq M_i - 1,5SD_i$	Less

(2) Quantitative data obtained from student learning outcomes tests are calculated using the analysis of the t-test test with the help of the program (SPSS 21 for windows).

RESULTS AND DISCUSSION

Test Data

Product trials are part of formative evaluations that function to find deficiencies in the products being developed. In this study, trials that have been carried out are alpha testing and beta testing.

Alpha Testing

Alpha testing involves material experts and media experts. Material experts play a role in evaluating the suitability of the material. Whereas the role of media experts is to evaluate the interactive learning multimedia display and the functioning of each component contained in interactive learning multimedia such as navigation, animation, and simulation.

Material Expert Testing

Material testing aims to obtain data on the feasibility of the material presented in the mathematics learning media application. Material experts provide assessments and advice on the material presented in the application. Media validation was carried out by 2 material expert lecturers using a Likert scale of 1 to 4. The results of tests conducted by material experts are can be seen in Table 2 below:

Table 2. Material Expert Rating Scores

Assessment Aspect	Average	Feasibility Criteria
Learning	3.30	Good
Material	3.32	Good
Result	3.31	Good

Based on Table 2 obtained an evaluation of learning media by material experts, from the learning aspect of 3.30 and the material aspect of 3.32, so that the average score obtained was 3.1. Based on the above calculation, the material expert assessment of multimedia interactive learning mathematics gets an average score of 3.1. Then the grouping of criteria based on Table 1. for the material presented in this learning media is in the "Good" category to be used.

Media Expert Testing

The multimedia application of mathematics learning is tested on media experts before being tested on students. The aspects tested are aspects of navigation, convenience, writing, and appearance. Media validation was carried out by two expert lecturers using a Likert scale of 1 to 4. The scores obtained can be seen in Table 3 below.

Table 3. Media Expert Rating Scores

Assessment Aspect	Average	Feasibility Criteria
Navigation	4	Very Good
Ease	3.6	Very Good
Writing (Text)	3.5	Good
Display	3.5	Good
Result	3.6	Very Good

Based on the data obtained in Table 3 the average multimedia learning score obtained from the navigation aspect is 4, the convenience aspect is 3.6, the writing aspect (text) is 3.5, and the display aspect is 3.5. Based on the average score of the four aspects obtained a final score of the feasibility of the media of 3.6. Thus, this multimedia learning criteria can be said in the “very good” category.

Beta Testing

Beta testing is conducted on 8th-grade students of SMP Negeri 3 Selong. This trial was conducted on 28 students. Following are the data obtained from the beta test:

Table 4. Respondent Assessment Results

Assessment Aspect	Average	Feasibility Criteria
Ease	3.9	Very Good
Motivation	3.8	Very Good
Victory	3.7	Very Good
Usefulness	3.8	Very Good
Result	3.8	Very Good

Based on Table 4 the feasibility percentage score obtained from the aspect of convenience is 3.9, the motivation aspect is 3.8, the attractiveness aspect is 3.7, and the benefit aspect is 3.8, so the final percentage is 3.8. Thus, based on the criteria table for the feasibility of multimedia learning in Table 1, it can be said that this media is in the “Very Good” category to use.

Product Test Result Description

Development Multimedia Learning Descriptions

The research method used in this research is research and development (R&D) of developing media through an analysis phase that includes problem analysis and needs analysis. The second stage is the design phase which includes making flowcharts, storyboards, and interface designs. Then the third stage is the stage of media development

which includes material collection, product manufacture, code writing, alpha testing, revision, and beta testing. This product development utilizes Adobe Flash CS 6 software, using the Action Script 3.0 programming language. The result of this multimedia development is in the form of an *.swf format application. and *.exe. with device specifications for running, it as follows: (1) Operating system; (2) at least 1 GB RAM; (3) Screen with a resolution of 10 inches.

Description of Eligibility for Mathematics Learning Multimedia

To assess the feasibility of the product, the validity was conducted by the material experts and the media experts. The experts provide advice on products that are developed if deemed still not feasible. For product trials, product tests were conducted on grade VIII junior high school students. In this trial, instruments were used using a scale score of 1-4 for material experts and media experts while for students using a scale of 1 to 4 according to predetermined guidelines. Based on the results of the feasibility assessment of the experts and students are described as follows:

Media Expert

The assessment conducted by media experts includes an assessment of navigation, convenience, writing, and display aspects to assess the product that has been developed. From the results of the assessment, revisions were made according to suggestions. (Praheto et al., 2019) the results of the assessment of media experts found the average score of the feasibility of the media from the navigation aspect of 4 with a very good category, aspects of convenience for 3.6 with a very good category, a writing aspect of 3.5 with a good category, and a display aspect of 3.5 with a category well. Based on the scores of the four aspects, the average final score of the media was obtained as 3.6. Thus, the feasibility category of this learning media can be said in the “Very Good” category to be used.

Material Expert

The assessment conducted by the material expert includes an assessment of the learning aspects and aspects of the material whether in accordance with the material being taught or not. From the results of the assessment, revisions were made according to suggestions. The results of the assessment of learning media by material experts,

from the learning aspects of 3.30 with good categories and the material aspects of 3.32 with good categories, so that the average final score of 3.6 is obtained. Thus, the mathematics learning media in the “Very Good” category is used.

Student

Assessments by students include aspects of convenience, motivation, attractiveness, and usefulness. From the assessment of these aspects, the percentage of eligibility score obtained from the aspect of convenience was 3.9 with a very good category, a motivation aspect of 3.8 with a very good category, and attractiveness aspect of 3.7 with a very good category, and a usefulness aspect of 3.8 with very good category, so the average final score of 3.8 is obtained. Thus, based on it can be said that learning media in the category of “very good” to be used in helping students learn Mathematics (Abdulrahman et al., 2020). Thus, according to students, the media are made easy to use, can motivate learning, interesting, and useful or help students in learning.

CONCLUSION

The ends that can be drawn from the exploration did are as the following: First, the item was created by adjusting the advancement model Alessi Trollip (2001), which comprises three phases, in particular arranging, plan, and improvement. The aftereffects of the item as programming with the arrangement *.Swf, and *.Exe. Second, the consequences of the item achievability test are as per the following: (1) the aftereffects of the appraisal of media specialists got the normal score of the media attainability of the route part of 4, the comfort part of 3.6, the composing part of 3.5, and the showcase part of 3, 5 Dependent on the score of the four viewpoints, the normal last score of the media got is 3.6 with the class “very good”; (2) Assessment of learning media by material specialists got a normal score from the learning part of 3.30 and a material part of 3.32, so the normal last score of 3.31 was acquired with the classification “good”; (3) the aftereffects of the evaluation by understudies are from the part of accommodation of 3.9, the inspiration part of 3.8, the part of engaging quality of 3.7, and the helpfulness part of 3.8, so the last score arrived at the midpoint of 3.8 with the classification “very good”.

The preliminaries in this investigation are still exceptionally restricted in the thin degree with little examples so it should be tried on a more extensive scale with bigger examples so the meaning of its utilization is clear, more exact, and more angles can be uncovered from the preliminary. In the following stage, it is additionally important to contrast the items in this examination and other comparable items to acquire a base norm of qualification and satisfaction of determining quality.

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