



Development of Android-based Interactive Learning Multimedia Using Articulate Storyline 3 in the Set Material

Ummul Huda^{1(✉)}, Silvia Maturrani¹, Laily Hidayati¹, Kurnia Rahmi Yuberta¹, Elda Herlina¹, and Delvi Eka Ariyanti¹

¹ Universitas Islam Negeri Mahmud Yunus Batusangkar, Indonesia
ummulhuda@uinmybatusangkar.ac.id

Abstract. The increasingly rapid development of technology requires teachers to be able to choose, use and develop various types of media or teaching materials that can construct students' knowledge independently at their own pace. Learning does not only focus on material and pedagogy but must be enriched with technological sophistication, considering the high influence of gadgets on gen-z students. On the other hand, sets are a basic concept that students must have in understanding more complex mathematical material. However, SMPN 2 Tanjung Emas teachers have not been able to choose, use or design media optimally, resulting in students' weak understanding of the concept of set. Therefore, this research aims to produce Android-based interactive learning media using Articulate Storyline 3 software that is valid and practical on set material. This 3D model development research uses validation sheets and student response questionnaires. The product was validated by three mathematics experts, then used by 20 class VII students. The research results show that the interactive multimedia developed is very valid and very practical.

Keywords: Interactive Multimedia, Android, Set Material

1 Introduction

The development of technology and information systems in the digital era has penetrated all lines of human life. The rapid development must be accompanied by efforts to balance the education system [1], by facilitating various innovations according to the development of science and technology [2]. This confirms that it is necessary to integrate the use of technology in the learning process [3], because technology has a very crucial role in learning [4]. One effort to solve problems in the educational technology approach is to use learning resources [4]. The part of learning resources that is closely related to technology is interactive multimedia.

Learning to use interactive multimedia can improve the ability to understand mathematical concepts [5], overcome various linguistic and non-linguistic problems in learning, which can attract students' interest and attention [6], increase learning motivation [3], as well as making learning more effective and efficient [7].

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Most teachers in schools have difficulty selecting, using and developing instructional media that are appropriate to the characteristics of students [8]. The technological fever that grips teachers demands the need to provide knowledge of the media itself, in order to be able to touch every student characteristic through selecting the right media [9]. This condition illustrates that some teachers are still reluctant to use media in learning, let alone develop it. Consistent results were found at SMPN 2 Tanjung Emas where the learning resources used were only the 2013 edition of the 2013 curriculum package without the help of other learning resources. Teachers find it difficult to find the right media so that the use of learning media that suits the needs of students is not optimal. On the other hand, the use of gadgets still dominates post-pandemic students' thinking.

Android-based interactive learning multimedia is a combination of various media used in the process of distributing learning messages where students are required to directly interact with learning multimedia that has been installed on each student's Android so that learning objectives are achieved. This is also supported by the condition of students who have Androids, as well as school regulations that allow the use of Androids in carrying out learning.

The use of articulate storyline 3 software in independent learning is a new innovation in learning so that students do not feel bored and the resulting product is interactive. Articulate storyline 3 has several interesting advantages to support the learning process: it can be created easily by yourself, whether experienced or not, it can include several forms of files, such as text, images, videos, animations and so on, can be in audio and visual form, sound and images can be created in an articulate storyline 3, there is a quiz maker application without uploading external files and provides interactive content to further involve students in learning [7].

Previous research has developed interactive learning multimedia based on Android using Articulate Storyline 3 with the Borg & Gall model for students at SMK Muhammadiyah 5 Kepanjen [10] The instruments used were observation sheets and interviews, questionnaires and documentation. However, there has been no similar research using the 4D model for junior high school students, which incidentally has different characteristics. So, this study aims to produce interactive multimedia based on Android using Articulate storyline 3 on set material.

Android-based Interactive Learning Multimedia uses articulate storyline 3 in the set material which has characteristics, namely: (1) There are learning objectives that are clearly formulated. All learning material for one competency or sub-competency being studied is contained in one complete medium. The aim is to provide students with the opportunity to learn the lesson completely, because the material is packaged into one complete unit. (2) There is learning material packaged into specific units/activities, making it easier for students to learn thoroughly. Lesson material is the core activity in this multimedia learning. Material is divided based on predetermined indicators. (3) Illustrative examples are available that support the clarity of the presentation of learning material. Students not only read the text but also see illustrations of a process that resembles the actual process, making it easier for students to understand. (4) There are practice questions, assignments and the like that allow students to provide responses and measure their mastery. The computer has been pro-

grammed to provide data based on the possible answers that will be given by students. (5) Contextual, namely the materials presented are related to the atmosphere or context of the task and the students' environment. The learning concept connects learning material with real situations, and motivates students to make connections between knowledge and its application in everyday life. (6) Having an attractive appearance by adding images and objects according to the demands of the material will increase students' interest in the subject matter. The material is packaged in multimedia, including text, animation, sound and video according to the demands of the material. Students not only read the text but also see animations about an actual process. (7) This interactive learning multimedia also provides responses to stimuli provided by students during program operation. Apart from that, it is possible for each response to be given automatic reinforcement which has been programmed, strengthening the student's correct or incorrect answer. (8) There are instructions or instructions for use that can help users, including ease of use. (9) Using interesting variations and high resolution quality. Multimedia is created using several presentation media creation applications, such as Articulate Storyline 3, Microsoft Power Point, Adobe Photoshop, Zepeto and Kinemaster. Articulate Storyline 3 is used as the basic application used to create this multimedia, while other applications such as Adobe Photoshop are supporting applications in creating images and icons needed in this multimedia. The additional application required is the Zepeto application. Zepeto is a 3D character creation application or game obtained from Google Playstore. This application is needed in making this media as a character maker in that media. Other additional applications such as Kinemaster are also needed to create illustrative videos in the media to be designed. Combining several applications creates an interactive learning multimedia that is ready to be implemented. Next, the last application used is the web to apk application. This application functions to change the HTML 5 format into an Android application that can be used on Android cellphones. (10) Android-based interactive learning multimedia using Articulate Storyline 3 is designed according to the context of students, namely learning multimedia that can be used directly via the Android that each student already owns. The material can be repeated according to the wishes of students and can be used by individual students not only at school but also at home. The material can be repeated according to the wishes of the students.

2 Methodology

This development research uses the 4D model from Tiangarajan [11], but only up to the development stage. The first stage is the define stage, which is conducting a needs analysis consisting of observations and interviews with teachers, analysis of learning resources, material analysis and analysis of student characteristics. At the design stage, it is necessary to formulate an interactive multimedia framework and format, type of writing, language and way of presenting the concept. The steps taken at this stage are making flowcharts, storyboards, gathering materials, programming, and finishing. Finally, the development stage is carried out by testing the validity and practicality of the product using validation sheets and student response questionnaires.

The validation sheet tests the feasibility of content, presentation, language and graphics. Questionnaires were distributed to 20 students in class VII.2 SMPN 2 Tanjung Emas to find out the ease of use of the product, time efficiency, suitability of the material, attractiveness and the possibility of creating independent learning by using this product.

The validation sheet aims to measure the suitability of interactive multimedia developed based on BSNP criteria [12], namely suitability of content/material, suitability of presentation, suitability of language and suitability of graphics. Eligibility of Content/material consist of: 1) Material coverage: (a) Completeness of the material, namely the material presented includes all the material contained in the competency standards (SK) and basic competencies (KD). Because the object that the author will use is a school that uses the 2013 curriculum, the material presented includes all the material contained in core competencies (KI) and basic competencies (KD). (b) Breadth of material, namely the material presented reflects the description that supports the achievement of all basic competencies (KD). (c) Depth of material, namely the material presented starting from the introduction of concepts, definitions, exercises, to interactions between concepts according to the level of education of students and in accordance with what is mandated by basic competencies (KD). 2) Accuracy of Material: (a) Accuracy of concepts, namely the concepts and definitions presented do not give rise to many interpretations and are in accordance with the concepts and definitions that apply in the field of mathematics. (b) Accuracy of procedures, namely the material presented explains the need for types of materials, tools and work steps in a coherent and correct manner in accordance with occupational safety and health principles accompanied by appropriate illustrations. (c) Accuracy of pictures, diagrams and illustrations, namely pictures, diagrams and illustrations presented in accordance with reality and efficiently to increase students' understanding. (d) Accuracy of facts and data, namely the facts presented in accordance with reality and efficiently to increase students' understanding. 3) Relevance: (a) In accordance with student development, namely the material is appropriate to the emotional, intellectual, physical, perceptual, social and creative development of the learning subject. (b) In accordance with education/learning theory, namely the description of the material has a basis in education/learning theory. (c) In accordance with current conditions, namely the information presented is actual and refers to the latest references.

Feasibility of presentation consist of: 1) Completeness of presentation: (a) Preliminary part, namely the completeness of the initial part including: cover, table of contents, display list and introduction and contains learning instructions and competencies to be achieved. (b) The core part, namely the completeness of the core part includes: chapter descriptions, chapter summaries, illustrations (pictures), exercises and evaluation/reflection. (c) The final part, namely the completeness of the final part includes: bibliography and attachments. 2) Presentation of information: sequence, namely systematic description; coherence, namely the information presented has complete meaning (binds together as one unit); consistency, namely consistency in the use of terms, concepts and other explanations; balance, namely the amount of material description is proportional (there is balance). 3) Presentation of learning: centered on students, namely the presentation of material places students as the sub-

ject of the lesson; encouraging exploration, namely fostering students' curiosity; developing experience, namely acquiring knowledge, attitudes, values and daily experiences; spur creativity, namely encouraging students to develop unique ideas; contains competency evaluation, namely containing an assessment of competency achievement (not just a cognitive assessment).

Language Eligibility consist of: 1) In accordance with standard Indonesian language rules: (a) grammatical accuracy, namely the sentences used to convey the message, referring to good and correct Indonesian grammar. (b) spelling accuracy (according to EYD), namely the spelling used in the enhanced spelling guidelines. 2) In accordance with the development of students: (a) In accordance with the development of students' thinking, namely the language used to explain concepts, show examples and give assignments, according to the level of cognitive development (thinking) of students. (b) The language used to explain concepts, show examples and provide assignments, is appropriate to student development. Then, Graphic Eligibility consist of: 1) Physical size of teaching materials: conformity of size to standards, conformity of size to material. 2) Cover design of teaching materials: consistent appearance of layout elements (according to pattern), displays a good center of view, has good contrast. 3) Design of teaching material content: consistent layout, attractive appearance, good contrast, harmony of colors, writing and images. Validity and practicality data were analyzed using percentages with formulas:

$$P = \frac{\text{total score for all aspects}}{\text{maximum score for all aspects}} \times 100\%$$

with the following range [13]:

Table 1. Category Validity and Practicality

No	Interval	Category
1	$0\% < P \leq 20\%$	Invalid/Inpractical
2	$20\% < P \leq 40\%$	Less valid/Less practical
3	$40\% < P \leq 60\%$	Fairly valid/Fairly practical
4	$60\% < P \leq 80\%$	Valid/Practical
5	$80\% < P \leq 100\%$	Very valid/Very practical

3 Result and Discussion

3.1 Define Stage

Learning in schools only utilizes book packages published by the Ministry of Education and Culture, without being accompanied by teaching materials or other media. Books are designed so that students are able to construct concepts independently, but books do not contain answer keys and assignment level sheets to measure and evaluate student learning outcomes independently. In addition, the book is more oriented to the cognitive aspect. Brief and minimal book descriptions do not match the character-

istics of students who are comfortable with conventional methods, where students need clear and detailed review material as well as lots of sample questions.

In addition, solving problems related to the concept of sets is still considered difficult by students, even though this material is the basis that must be mastered. Set theory is the basis for the development of mathematics which is closely related to everyday life, but is quite difficult for students to understand [14]. This is in line with what happens in schools where students often experience difficulties in solving social problems. When associated with several examples of sets, many students have difficulty understanding the meaning of "objects that are clearly defined". This is evidenced by the achievement of the learning outcomes of most of the students who did not complete.

Based on the results of observations, learning seems to be still teacher-centered, dominated by the use of the lecture method, and rarely uses learning media. Further investigation through interviews illustrates that educators sometimes use teaching aids and learning media that are far from optimal. Teachers realize that learning will be more effective with the use of media, but teachers still have minimal knowledge regarding the use and development of learning media. Furthermore, students have different learning styles and learning speeds. Initiative for independent learning, doing assignments, motivation and level of intelligence are low. Furthermore, students want learning that is relaxed and not boring because it still contains the influence of post-pandemic gadgets.

For this reason, it is necessary to develop learning media that are able to arouse desire and stimulate interest in order to affect students' psychology [15]. In accordance with the context in the field, it is necessary to develop Android-based interactive multimedia on the set.

3.2 Design Stage

The development of Android-based interactive learning multimedia was designed with the help of articulate storyline 3 software. For image, sound, video editing and character creation using Adobe Photoshop, Power Point, Kinemaster and Zepeto games. Products are packaged according to the demands of the material, oriented to students, accommodate various student characteristics, train independent learning, and stimulate thinking skills and are presented in a fun way so that they are effective and efficient in achieving learning goals. The advantages of using Android-based interactive learning multimedia can help teachers present material interactively, modify material to be more interesting, easy to understand and fun [16]

The first stage begins with making a flowchart. The flowchart contains the program flow that is made from the first entry to the exit (figure 1). All views and topics that will be presented are made in the form of diagrams so that you can see the links and relationships between one another.

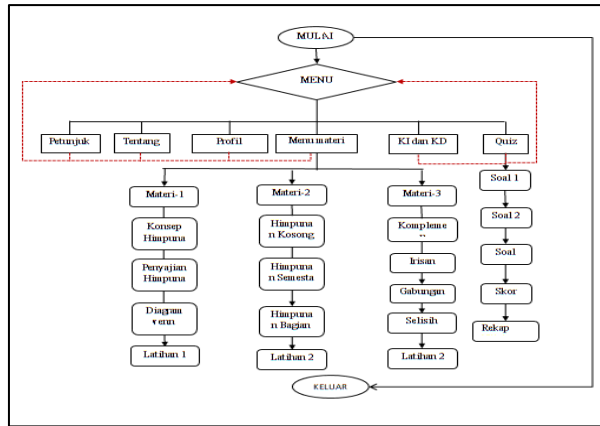


Fig. 1. Flowchart

Then a storyboard is created which contains interactive multimedia displays visually and audio from the flowchart. The initial appearance of the storyboard contains an identity in the form of an application title, curriculum, and the name of the product maker (figure 2). Students can press the start button and will move to the main menu (figure 3).



Fig. 2. Initial View



Fig. 3. Main Course

The main menu consists of three options, namely learning outcomes (KI/KD), material deepening and learning evaluation (Quiz). When students click on KI/KD, a display similar to Figure 4 will appear, where students are asked to read and understand what competencies must be mastered after studying the set material. However, if students click on the material button, a material menu display will appear (figure 5).

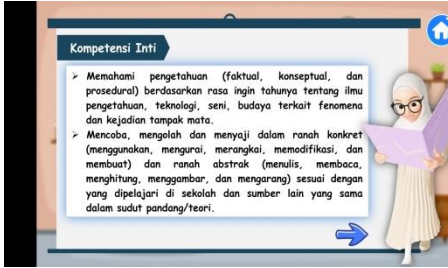


Fig. 4. KI and KD



Fig. 5. Material Menu

Set material is divided into three sub-discussions, namely the concept of sets, types and operations that apply to sets. Presentation of the material is designed in the form of conversations, invitations, presentation of problems and is equipped with videos as shown in Figure 6 and Figure 7.



Fig. 6. Set Concept



Fig. 7. Video

When students click on the red video button (figure 6), a video about the set concept will appear (figure 7). After watching the video, students are asked to write down their responses regarding the definition or meaning of sets in the white column provided (figure 8). If students have given answers, they can press the green OK button, then the definition of the set will appear (figure 9).



Fig. 8. Opinion Column



Fig. 9. Set Definition

If students are still unsure or don't understand the video explanation, students can press the repeat video button (figure 9). If the student answers successfully, an appreciation will be given in the form of a fun emoticon. Henceforth, students will be directed to the next page and follow the instructions given until the final stage of the material. Students who complete the lesson to the end of the material will get a code like Figure 10. The codes collected at the end of each material function as passwords for taking part in the quiz (Figure 11).



Fig. 10. Quiz Code



Fig. 11. Quiz

The final stage of learning to use Android-based interactive multimedia is evaluation by utilizing the online quizziz application. Before starting the quiz, students must first enter the code and name as shown in Figure 12 and Figure 13.

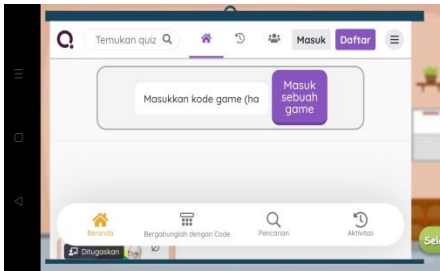


Fig. 12. Enter Code

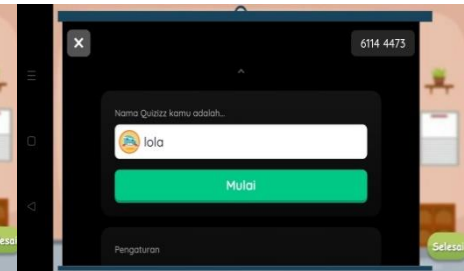


Fig. 13. Enter Name

The quiz consists of 10 multiple choice questions that are displayed randomly and are limited in time to minimize students cheating and cheating. After completing the quiz (figure 14), students can see the score achieved (figure 15).



Fig. 14. Quiz Questions



Fig. 15. Quiz Score

Recap scores of students working on quizzes are sent directly to the teacher's quizziz account (figure 16). Teachers can monitor student work and provide follow-up on the evaluation results.



Fig. 16. Value Recap

The materials used are in the form of video, sound and images. Videos are made using the kinemaster application, while images and buttons are obtained from the internet and the articulate storyline application 3. Sound is downloaded from the internet and YouTube, while material is sourced from junior high school textbooks and other sources such as the internet and modules. Then, character creation uses the Zepeto application, which is a character creation application according to your own wishes.

All materials that have been collected are arranged in accordance with the demands of the material and proper presentation rules. Android-based interactive multimedia is created using the articulate storyline 3 software and produces an html 5 project. The development of interactive android-based learning multimedia with articulate storyline 3 features a learning media menu, including: 1) syllabus menu containing basic competencies, core competencies and learning objectives; 2) menu material packaged in practical presentations with learning videos; 3) a quiz menu that contains exercises or tests of students' understanding of the material being taught, both cognitive and psychomotor aspects; 4) the glossary menu contains a glossary of words in the material that makes it easier for students to understand; 5) the guide menu contains an explanation of each menu in the main menu, and 6) the about menu which contains a brief explanation of the identity of the researcher [10].

The last stage is in the form of reviewing and testing the program's readability so that it is in accordance with the expected target. The end result of finishing activities is packaging, namely packaging programs in the form of android applications with the help of web to apk applications. This application is able to change html and URL projects into applications that can be used on Android smartphones. The end result is an android application that is ready to be used by students.

3.3 Development Stage

The aim of the development stage is to test the validity and practicality of the product. Validity data was obtained from an Android-based interactive multimedia validation sheet in a set developed based on the National Education Standards Agency (BSNP) consisting of content/material feasibility, presentation feasibility, language eligibility and graphic feasibility. The validation sheet was assessed by three mathematicians with the following results (Table 1):

Table 2. Validation Results

<i>No</i>	<i>Rated Aspect</i>	<i>Validator</i>			<i>Sum</i>	<i>Max Score</i>	<i>%</i>	<i>Explanation</i>
		<i>1</i>	<i>2</i>	<i>3</i>				
<i>1</i>	<i>content eligibility</i>	<i>31</i>	<i>38</i>	<i>32</i>	<i>101</i>	<i>120</i>	<i>84</i>	<i>very valid</i>
<i>2</i>	<i>presentation eligibility</i>	<i>21</i>	<i>24</i>	<i>19</i>	<i>64</i>	<i>72</i>	<i>89</i>	<i>very valid</i>
<i>3</i>	<i>language feasibility</i>	<i>18</i>	<i>23</i>	<i>19</i>	<i>60</i>	<i>72</i>	<i>83</i>	<i>very valid</i>
<i>4</i>	<i>graphic feasibility</i>	<i>26</i>	<i>32</i>	<i>28</i>	<i>86</i>	<i>96</i>	<i>90</i>	<i>very valid</i>
	<i>Total</i>	<i>96</i>	<i>117</i>	<i>98</i>	<i>311</i>	<i>360</i>	<i>86</i>	<i>very valid</i>

The results of the validity show that the android-based interactive multimedia in the set meets the eligibility criteria for a product with a very valid category. These results are consistent with research entitled 1) Development of interactive learning media for Android-based correspondence subjects using articulate storyline 3 [10]; 2) Development of articulate storyline-based math learning media on flat sided room material for class VIII [15]; and 3) Development of amulet learning media using the articulate storyline [17].

Android-based interactive multimedia using articulate storyline 3 has several advantages, including in the form of an application that can be published to the play store, small storage space, a more attractive appearance, accessible offline and online, and student center presentation. This helps students build concepts independently and can be done anytime and anywhere. In contrast, this multimedia is limited to two basic competencies, can only be accessed using the Android operating system with a minimum of version 5 or Lollipop, has the same password code for each student, and the teacher cannot detect the correctness of the responses given by students during learning. The same password code allows students to ask their friends without completing learning first.

To test product practicality, as many as 20 students were asked to use Android-based interactive multimedia in the set. Then, students asked for their responses

through a response questionnaire consisting of 24 statements. Questionnaire result data can be seen in table 2.

Table 3. Practical Results

No	Indicator	Percentage (%)
1	Ease of use	83
2	Time efficient	86
3	Suitability to the material	82
4	attractiveness	85
5	Can be used as self-learning	82
Average		83,5
Categori		very practical

These results indicate that Android-based interactive multimedia in the set is feasible to use in the very practical category. The use of interactive multimedia is fun for students, because it is easy to operate and efficient in terms of time. Selection and use of the right media can create an effective and efficient atmosphere [16], positive impact on students' understanding [17]

Furthermore, students see that this multimedia has its own charm both in design, media, color and appearance. The material is presented with various illustrations and images that are easy to understand and in accordance with the expected basic competencies. Finally, this condition is able to make student learning independent and increase motivation. A media is appropriate to use if it is able to make it easier for teachers and students to understand the material, is easy to use, stimulates interest and attention and makes students independent in learning interactively.

4 Conclusion

Android-based interactive learning multimedia in this set of materials is designed using articulate storyline 3 which can be operated offline with a small storage space. The results show that this interactive multimedia is effective with the categories very valid and very practical. In other words, this interactive multimedia is suitable for use in the mathematics learning process.

Developing Android-based interactive learning media using Articulate Storyline 3. There are menu features in the learning media, including a syllabus menu containing basic competencies, core competencies and learning objectives, a material menu containing learning packaged in practical presentations and learning videos, a quiz menu containing practice or test students' understanding of the material being taught in both cognitive and psychomotor aspects, the glossary menu contains a list of terms in the material that makes it easier for students to understand, the guide menu contains an explanation of each menu in the main menu, and the about menu contains a brief explanation of the identity of the researcher.

Android-based interactive learning multimedia using Articulate Storyline 3 has several advantages, including, in the form of an application that can be published on Playstore, so it can be used by anyone and anywhere. The storage space for this appli-

cation is small so it doesn't require a lot of storage space, the size is only 22 Mb. Apart from that, the multimedia display is more attractive, thereby increasing the interest and curiosity of students. This application can be accessed offline and online. For users who don't have a data package, this application can be served offline, but if you want to take quizzes in this application you have to activate a temporary data package, because the quizzes in this application are linked to the quizziz website and are online. Furthermore, the presentation of the material is student centered, where students are more active and free to provide their own responses, and can build concepts for students.

Students agree that learning using Android-based interactive learning multimedia makes learning time effective and enjoyable. The use of interactive multimedia in learning is one potential way [18] to foster students' learning motivation [19].

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