



St International Conference on Innovation in Science, Health, and Technology (ICISHT)

This

Certificate of Recognition

is awarded to

Nursiya Bito

For successfully presenting a research paper entitled :

The Development of Interactive Learning Multimedia in the Topic of Sphere

held on **December 10-11, 2020** at the **Universitas Negeri Gorontalo** in Gorontalo, Indonesia



Director Innovation Center of Universitas Negeri Gorontalo Funco Tanipu, ST.MA

NIP.193106122009121002



UNIVERSITAS NEGERI GORONTALO



THE DEVELOPMENT OF INTERACTIVE LEARNING MULTIMEDIA IN THE TOPIC OF SPHERE

Presented by: Nursiya Bito Universitas Negeri Gorontalo

THE 1th INTERNATIONAL CONFERENCE ON INNOVATION IN SCIENCE, HEALTH AND TECHNOLOGY (ICISHT) Desember, 11th 2020 Gorontalo, Indonesia



Introduction

The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



serves as a process that is designed and emphasized on exploration and investigation to familiarize students to use science in solving problems

Innovations in math learning are attempted through the utilization of information and communication technology (ICT)

MATHEMATICS• LEARNING

00

Using multimedia in the classroom will create a significant learning condition as the students take different opportunities of learning with the designed multimedia that are relevant to learning objectives

Utilizing instructional multimedia enables students to be more engaged in the classroom, making the teachers not become the only learning source.

4 Animation in multimedia makes it attractive and able to increase student learning outcomes





Research Methodology

The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



The development model referred to the 4-D Model (Define, Design, Develop and Disseminate) proposed by Thiagarajan, Semmel and Semmel [1974] This research aims to produce mathematics instructional media in the form of multimedia learning about sphere material, assisted by Adobe Flash as a learning medium for 9th-grade students of MTsN 2 Boalemo



The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



EXPERT APPRAISAL

According to the results of the media and material expert from 0 to 5, the score developed materials got 4.33 (good category) and 4.28 (good category), respectively. The readability of the learning materials was measured at 3.52 on average The validation of multimedia learning by media experts includes several observed aspects, namely; the aspects of the material, the aspects of quality and manifestation, and aspects of the attractiveness.
The validators gave 5 as the highest score and 3 as the lowest score.
This suggests that the observed aspects in interactive multimedia learning according to media experts can be used with a few revisions



The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



PRODUCT TRIAL Analysis of Teacher Ability to Manage Learning

In analyzing the teacher's ability to manage to learn, one observer was involved in the task of observing the teacher during the learning process ofsphere material using interactive multimedia learning. The analysis results of the teacher's ability in managing the learning process aboutsphere using interactive multimedia learning in of IX² at MTs Negeri 2 Boalemogotthe score of 3, which is included in the good category. This proves that the ability of the teacher to manage to learn is effective.



The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



PRODUCT TRIAL Analysis of Student Activities

The activity of the participants was observed by two observers and the observed students were 6 students of IX² at MTs Negeri 2 Boalemo, consisting of 2 high-ability students, 2 medium-ability students, and 2 low-ability students. The categories observed were:

- Students' preparationin receiving the learning materials
- Student cooperation in learning
- Student participation in the use of interactive multimedia learningonsphere material.
- Activities to end the learning process
- Irrelevant behavior to teaching and learning activities.
- Each category of observation regarding students' activity in the use of interactive multimedia learning in learning sphere material based on the criteria for achieving the effectiveness of learning. Therefore, it can be concluded that the activities of students in learning are considered to be effective by using interactive multimedia learning.



The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



PRODUCT TRIAL Student Response Analysis

To get students' responses, questionnaires were distributed to the students of IX² at MTs Negeri 2 Boalemo after the learning activities ended. The presentation of each aspect exceeds 70%, where 78% of students stated that sphere material was easier to be understood with the aid of interactive multimedia learning, 100% of students stated that they were interested in the use interactive multimedia learning onsphere material, 100% of students stated that they were new to interactive multimedia learning aboutsphere material, 83% of students stated that they were new to the presentation of sphere material in multimedia interactive learning, 87% of students stated that they were new to the atmosphere in the classroom during the use of interactive multimedia learning about spherematerial, 100% of students expressed interest in learning mathematics using interactive multimedia learningabout sphere material, 96% of students stated that they clearly understood the language used in multimedia interactive learning about sphere material, 100% of students expressed interest in the appearance (writing, illustrations/pictures and location of images) in interactive multimedia learning about sphere material, and 100% of students stated that the sphere material was easier to understand if presented in interactive multimedia learning. Based on the criteria, students give positive responses (easy, interested, new, clear, and easy to understand) to interactive multimedia learning about sphere material. This means learning sphere material using interactive multimedia learning is considered effective in terms of the responses of students.



The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



PRODUCT TRIAL Analysis of Learning Outcomes Test

In the analysis of the learning outcomes test, several questions were arranged to obtain students' learning outcomes using interactive multimedia learning on sphere material. The questions were constructed and validated by the mathematics lecturer.

After the revision was finished, the learning outcomes test could be used to see student learning outcomes after using interactive multimedia learning on sphere material in the 9th-grade classes at MTs Negeri 2 Boalemo. The percentage of completeness of students is 74%, as explained in chapter III that classical completeness will be achieved if in a class that is taught using interactive multimedia learning onsphere material more than 70% of students complete their learning. This means that learning sphere material using interactive multimedia learning is considered to be effective in terms of learning outcomes tests.



Acknowledgements

author: Nursiya Bito

The 1th International Conference on Innovation in science, Health, and Technology (ICISHT) Gorontalo, 11 Desember 2020



PDD Scholarship of The Indonesia Goverment for Financial Support

Trans Bahasa Gorontalo

Kemenkumham Indonesia

The Development of Interactive Learning Multimedia in the Topic of Sphere

Nursiya Bito, Nur Fadlia Mounte, Dewi Rahmawaty Isa

Universitas Negeri Gorontalo

nursiyabito@gmail.com

Abstract. The Present work was intended to develop an interactive multimedia learning materials discussing the topics of sphere fot ninth grade students of Islamics Junior High Schools. The study employed a research and development methods using a modified \$D model: its phases consists of three: define, design and develop. An application program called adobe flash was used to develop the learning materials. According to the results of the media and material expert from 0 to 5, the score developed materials got 4.33 (good category) and 4.28 (good category), respectively. The readability of the learning materials was measured at 3.52 on average. Further, 70% of the students responded to the interactive multimedia learning materials positively. These results signified that the develop media were appropriate to be implemented by teachers in teaching the topic of the sphere (in mathematics subject).

1. Introduction

Technology development affects the entire fields in society including education. As a part of global demands, education needs to be flexible and adjustable based on the technology developments itself to improve its quality, especially the usage of information and communication technology in the form of instructional media, which is expected to be properly utilized by teachers during the learning process. It is explained by Suryani et al (2018: 4) that instructional mediais a means of transmitting messages or thoughts that can stimulate students' thoughts, feelings, attention, and willingness so that they can be engaged with a purposeful learning process.

Instructional media is a tool, designed in such a wayto facilitate the learning process. Also, instructional media can enhance the process of interaction between teachers, students, and their learning environment. Instructional media serves as a teaching aid, one of which is to support teachers'usage of teaching methods. In this case, the instructional medianeeds to be attractive to motivate students in learning and ease them in understanding the materials, which will certainly give an impact on their achievements.

In line with the above statement, Arsyad (2006: 15) suggested that the use of instructional media in the teaching and learning process can produce new desires and interests, generate motivation and stimulation of learning activities, and even bring psychological influences upon students. The use of instructional media at the learning orientation stage will help the effectiveness of the learning process. In learning mathematics, instructional mediacan ease students in understanding the material quicker and make those that are considered to be non-concrete and foreign more understandable. The use of instructional media helps teachers to project the outside world into the classroom to increase students' knowledge regarding the corresponding materials. It also prevents them from merely imagining the materials and guide them to directly practice it in the classroom.

Using instructional media during the learning process can trigger student interest and motivation to rise due to its psychological influences on them. As stated by Suryani et al (2018: 12), from a psychological perspective, instructional mediaexhibits several functions, namely:

- 1) Ethical Function: the function of attracting students' attention
- 2) Affective Function: the function of affecting students' feelings, emotions, acceptance, and rejection towards learning.
- 3) Cognitive Function: the function providing the latest knowledge and understanding.
- 4) Psychomotor Function: the function of helping students master motor skills or other types of skills. Some of the media are laboratory facilities or exercise videos as a substitute for instructors in sports subjects
- 5) Imaginative Function: the function of constructing students' imagination.
- 6) Motivation Function: the function of generating students' motivation. Instructional media make lessons more interesting, relieve students' pressure and boredom, and motivate them to be more active during the learning process

Delivering materials that originate from real experience requires instructional media. Real experience is an effective way of teaching because it can involve students andthey will gain direct understanding and participate in the discussed activities. Besides, as educators, teachers will also be helped byinstructional media. Media provides a choice for teachers to present the students with imperceptiblematerials, such as the inside of a rocket. Instructional media must be interesting and using media that contains pictures or videos might increase the chance of attracting students' attention and indirectly generate their motivation and interest in learning.

Related to interactive multimedia learning, Kadaruddin (2018: 13) explained that interactive multimedia is a presentation system using an application program on a computer that combines various visual and audio media applications into it, and is controlled interactively with a control application to provide convenience for users. From this explanation, it can be concluded that interactive multimedia learning is a combination of numerous visual and audio media applications in the form of text, sound, images, animation, and video that are controlled by an application.

Interactive multimedia learning can be used as a learning medium, both in class and individually. As stated byWati, E. R (2016: 130-132), computer-based interactive (capable of accommodating user responses) multimedia possesses the characteristic of being a combination of numerous interactive media that are independent (can be used without guidance), widen the competences for alternative instructional media, and relevant to curriculum objectives. Thus, it can be concluded that interactive multimedia learning is a combination of several interactive media that can be used without any assistance can be presented in such a way to assist students in learning the material by themselves.

The development of interactive multimedia learning requires the help of an application to combine several visual and audio media into the form of text, sound, images, animation, and video with a control application. Adobe Flash is considered a useful application forits development. Regarding interactive multimedia learning, assisted by Adobe Flash, Putra (2017: 10) explained that Adobe Flash is a multimedia platform that was created by Macromedia and is now being developed and distributed by the Adobe System. Since 1996, Flash has been a popular method for integrating animation and interactivity to web pages. Flash is commonly used to create animations, design advertisements, implement multiple web components, integrate videos into web pages, and recently, develop RIA (Rich Internet Applications). Flash can be used to manipulate both vector and raster graphics and supports audio and video streaming. Therefore, it can be concluded that Adobe Flash is an application that can be used to add interactive components into a website, such as animation, graphics, sound, and video. Adobe Flash was chosen as a supporting application in developing interactive multimedia learning, becauseaside from being used to combine various media, it can also produce output files in the form of an application with an offline system that has a ".exe" format to fit all types of computer.

In line with the above opinion, Ashyar (2012: 187) mentionedsix advantages of Adobe Flash, which are shown below.

- a) Relatively small file size
- b) Capable ofcreating motion animation (*motion tween*), shapemodification (*shape tween*), and color alteration (*color tween effect*).
- c) Capable of creating masking and motion guides.
- d) Capable of making interactive buttons with a movie.
- e) Capable of generating logo animation, interactive media, interactive games, multimedia presentations, and simulations/visualizations.
- f) Can be saved into several file types such as SWF, HTML, GIF, and so on.

Flash performance can also be combined with other programs to create interactive animation, which is crucial for developing interactive multimedia. In line with that, Pranowo (2011: 1) stated that Adobe Flash is a software that is enjoyed by most people due to its innumerable capabilities of working with multimedia-related objects.

2. Research Methods

This research used research development (Research and Development) with a descriptive approach oriented to product development. Sugiyono (2015: 28) stated that the Research and Development act as an instrument of products' validation and development. This research aims to produce mathematics instructional media in the form of multimedia learning about sphere material, assisted by Adobe Flash as a learning medium for 9th-grade students of MTS

As for development, the stages are shown as follows:

a. Define Stage

This stage's goal is to define the learning condition by analyzing the objectives within the boundaries of the developed material. In this stage there are five steps of the activity, namely as follows:

1. Preliminary and FinalAnalysis

The preliminary and final analysis aims to identify encountered problems during the learning process and later on, determine suitable learning alternatives and contemplate the need for developing multimedia learning that is relevant to the selected learning model. The results are used as the basis for developing multimedia learning aboutsphere material. The identification of the problem was done through observation at MTs Negeri 2 Boalemo.

2. Student Analysis

Student analysis aims to examine students' characteristics following the design and development of multimedia learning. These characteristics include the ability and circumstantial knowledge, attitudes towards learning topics, media selection, format selection,

language choice, and students' cognitive development. The chosen students were the 9th-grade students at MTs Negeri 2 Boalemo.

3. Topic / Material Analysis

This analysis aims to identify, detail, and systematically arrange the main concepts of sphere material that were taught to the students. The sphere material is included in the Curriculum of 2013 (K13)

4. Task Analysis

Task analysis is the identification of general tasks and special tasks required in learning that is basedon the corresponding curriculum. General tasks refer to basic competencies while specific assignments refer to indicators of learning outcomes. These results are used in determining the media, the learning format, and the sequence of learning activities.

5. Specifications of Learning Outcomes Achievement Indicators

This analysis is the formulation of learning objectives based on indicators and elaborated based on the analysis results of material and previously compiled assignments. b. Design Stage

The purpose of this stage is to design learning-oriented learning multimedia and obtain examples of learning multimedia. The designed learning multimedia includes sphere material consisting of definitions, properties, elements, surface area, volume, and practice questions. For research purposes, several media instruments needed for each meeting were also designed and included in learning management observation sheets, student activity observation sheets, and student response questionnaires. The results at this stage are called **Draft I**. The activities at this stage include:

1. Media Selection

Media selection is executed to determine the suitable media in presenting the materials. The media selection process is attuned to the task analysis, material analysis, and available facilities at the school.

2. Format selection

Format selection aims to choose a format that fits the described factors in the learning objectives, namely the format for designing content and the selection of learning strategies and learning resources. This is performed so that the instructional media does not deviate from the existing standards.

3. Initial Learning Multimedia Design

The initial design is a multimedia learning design that will involve the activities of teachers and students. The learning multimedia design that is made is the sphere material and learning outcomes. The basis for the test preparation is an analysis of the specifications of learning objectives which are described in indicators of learning achievement.

The initial design of the media was made in the form of PowerPoints, then completed with the help of Adobe Flash to produce interactive multimedia learning. Adobe Flash was used to create interactive buttons, adding accompanying music, inserting dubbing material, and putting interactive games in multimedia learning.

c. Development Stage

The purpose of the development stage is to produce a revised final **Draft** of multimedia learning based on expert input, and data obtained from trial tests. At this stage there are two steps of the activity, namely:

1. Expert Validation

Expert validation is a multimedia assessment of learning conducted by experts (mathematics lecturers and mathematics teachers). Assessment is focused on content, language, format, and illustration, as well as suitability for learning. Experts are given a validation sheet and **Draft I** which will be validated. The validation sheet is used to obtain data about the opinions, suggestions, and comments of experts regarding **Draft I**. Validation sheets are used to assess multimedia and test learning outcomes. Each validator writes their assessment on their corresponding sheet. The assessment itself consists of 5 categories, namely terrible (score 1), bad (score 2), quite good (score 3), good (score 4), and excellent (score 5). The validator also writes down their suggestions and comments. The results were analyzed by considering the validator's suggestions and comments and used as a guideline for revising **Draft I** to obtain **Draft II**.

2. Readability Test

A readabilitytest of **Draft II** was done before the trial test to see whether multimedia learning could be read clearly and understood by students. The research subjects in the readability test were 6 students of 9th grade in the MTS Negeri 2 Boalemo. In the readability test, 6 diverse students were taken, consisting of 2 high-ability students, 2 moderate-ability students, and 2 low-ability students. The result is used to revise **Draft II** to obtain **Draft III**, which is used for the trial test.

3. Trial test

The trial test was conducted to obtain direct input from teachers, students, and observers regarding the compiled learning multimedia. The test results were used as the basis for perfecting **Draft III** into decent multimedia and a suitable medium for learning mathematics. The instruments used in this research were validation sheets, observation sheets for teacher ability and student activity, questionnaires for students' responses, and learning outcomes tests.

3. Results and Discussion Development Research Results

The stages and results of developing multimedia learning:

a. Define Stage

The defined stage is the initial resistance that is executed in the research and development process of the 4D model. In this stage there are five steps of activities carried out by researchers, namely as follows:

1) Preliminary and Final Analysis

In the preliminary final analysis, the identification of problems faced in the learning process was done by observation at MTs Negeri 2 Boalemo in January,on the even semester of the academic year of 2019/2020. The result showed that there were several problems, such as lack of interest and participation in learning mathematics, especially sphere material, which was mainly caused by a teacher-centered atmosphere. The materials were mostly delivered by lecturing and demonstrating how to find the formula for the volume of a sphere using a cone. PowerPoint was sporadically used but unable to draw students' attention due to being unattractive for them. Students tended to get bored more quickly and resulted in bad student learning outcomes.

From the problems, interactive multimedia learning is needed to assist teachers and students in the learning process. Interactive multimedia learning is made as attractive as possible with the help of Adobe Flash to increase students' interest and motivation and fulfill learning objectives

2) Student Analysis

Students were analyzed after the problem was identified. The characteristics of the 9thgrade students of MTs Negeri 2 Boalemo were examined and the result showed that they possess a lowlevel of interest in the materials. It is proven that the materials were taught only by showing pictures and tell the sphere formula in a conventional way. It is also shown that students demanded fun mathematic learnings to increase the learning outcomes.

3) Topic / Material Analysis

The result showed that the main concepts in sphere material would be systematically arranged and included in the interactive multimedia learning that will be taught to the students, which refers to the Curriculum of 2013 (K13). this is the definition, the elements, the volume, and the surface area of a sphere

4) Task Analysis

Tasks are identified as general tasks and special tasks that are under the Curriculum of 2013 (K13). General tasks refer to basic competencies while specific assignments refer to learning outcome indicators.

5) Specification of Learning Objectives

Learning objectives are formulated based on indicators and elaborated based on the analysis results of material and previously compiled assignments. The results of the specification of learning objectives are described as follows:

Students are expected to:

- a) Correctly explain the meaning of asphere.
- b) Give examples of some spherical objects.
- c) Determine the surface area of a sphere with a known radius.
- d) Determine the volume of a sphere with a known radius.
- e) Determine the surface area of the combined curved solid figures correctly.
- f) Determine the volume of the curved solid figures correctly.
- g) Solve everyday problems based on observations related to the surface area and volume of a sphere and a combination of several curved solid figures.
- b. Design Stage

At the design stage, an initial product design (prototype) was made, in the form of a PowerPoint presentation and a learning multimedia design framework will be developed afterward. Furthermore, the initial product was modified into interactive multimedia learning assisted by Adobe Flash applications. The modification process was assisted by experts to produce interesting interactive multimedia learning called **Draft I**. There are three steps in the design stage, namely media selection, format selection, and initial design of multimedia learning. The results of these steps include:

1. Media Selection Results

Interactive multimedia learning is the instructional media needed in the learning process aboutsphere material onthe 9th-grade students of MTs Negeri 2 Boalemo. The media is adapted to the task analysis, material analysis, and the available facilities in schools such as LCDs, speakers, and laptops. The interactive multimedia learning was created by combining images, videos, and animation, and software named Adobe Flash due to its versatility in merging images, videos, and animations, Adobe Flash can also produce output files in the form of an application with an offline system that has the format ".exe" to fit all types of computers.

2. Result of Format Selection

The chosen format is based on the factorsdescribed in the learning objectives, namely the format for designing content, selecting strategies, and learning resources. There are many formats for presenting material in interactive multimedia, including tutorials, drills, and practices, simulations, experiments, and games. Several formats namely tutorial format, training format, and simulation were combined to present the materials on interactive multimedia. The combination is considered to be suitable for the sphere material because the material is presented in stages along with the examples related to students' daily lives and at the end of the material, some practice questions were given. The results of choosing the format include:

- a) The materials' illustration was delivered using a combination of text, images, audio, video, and animation.
- b) Multiple choice was chosen as he form of questions to evaluate learning outcomes.
- c) The media access system was presented offline (without using an internet connection)
- d) The format of the media presentation is in the form of an application.



Development Stage

This stage aims to produce the final form of interactive multimedia learning products aboutsphere material. Several revisions were made to produce good interactive multimedia learning, which is based on input from experts and by looking at the results of readability tests and limited trial tests. The used multimedia development instruments were the validation sheets of media experts and material experts, students' response sheets to readability, observation sheets of teacher ability and student activity, student response questionnaire sheets, and learning outcome tests.

The multimedia development instrument has previously been validated using the construct validity of thelecturers of the Mathematics Education program. Expert suggestions and revised results of interactive multimedia learning are as follows:

1. Expert Validation

The initial design of interactive multimedia learning that has been compiled at the design stage, which was the results in the **Draft I**, is validated by experts (mathematics lecturers or mathematics teachers). These experts are divided into two, namely media experts and material experts.

a) Validation of Media Experts

The validation of multimedia learning by media experts includes several observed aspects, namely; the aspects of the material, the aspects of quality and manifestation, and aspects of the attractiveness. The validators involved in the validation process were one mathematics lecturer at Universitas Negeri Gorontalo, one mathematics teacher at MTs Negeri 2 Boalemo, and 1 master student of the Mathematics Education program at Universitas Negeri Gorontalo. The validators gave 5 as the highest score and 3 as the lowest score. This suggests that the observed aspects in interactive multimedia learning according to media experts can be used with a few revisions.

The result showed that some criticisms and suggestions were used as consideration for revising interactive multimedia learning.

b) Material Expert Validation

Validation of multimedia learning by material experts includes several aspects, namely aspects of the quality of multimedia learning material, aspects of technical, and aspects of language components. The validators involved in the sphere material validation process were one mathematics lecturer at Universitas Negeri Gorontalo, one mathematics teacher at SMA Negeri 1 Paguyaman, and one master student of the Mathematics Education program at Universitas Negeri Gorontalo. The validators gave 5 as the highest score of 5 and 3 as the lowest score. This means that the observed aspects in multimedia interactive learning according to material experts can be used with a few revisions.

The results of the material expert's validation, criticism, and suggestions can be used as consideration for revising interactive multimedia learning.

Draft Iwas revised by considering the criticism and suggestions of the validators (media experts and material experts) andit led to **Draft II**, which would be used in the readability test.

2. Readability Test

The readability test for **Draft II** was conducted in a different school from the pilot school, namely SMP Negeri 1 Duhiadaa. The readability test was executed on 6 students consisting of 2 high-ability students, 2 moderate-ability students, and 2 low-ability students. The average score obtained from several students at the time of the readability test was 3.52,

including in the category of strongly agreeing to the aspects observed in interactive learning multimedia. From the results of the readability test, comments and suggestions from several students were obtained, which were used as material for consideration in revising interactive learning multimedia. The result of this revision is called **Draft I**.

Interactive multimedia learning trial test 3.

The third draft resulted from the readability test was done at MTs Negeri 2 Boalemo. The purpose of the limited trial tests is to acquire several inputs from teachers, students, and observers on interactive multimedia learning. The results were used as the basis for refining Draft III into proper and suitable multimedia. The trialtest involved 23 students from the class of IX² at MTs Negeri 2 Boalemo, one mathematics teacher, and two observers, who were in charge of observing student activities and one observer, who was in charge of observing the teacher during the use of interactive multimedia learning onsphere material.

The following is the data obtained from the trialtest of interactive multimedia learning about sphere material in the class of IX² at MTs Negeri 2 Boalemo:

Analysis of Teacher Ability to Manage Learning a.

In analyzing the teacher's ability to manage to learn, one observer was involved in the task of observing the teacher during the learning process of sphere material using interactive multimedia learning. The analysis results of the teacher's ability in managing the learning process aboutsphere using interactive multimedia learningin of IX² at MTs Negeri 2 Boalemogotthe score of 3, which is included in the good category. This proves that the ability of the teacher to manage to learn is effective.

Analysis of Student Activities b.

The activity of the participants was observed by two observers and the observed students were 6 students of IX² at MTs Negeri 2 Boalemo, consisting of 2 high-ability students, 2 medium-ability students, and 2 low-ability students. The categories observed were: Students' preparationin receiving the learning materials

- 1)
- 2) Student cooperation in learning
- Student participation in the use of interactive multimedia learningonsphere material. 3)
- 4) Activities to end the learning process
- 5) Irrelevant behavior to teaching and learning activities.

Each category of observation regarding students' activity in the use of interactive multimedia learning in learning sphere material based on the criteria for achieving the effectiveness of learning. Therefore, it can be concluded that the activities of students in learning are considered to be effective by using interactive multimedia learning.

Student Response Analysis C.

To get students' responses, questionnaires were distributed to the students of IX² at MTs Negeri 2 Boalemo after the learning activities ended. The presentation of each aspect exceeds 70%, where 78% of students stated that sphere material was easier to be understood with the aid of interactive multimedia learning, 100% of students stated that they were interested in the use interactive multimedia learning onsphere material, 100% of students stated that they were new to interactive multimedia learningaboutsphere material, 83% of students stated that they were new to the presentation of sphere material in multimedia interactive learning, 87% of students stated that they were new to the atmosphere in the classroom during the use of interactive multimedia learning about spherematerial, 100% of students expressed interest in learning mathematics using interactive multimedia learningabout sphere material, 96% of students stated that they clearly understood the language used in multimedia interactive

learning about sphere material, 100% of students expressed interest in the appearance (writing, illustrations/pictures and location of images) in interactive multimedia learning about sphere material, and100% of students stated that the sphere material was easier to understand if presented in interactive multimedia learning. Based on the criteria, students give positive responses (easy, interested, new, clear, and easy to understand) to interactive multimedia learning about sphere material. This means learning sphere material using interactive multimedia learning is considered effective in terms of the responses of students.

d. Analysis of Learning Outcomes Test

In the analysis of the learning outcomes test, several questions were arranged to obtain students' learning outcomes using interactive multimedia learning on sphere material. The questions were constructed and validated by the mathematics lecturer.

After the revision was finished, the learning outcomes test could be used to see student learning outcomes after using interactive multimedia learning on sphere material in the 9th-grade classes at MTs Negeri 2 Boalemo. The percentage of completeness of students is 74%, as explained in chapter III that classical completeness will be achieved if in a class that is taught using interactive multimedia learning onsphere material more than 70% of students complete their learning. This means that learning sphere material using interactive multimedia learning is considered to be effective in terms of learning outcomes tests.

Interactive multimedia learning aboutsphere material made with the aid of Adobe Flash was developed using a modified 4D model. This learning multimedia consists of two main components, namely sphere material and practice questions. Multimedia is embedded with text, images, audio, video, animation, and interactive buttons that can attract the students to directly interact with the media, which ease the teachers in delivering the learning material and helping students to learn. As users, students are given complete control to choose which ones to learn first, to solve practice questions, and find out the results. Exercise questions in multimedia are formulated by referring to indicators of achievement of learning objectives.

To identify the effectiveness of the developed multimedia, researchers conducted tests at MTs Negeri 2 Boalemo. The trialtest was executed to obtain data from teachers' and students' activity during the learning process, student responses to multimedia, and student learning outcomes. One observer was involved to observe the teacher's activities in managing learning. The analysis results of the teachers' ability to manage to learn using multimedia are categorized as good, which can be considered as effective when perceived from the teachers' ability to manage to learn. In observing the activities of students, two observers were involved to observe the dominant treatment of students during the learning process. Presentation of student activities is at the ideal tolerance limit under the criteria for achieving the effectiveness of learning.

Student responses to multimedia learning were obtained through questionnaires, which showed positive response to multimedia. This means that learning is effective based on students' responses. It was observed that students exhibited an increase in their motivation and attention to the materials. In line with the opinion of Saselah et al (2017) that the characteristics of multimedia learning that have been developed are interesting and fun, with very high students' interest and activity.

Based on data analysis, the development of multimedia learning is categorized as very effective in use, thus learning using multimedia helps in improving the quality of the learning process. Interactive multimedia learningcan transfer messages from sender to receiver, thereby triggering student motivation and attention in the learning process. In line with what Munir (2012: 40) stated that using multimedia in the learning and teaching system can allow

students to think critically, become problem solvers, are more likely to seek information, and be more motivated in the learning process. Learning using multimedia provides positive changes to students compared to conventional learning. As stated by Bito et al (2019), the elements in multimedia help in describing concepts that are difficult to deliver or concepts that require accurate delivery. Learning can be more interesting and fun when using multimedia so that it allows student motivation and interest in learning to increase.

4. Conclusion

From the explanation in the previous chapter, it can be seen that interactive multimedia learning about sphere material, assisted by Adobe Flash was developed using a modified 4D model and based on the results of assessments from media experts and material experts, students' readability test and some data obtained from the limited trialtest at MTs Negeri 2 Boalemo, it can be concluded that the interactive multimedia learningabout sphere material is proven to be decent and suitable to be used as a medium for learning mathematics.

Aknowledgements

The authors sincere thanks to Trans Bahasa, Gorontalo for editing a draft of this manuscript, Kemenkumham Indonesia for HKI of this multimedia, and gratitude to the PDD Scholarship of The Indonesia Goverment for Financial Support (Recearch Grant No.071SP2H/LT/DRPM/2019). The authors would also like to acknowledge the help of the anonymous reviewers

References

- Anggereni, Santih. 2016. EfektifitasPembelajaranMenggunakan Media Pembelajaran Macromedia Flash dalamMeningkatkanPemahamanKonsepFisikaMateri Hukum Newton. Volume 4 Nomor 2, hlm335.
- Arsyad, Azhar. 2006. Media Pembelajaran. Jakarta: PT Raja GrafindoPersabda.
- Ashyar, Rayandra. (2013). *KreatifMengembangkan Media Pembelajaran*. Jakarta: GaungPersada Press Jakarta
- Baharuddin& Eka Nur Wahyuni. 2015. *TeoriBelajar dan Pembelajaran*. Yogyakarta: Ar-Ruzz Media.
- Bito, Nursiya. (2009). Pembelajaran Berdasarkan Masalah Untuk Sub Materi Pokok Prisma Dan Limas Di Kelas VIII SMP Negeri 11 Gorontalo. Tesis: Program Pasca Sarjana, Universitas Negeri Surabaya.
- Bito, Nursiya dkk. 2019. The Development of Character Building-Based Two-Dimensional Shapes Multimedia on Junior High School Students in Gorontalo Province, Indonesia.Volume 48 Nomor 1, hlm 123. ISSN 2307-4531.

Haryono. 2015. FilsafatMatematika. Bandung: Alfabeta.

- Kadaruddin. 2018. Mahir Desain Slide Presentasi dan Multimedia PembelajaranBerbasis Power Point. Yogyakarta: CV Budi Utama
- Khabibah, Siti. 2006. Pengembangan Media Pembelajaran Matematika dengan Soal Terbuka untuk Meningkatkan Kreativitas Peserta Didik Sekolah Dasar. (Program Pasca Sarjana UNESA).
- Komariah, Siti dkk. 2018. Pengembangan Media PembelajaranMatematikaSiswa SMP Berbasis Android. Volume 4Nomor1, hlm43. ISSN 2477-2348.
- Munir. 2012. Multimedia Konsep dan Aplikasidalam Pendidikan. Bandung: Alfabeta.

Novitasari.2016.PengaruhPenggunaanMultimediaInteraktifTerhadapKemampuanPemahamanKonsepMatematikaSiswa.Volume 2Nomor 2, hlm 8. ISSN: 2460-7797.

- Pranowo, G. (2011). KreasiAnimasiInteraktifdengan Action Script 3.0 pada Flash CS5. Yogyakarta: Andi Offset.
- Putra, Syahrizal D. BelajarMandiri Adobe Flash CS6. Surabaya: CV.Garuda Mas Sejahtera

Sagala, Syaiful. 2009. Konsep dan MaknaPembelajaran. Bandung: Alfabeta.

- Saselah, Yeni dkk. 2017 Pengembangan Multimedia InteraktifBerbasis Adobe Flash CS6 Professional Pada PembelajaranKesetimbangan Kimia. Volume 2 Nomor 2, hlm 87. ISSN 2503-4146.
- Setyadi, Danang. 2017. Pengembangan Media PembelajaranMatematikaBerbasis Web pada MateriBarisan dan Deret. Volume 8 Nomor, hlm 1. ISSN: 2086-2334.
- Sugiyono, 2015. MetodePenelitian dan Pengembangan (Research and Development). Bandung: Alfabeta.
- Suryani, dkk. 2018. Media PembelajaranInovatif dan Pengembangannya. Bandung: PT. RemajaRosdakarya

Supratiningrum, Jamil. 2013. Strategi Pembelajaran. Jogjakarta: AR-Ruzz Media

- Tafonao,Talizaro.2018.PerananMediaPembelajarandalamMeningkatkanMinatBelajarMahasiswa.Volume 2Nomor 2,hlm 103. ISSN: 2549-1725.
- Thiagarajan, Sivasailam. Dorothy S. Semmel dan Melvyn I. Semmel. 1974. *Instructional Development for Training Teachers of Exceptional Children*. A Source Book. Bloomington: Central for Innovation on Teaching Handicapped
- Wati, E. R. (2016). Ragam Media Pembelajaran: Visual-Audio Visual- KomputerPowerpoint-Internet- Interactive Video. Jakarta: Kata Pena