DEVELOPING INTERACTIVE LEARNING MEDIA BASED ON ADOBE ANIMATE APPLICATIONS FOR GEOMETRY TRANSFORMATION

Baihaki Baihaki[1], Soraya Djamilah[2], Ahmad Lazwardi[3]

[1]Universitas Muhammadiyah Banjarmasin, Jl. Gubernur Syarkawi, Barito Kuala, Indonesia.
baihakib072@gmail.com
[2]Universitas Muhammadiyah Banjarmasin, Jl. Gubernur Syarkawi, Barito Kuala, Indonesia.
soraya29.sd@gmail.com
[3]Universitas Muhammadiyah Banjarmasin, Jl. Gubernur Syarkawi, Barito Kuala, Indonesia.
lazwardiahmad@gmail.com

ABSTRACT

Some mathematical material will be challenging to understand without learning media, primarily topics that requires visualization, such as geometric transformations. This study aims to describe the process of developing interactive learning media based on the Adobe Animate application of geometry transformation. It also describes the validity and practicality of the developed learning media. This type of research is research and development. The product developed was an interactive learning media application on geometry transformation material created using Adobe Animate. The development model used was the Multimedia Development Life Cycle (MDLC), consisting of six stages: concept, design, collection of materials, manufacture, testing, and distribution. The research found that the interactive learning media developed were fairly valid (80.12%), with a high level of practicality (4.19). Overall, the learning media developed is feasible to be used in the learning process or as a means of independent learning for students of geometry transformation.

ARTICLE INFORMATION

Corresponding Author

Soraya Djamilah
Universitas Muhammadiyah Banjarmasin
Jl. Gubernur Syarkawi, Barito Kuala, Kalimantan Selatan, Indonesia
Email: soraya29.sd@gmail.com

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INTRODUCTION

Mathematics is important to be mastered well by students. Mathematics is an essential subject because its existence can help humans solve various problems in almost every aspect of life, even in today's technological and digital era (Sari & Noer, 2017; Siregar, 2017). Therefore, mathematics began to be taught at the elementary school level. Although it is important to master mathematics well, most students dislike the subject because they consider it difficult. Most students think mathematics is complicated and not directly related to their lives. This notion can be understood because, in addition to its abstract nature, the learning process is conventional and monotonous, so it is less able to activate students' potential (Rahmawati, 2018).

One of the mathematics materials in high school that students find difficult is transformation (Zanthy & Maulani, 2020). One of the reasons is that most teachers use direct learning models, such as only using books as learning resources and simple tools and materials in learning so that students feel bored (Handayani & Sulisworo, 2021). Transformation is one of the materials in Year 11, which includes translation, reflection, rotation, dilation, and composition transformation. The research revealed that students had difficulty understanding the concepts and variations raised and identifying transformations, including translation, reflection, rotation, dilation, and combination of transformations (Albab et al., 2014). Therefore, it is necessary to innovate a learning process to overcome the difficulties in the transformation material.

One effort to make it easier for students to understand the material is using learning media. Learning media is a tool to make it easier for students to understand the material so that the messages conveyed by educators do not misunderstand (Netriwati & Lena, 2018). Teachers must consider the facilities owned by students in the classroom so that learning media can run well. In addition, learning media also play a role in encouraging students to be able to learn properly and correctly.

Technology development is progressing rapidly and has developed in all lines, especially in education and learning. The use of technology in education is very helpful in the implementation of the learning process. Through technology, learning will become more varied. Technology development makes it easier for an educator, for example, in terms of using learning media that make the learning situation in the classroom more attractive to students.

Utilizing current technology, one of the efforts to increase students' understanding is to

use multimedia learning media. The multimedia used can be in the form of interactive multimedia. Interactive multimedia combines images, video, animation, and sound in one software that allows users to interact directly (Novitasari, 2016).

One application that can create interactive multimedia is the Adobe Animate application. Adobe Animate is a multimedia animation program developed by Adobe Systems. This application can design vector graphics and animations and publish them into animation, online videos, websites, web applications, internet applications, and video games (Wibawanto, 2018). Adobe Animate is the latest version of Adobe Flash CS 6, where Adobe Animate is a replacement software and complements the shortcomings that exist in Adobe Flash. Adobe continued to develop flash until it changed its name to Adobe Animate cc by supporting the web by designing HTML5 animations, making editing publishing, animated advertising media, animated videos, learning media, web versions of games, and much more (Saputro, 2018). Based on research by Mukhayat et al. (2020), it was found that there was an effect of learning using Adobe Flash learning media (a previous version of Adobe Animate) on the ability to understand mathematical concepts of students. Through interactive multimedia containing text, sound, and animation, it is hoped that it can train students' abilities to communicate mathematical ideas. Students can access the learning media from Adobe Animate via smartphones. With this ease of access, it is hoped that the learning media can attract students' attention and encourage independent learning. Hence, it is necessary to make an innovation in learning mathematics through interactive learning media to maximize students' abilities.

In this study, the development of interactive learning media is based on the Adobe Animate application of geometry transformation material. The novelty of this study is the material chosen for developing a learning media application, namely the geometry transformation at the high school level. This material is more advance than those at the junior high school level because it contains a transformation matrix. Furthermore, this study aims to describe the development process and the validity and practicality of the learning media developed.

METHOD

This type of research is research and development, where the product developed in this study is an interactive learning medium based on the Adobe Animate application of geometry transformation material. This research and development design belongs to research and

development level 4, which researches and tests to create a product that does not yet exist (Sugiyono, 2017). The development model used is the Multimedia Development Life Cycle (MDLC) Luther's version developed by Sutopo (2009). MDLC was chosen because this model is more specific to multimedia-based development, in accordance with the media to be developed in this study, namely learning media in the form of applications containing images, sounds, and animations. The MDLC Development Cycle can be seen in Figure 1.
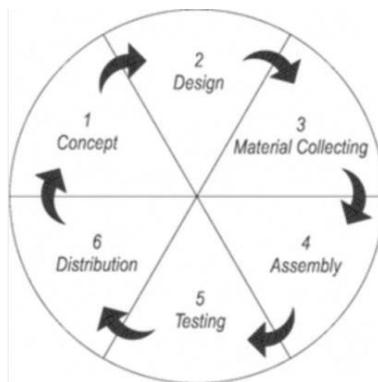

Figure 1. MDLC Development Cycle (Nurajizah, 2016).

The Multimedia Development Life Cycle (MDLC) consists of six stages.

Concept

The concept stage begins with determining the purpose of making the application and determining the user of the application.

Design

The design stage is the stage for making detailed product specifications. At this stage, a storyboard describes a series of stories or each scene so the users can understand it.

Collecting Content Material

This stage is the stage of collecting materials in accordance with the needs of the learning media to be made. The materials needed include images, animations, audio, and text, both ready-made and those that still need to be modified as needed.

Assembly

This stage is the stage of making the entire learning media. The learning media created are based on the previous design and material collection stages.

Testing

This stage is carried out to ensure that the results of making learning media are according

to plan. There are two types of testing used, namely Alpha and Beta testing. The alpha test was conducted to determine the validity of the media created. While the Beta test is a test carried out to determine the level of practicality.

Distribution

Distribution can be done after the learning media are declared suitable for use. At this stage, the learning media will be stored in a storage medium such as Google Drive, mobile devices, or websites.

In this research and development, the researchers used a questionnaire instrument with a Likert scale to obtain the validity and practicality of the learning media made as well as documentation in the form of photos or screenshots during the research. The questionnaire used was adopted from Pratama et al. (2020). The five-points Likert scale was used in the questionnaire, with the responses are Strongly Disagree = 1, Disagree = 2, Doubt = 3, Agree = 4, nd Strongly Agree = 5 (Sugiyono, 2017). Furthermore, the data analysis examined the validity and practicality of the developmental learning media. The explanation is validity test as follows (1):

Validity test using the following formula (Rozak et al., 2018) :

$$V = \frac{TSh}{TSe} \times 100\% \tag{1}$$

Information:

V	:	Validity Percentage
TSh	:	The total score of expectations
TSe	:	Total empirical score

The calculation results is in the form of a percentage of validity. Then the results obtained are then interpreted into categories which can be seen in table 1 below (Rozak et al., 2018):

Table 1. Validity Criteria

Validity Percentage	Validity Level
$85,01\% - 100,00\%$	Very valid, or can be used without revision
$70,01\% - 85\%$	Quite valid, or can be used but needs minor revision
$50,01\% - 70,00\%$	Not valid; it is recommended not to use it because it needs a major revision
$01,00\% - 50,00\%$	Invalid, or should not be used

Practicality test using the following formula (Rozak et al., 2018) shows (2):

a. Determine the average value of all respondents for each criterion:

$$I_{sj} = \frac{\sum_{i=1}^{n} \sum_{j=1}^{m} S_{ij}}{n} \tag{2}$$

Information:

I_{sj} : the average score of all students for the j criteria
n   : number of students
m   : number of criteria
S_{ij} : the score of the i student against the j criteria

b. Determining the value of practicality shows (3):

$$P = \frac{I_{sj}}{m} \tag{3}$$

Information:

P   : the final value of practicality
n   : number of students
m   : number of criteria
I_{sj} : the average score of all students for the j criteria

The results of the practicality calculations are then interpreted into the criteria in table

2 below (Rozak et al., 2018):

Table 2. Practicality Criteria

Practicality Score	Practicality Level
$P = 5$	Very high
$4 \leq P \leq 5$	High
$3 \leq P \leq 4$	Medium
$2 \leq P \leq 3$	Low
$1 \leq P \leq 2$	Very low

RESULT AND DISCUSSION

The following is a description of the learning media development process carried out using the Multimedia Development Life Cycle (MDLC) method:

Concept

At this early stage, the product that will be made as an interactive learning media application has been determined for Year 11 geometry transformation. The purpose of making it is to help students learn mathematics, especially in the material transformation of class XI geometry. Then the users of this application are teachers or students teaching or studying geometry transformation material.

Design

The product specifications to be made are in the form of interactive learning media in the form of applications. On the home screen, there are several buttons and the main menu. As for the main menu, four buttons represent each subject in the transformation material:

translation, reflection, rotation, and dilation. On each of the main menus, after clicking, several menus will appear, such as the concept of the material, an explanation of the transformation matrix, examples of discussion questions, and exercises in the form of multiple choice questions. Furthermore, the storyboard of the product to be made can be seen in Figure 2 below.
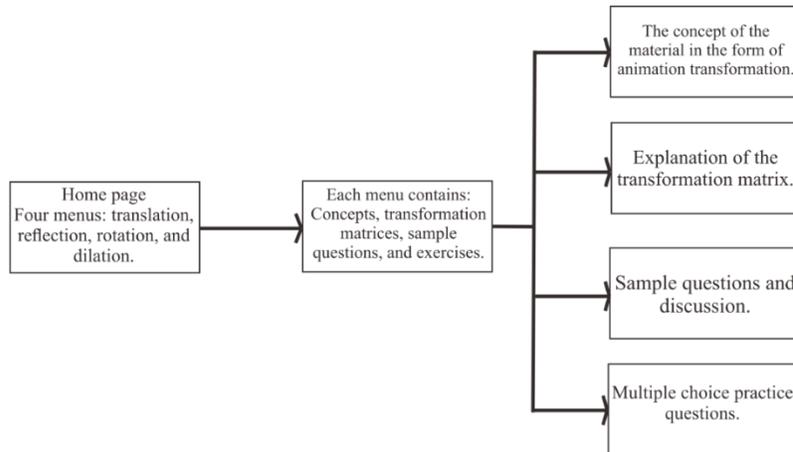

Figure 2. Storyboard of Products to be Made

Collecting Content Material

The primary materials needed are images, text, and audio. At this stage, the background media that will be used is created. Then some buttons and images of objects needed in the making media are also prepared by downloading some symbols or logos from free image providers on the internet and making your own using a graphic design application. The buttons and objects are then saved as PNG images. Some buttons and media objects can be seen in Figure 3 below.

Figure 3. Buttons and Media Objects

Furthermore, images containing text, such as transformation matrices and sample questions, are also prepared. Finally, the app icon is also set up as an app icon on Android

devices.

Assembly

This stage begins with creating the home page in scene 1 by entering several buttons, such as the music button, the note button, the profile button, the exit button, and the four transformation buttons. Then the buttons are animated through a movie clip and given a specific code for later. If the button is clicked, it will go to the next frame or a page that has been determined. Figure 4 below shows the homepage.

Figure 4. Homepage

Suppose one of the transformation buttons is clicked. In that case, it will go to a frame or a page that contains four menus, namely concepts, transformation matrices, sample questions and discussions, and exercises. In addition, there is also a home button to return to the home page or home page. Figure 5 below shows the menu page for one type of transformation.

Figure 5. Menu page on one type of transformation

In the frame containing the concept, several objects such as Cartesian diagram images, points, coordinates of the starting point, transformation buttons, and the coordinates of the

transformed points are included. Some of these objects are inserted into a movie clip to animate the movement of a transformation by giving motion twins to the point and code to run the movement command of a transformation. Figure 6 below shows the material concept page.
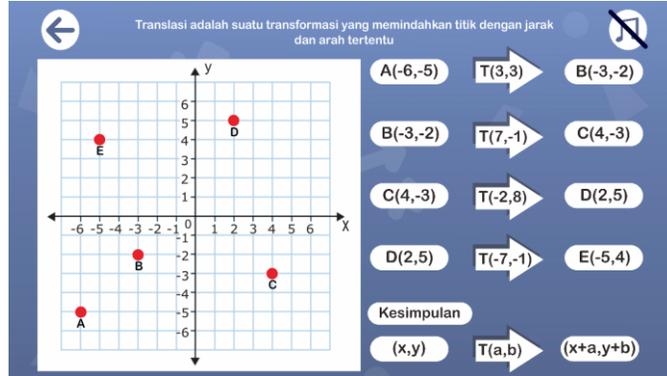

Figure 6. Example of a Concept Page

Next, a page containing the transformation matrix, sample questions, and exercises is created. The last step in this stage is to publish learning media that have been made into applications that can be run on computers and android devices. Two application files are generated; the file of type ".exe" can be run on a computer device, while the file of type ".apk" can be run on an Android device.

Testing

The Alpha test was carried out to determine the validity of the media, the assessment of media experts by Mr. Ryan Angga Pratama, M.Pd a lecturer in mathematics education at the Universitas Balikpapan obtained a validity percentage of 87.69%, meaning highly valid. The results of the media expert's assessment can be seen in Table 3.

Table 3. Media Expert Assessment Results

Indicator	Score
Effect	5
Background	4
Color composition	3
Font type	4
Font size	4
Text display	4
Image/object placement	5
Image/object proportion	5
Display design	4
Touch function	4
Media flow	5

Indicator	Score
Ease of operation	5
Ease of management	5
Total	57
Percentage	87.69%
Criteria	Highly Valid

Furthermore, the assessment of the material expert by Ms. Fithria Ulfah, M.Pd as a mathematics education lecturer at the Universitas Muhammadiyah Banjarmasin obtained a validity percentage of 73. 84%, meaning it is quite valid. The results of the material expert's assessment can be seen in Table 4.

Table 4. Results of Material Expert Assessment

Indicator	Score
Compatibility with textbooks (Mathematics book for class XI Kemendikbud revised 2017 edition)	4
Conformity with basic competence	4
Completeness of questions	3
Systematic/sequential	4
Clarity of the presentation of the discussion material	4
Clarity of the question	4
Questions according to the textbook	4
Clarity of question display	4
The truth of the discussion of sample questions	4
Difficulty level suitability	3
Benefits of learning motivation	3
Ease of independent study	4
The benefits of reasoning	3
Total	48
Percentage	73.84 %
Criteria	Quite Valid

Next, the assessment of learning practitioners by Mrs. Ainun Jariah, S.Pd., M.Si as a mathematics teacher at MA Muhammadiyah 2 Al-Furqan obtained a validity percentage of 78.82%, meaning it is quite valid. The results of the assessment of learning practitioners can be seen in Table 5.

Table 5. Assessment Results of Learning Practitioners

Indicator	Score
Compatibility with textbooks (Mathematics book for class XI Kemendikbud revised 2017 edition)	4

Indicator	Score
Conformity with basic competence	4
Completeness of questions about the material	4
Systematic/sequential	4
Clarity of material presentation	4
Clarity of the question	4
The questions correspond to the textbooks	4
Clarity of question display	4
The truth of the discussion	4
Difficulty level suitability	4
Benefits of learning motivation	3
Ease of independent study	3
The benefits of reasoning	4
Learning media innovation	4
Ease of operation	5
Educational media flow	4
Benefits in the world of education	4
Total	67
Percentage	78.82 %
Criteria	Quite Valid

The percentage of the combined validity of the three experts is 80.12%, meaning it is quite valid or the product made can be used but needs minor revisions. The product was revised based on some comments and suggestions from the three validators, as follows.

1) The sound button sometimes doesn't work properly; there are some moments when the music overlaps.
2) The practice questions given are very few.
3) Practice questions can be made more varied to foster students' reasoning. For example, enter a reflection problem for a circle or parabola reflected on the x-axis.

Next, the revised aspects per validators' comments and suggestion are as follows.

1) The sound button is fixed so that the music doesn't overlap anymore by making the sound button appear on every menu where previously it was only on the start menu or homepage.
2) Examples of questions are made more varied by including transformation questions for circles or parabolas so that there are four examples of questions where previously there were only three questions.
3) The practice questions are made more varied by adding one more question package so that there are two practice questions packages where previously there was only one package.

Then the Beta test was carried out to determine the practicality of the media that had been made. In a small-scale trial, the application can run well on five student devices, and a practical value of 4.30 is obtained, which is included in the high category. The implementation of large-scale beta tests can be seen in Figure 7.

Figure 7. Large-Scale Beta Test

On a large-scale, learning media were used in one meeting, then students and teachers assessed a given questionnaire. In this large-scale trial, the practicality value of 29 students was 4.13, which was included in the high category. Finally, from the teacher respondents who teach, the practicality value is 4.15 and is included in the high category. The overall category is included in the high category, with a practical value of 4.19. The results of the beta test assessment can be seen in Table 6.

Table 6. Beta Test Assessment Results

Indicator	Small Scale	Large Scale	
	Score 5 students	Score 29 students	Score from teacher
Attractive view	21	124	4
Interesting sound effects	23	109	4
Easy touch function	22	131	5
Educational media flow	22	124	4
Ease of operation	21	128	5
Clarity of the question	21	125	4
Completeness of the question	22	122	4
Completeness of the presentation of the discussion of the question	21	121	3
The suitability of the questions with the abilities of students	21	114	4
Learning is varied and fun	22	122	4
Ease and motivation to learn independently	22	107	5

Indicator	Small Scale	Large Scale	
	Score 5 students	Score 29 students	Score from teacher
Usefulness of knowledge	20	118	5
Usefulness of reasoning	22	113	3
Total	280	1558	54
Practicality Score	4.30	4.13	4.15
Practicality Level	High	High	High

In addition, students also provide some positive comments related to the learning media developed, as follows.

1) Learning using this learning media makes learning easy and fun.
2) The application is excellent and interesting, helpful for students to learn independently, and presented clearly.
3) The application is attractive, good, and easy to reach independently.
4) Good app to help self-study.

Meanwhile, students also gave some suggestions, as follows.

1) Avoid typos to avoid mistakes
2) In order to correct the problem of writing errors in the material.
3) Be more careful in giving or arranging numbers.

Some of the suggestions above were given by students because, at the time of the test, a few errors were found in the answers of the sample questions section. After doing the Beta test, the media were revised to fix typos.

Distribution

The distribution is carried out after the learning media are declared valid and practical. At this stage, the learning media is stored in Google Drive (https://bit.ly/FileAplikasiTransformasiGeometri). The application file can also be accessed via the QR code in Figure 8.

Figure 8. QR Code File for Learning Media Applications

Based on the research and development, it is found that the interactive learning media developed is fairly valid (80.12%). This means that the learning media that has been made can be said to be valid; it just needs to be revised. Then based on Nisa's research (2021), this means that based on the assessment of the validator, the interactive media that has been created has met and is following the indicators and is suitable for use. According to Naimahtuti (2018), the media that are declared valid is then worthy of being tested in learning, in this study, the practicality test.

In the practicality test, a high level of practicality was obtained (4.19). This means that the learning media created can be said to be practical for use by both students and teachers in the learning process. With a relatively high level of practicality, it can be interpreted that the learning media can be used easily during learning situations in the classroom or used independently by students. Overall, the media produced are valid and practical. This is in line with the research of Pratama et al. (2020), where learning media that are declared valid and practical is feasible as alternative learning media in learning activities. Nisa (2021) also stated that interactive learning media could attract students' attention and make learning in the classroom more enjoyable.

CONCLUSION

Based on the research and development that has been done, this research has fulfilled the stated research objectives. The following conclusions are obtained: Produce learning media in the form of applications for geometry transformation material with the development process using the Multimedia Development Life Cycle (MDLC) model. The learning media developed is included in the quite valid category.The learning media that has been developed has a high level of practicality.

Overall, the learning media developed is feasible and can be used in the learning process or as a means of learning for students independently of geometry transformation material. Then it is suggested that in the future, it will be possible to develop interactive learning media with different learning materials and measure their effectiveness in learning.

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