

DEVELOPMENT OF DIGITAL COMIC LEARNING MEDIA IN CLASS X TRIGONOMETRY MATERIAL

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ABSTRACT

Based on the problems in the field some students do not have worksheets and printed books. So that teachers use media in the learning process, but the media that teachers use still has shortcomings. Therefore, the purpose of this research is to develop and produce digital comic learning media on trigonometry material. This type of research is Research and Development (R&D). The model used in this study is the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. This research was carried out only in the valid and practical stage by using data collection instruments, namely product validation questionnaires by experts and practicality questionnaires by students. The level of validity of this product can be seen from the validation results of material experts and media experts. The percentage result of the material expert assessment is 74.44% and is included in the valid category, and the percentage result of the media expert assessment is 88.18% and is included in the very valid category. The average value of the final percentage of the four validators is 81.31% and is included in the very valid category. The level of practicality of this product is obtained from the results of student response questionnaires by 9 respondents in class X IPA 3 SMA Negeri 2 Sekampung with an average percentage of 81.33% and is included in the very practical category. Based on the results obtained, it can be concluded that the product developed is very valid and practical to use.

Keywords: development; digital comics; learning media; trigonometry

ABSTRAK

Berdasarkan permasalahan dilapangan bahwa ada beberapa peserta didik yang tidak memiliki LKS, dan buku cetak. Sehingga guru menggunakan media dalam proses pembelajaran, akan tetapi media yang guru gunakan masih terdapat kekurangan. Oleh karena itu tujuan penelitian ini adalah untuk mengembangkan dan menghasilkan media pembelajaran komik digital pada materi trigonometri. Jenis penelitian ini merupakan Research and Development (R&D). Model yang digunakan pada penelitian ini adalah model ADDIE (Analysis, Design, Development, Implementation, Evaluation). Penelitian ini dilakukan hanya sampai pada tahap valid dan praktis dengan menggunakan instrumen pengumpulan data yaitu angket validasi produk oleh ahli dan angket kepraktisan oleh peserta didik. Tingkat kevalidan produk ini dapat dilihat dari hasil validasi ahli materi dan ahli media. Hasil persentase penilaian ahli materi sebesar 74,44% dan termasuk dalam kategori valid, serta hasil persentase penilaian ahli media adalah sebesar 88,18% dan termasuk dalam kategori sangat valid. Nilai rata-rata persentase akhir dari keempat validator sebesar 81,31% dan termasuk dalam kategori sangat valid. Tingkat kepraktisan produk ini diperoleh dari hasil angket respon peserta didik oleh 9 responden kelas X IPA 3 SMA Negeri 2 Sekampung dengan rata-rata persentase sebesar 81,33% dan termasuk dalam kategori sangat praktis. Berdasarkan hasil yang diperoleh, dapat disimpulkan bahwa produk yang dikembangkan sangat valid dan praktis untuk digunakan.

Kata Kunci: komik digital; media pembelajaran; pengembangan; trigonometri

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Introduction

Mathematics is a subject that is taught at every level of education starting from elementary school, high school, to the university level. The purpose of mathematics learning according to Permendiknas Number 22 of 2006 concerning content standards is to understand mathematical concepts, describe how the relationship between mathematical concepts and apply concepts. Based on these goals, teachers in the mathematics learning process must help students to understand mathematical concepts. To help achieve the goals of mathematics learning, teachers need learning media to help convey the material in the teaching materials so that students better understand and understand the mathematical concepts taught. Media itself is defined as a communication tool used in the learning process to bring information in the form of teaching materials from teachers to students so that students become interested in participating in learning activities (Kustiawan, 2016). In addition, the use of learning media in the learning process can increase students' motivation to learn. This can be seen from the results of the study (Retnowati, 2017) stated that the use of learning media has an effect on students' learning motivation in Islamic religious education subjects.

Based on the observations that have been made at SMA Negeri 2 Sekampung, several obstacles experienced by teachers and students are found in the learning process. Through an interview with a mathematics teacher in class X of SMA Negeri 2 Sekampung, there were several obstacles, especially when the learning process was carried out online. One of the obstacles is that during learning the teacher cannot convey the material optimally due to the limitations of the media used by the teacher. Teachers use learning media in the form of learning videos that the teacher records themselves which only contain explanations of the material and have a long duration and sometimes teachers also use videos on YouTube. This makes learning less than optimal because some students cannot *download* the learning videos provided by the teacher due to memory and quota limitations so it is difficult to see the videos sent by the teacher. In addition, the learning media provided by the teacher does not contain sample questions. So that it makes it difficult for students to understand the material. Furthermore, the teacher said that in mathematics learning in class X Science 3 SMA Negeri 2 Sekampung, learning resources are available, namely LKS and printed books. However because the current learning process is online, students cannot participate in learning optimally. The results of the pre-survey questionnaire distributed to 36 students of class X Science 3 that 41.6% or 15 out of 36 students thought that mathematics was difficult, 69.4%, or 25 out of 36 students stated that trigonometric material was quite difficult, 72% or 26 out of 36 students felt helped during the learning process using media and 66.7% or 24 out of 36 students liked media such as comics.

Based on the existing problems and needs to get learning media that can make it easier for students to learn, learning media in the form of digital comics will be made. Comics are one of the things that provide attraction and are easy for students to understand in the learning process. (Astriyani et.al., 2024) Rapid technology and the increasing number of learning applications needed for learning require visualization and at the same time learning material using digital technology. (Kanti, et. al., 2018) Explaining comics has attractions, including attractive

appearances, and can help students understand concepts. Comics allow students to be interested in reading learning materials because comics have a coherent and orderly storyline so that they are easy to understand and remember by students.

This comic learning media will be made in digital form, because the school has computer laboratory facilities and the school also allows students to bring *smartphones* to school, so that in the process of learning comic learning media *digital* can be unlocked using *smartphone* students, especially in the online learning process that is happening today, digital comic learning media that can be accessed through *smartphone* Students can help students in understanding the material, especially in trigonometry material. This is in line with research conducted by (Noorhayati et. al., 2021) That is one of the advantages of Android-based learning media in this study, namely that this Android-based mathematics learning media can facilitate and ease the task of educators in learning process activities, because this mathematics learning media can be used by students independently anywhere both in school and outside of school. In addition, digital comic learning media also has an attraction for students. This is reflected in the results of the study (Kanti et al., 2018) stated that digital comic learning media is a very good attractive to students, as shown by the results of student response questionnaires with the results of digital comic learning media very interesting. In addition, digital comic learning media can also support the achievement of learning goals. This can be seen from the results of research from (Yuliana et al., 2017) stated that digital comic learning media can support student success and achievement of learning goals. With the existence of interesting learning media that can motivate students, the media can make it easier for students to understand the subject matter, especially in Trigonometry material. This is in line with the results of the study (Budiarti and Haryanto, 2016) stated that comic learning media had a positive and significant effect on students' learning motivation.

Based on the above description, in this study, digital comic learning media will be developed as a companion teaching material to help students understand the material better, the learning media is digitally based on trigonometry material. Therefore, the purpose of this research is to develop and produce products in the form of digital comic learning media on valid and practical trigonometry materials.

Research Methods

The type of research used in this study is *Research and Development* (R&D) or research and development. Definition of research and development or *Research and Development* (R&D) is often defined as a process or step to develop a new product or improve a product that has been there is (Zakariah et al., 2020). In this research and development, the development model used is the ADDIE model. The ADDIE development model consists of five stages as the name implies, which stands for *Analysis* (Analysis), *Design* (Design), *Development* (Development), *Implementation* (Implementation), and *Evaluation* (Evaluation). In this research and development, it is only at the stage of *development* by evaluating all stages, due to research limitations in terms of time, conditions, and costs for research. Similar research was also conducted by (Melda et al., 2019) et al., 2019) which states that the research and development carried out only reaches the development stage (*development*). This is due to limitations in terms of time and cost of research carried

out, besides that, the purpose of the research is only to find out the validity and practicality of the product developed. The following is a brief description of each stage of ADDIE.

Analysis

This stage is carried out by observation at SMA Negeri 2 Sekampung to obtain information which is then analyzed to find out the problems that exist in the school and find out the needs of the school to deal with these problems. There are several activities at this stage, namely needs analysis, student analysis, and school environment analysis.

Design

At this stage, it contains about product design and product manufacturing. The product design stage consists of plot design, character design, story script making, and mastery design.

Development

The design of the product is realized at this stage of development. At this stage, product validation is also carried out. Validation was carried out by two material experts and two media experts. The purpose of this validation is to produce a valid product so that it can be tested on students. After the product is declared valid, the next stage is to test the practicality of the product to students. These trials are called small group trials, Small group trials were conducted on 25% of the number of students in the class (Kurniahayati and Syamsurizal, 2013) So in this study to determine the number of small group trial subjects, refer to the research conducted by Kurniahayati and Syamsurizal. So the number of trial subjects used for the small group trial was 25% of the 36 students in the class, namely 9 students of class X Science 3 SMA Negeri 2 Sekampung were randomly taken. The data collection instruments are product validation questionnaires by experts and practicality questionnaires by students.

The data obtained is then analyzed to determine the level of validity and practicality of the product using product validation analysis and product practicality analysis. (Muriati, 2014) states that the general formula for managing grouping data from whole items is:

$$persentase = \frac{\text{jumlah skor yang diberikan validator}}{\text{jumlah skor maksimum}} \times 100\% \quad \dots 1)$$

If the results obtained are 60%, the product can be said to be valid and practical to use.

Implementation

The next stage is the implementation stage. According to (Fajarini, 2018) Implementation is a real step to implement the learning system that we are creating. This means that at this stage everything that has been developed is installed or researched in such a way that it can be implemented by its role or function. The implementation or delivery of learning materials is the fourth step of the ADDIE learning system design model.

In this study, the implementation stage was not carried out. Because the purpose of research only focuses on the stage of developing or producing products, besides that researchers' limitations such as time and conditions are one of the factors in considering this. Some of the studies that use the ADDIE model but do not reach the implementation stage are the research conducted by (Hanum et al., 2017) about the development of newsletter learning media on the basic laws of chemistry using ADDIE, but it is only carried out up to the development stage because the research is only to develop a decent learning media. Similar research was also conducted by (Astuti et al., 2017) which states that the development research carried out using the ADDIE model has only reached the stage *Development* or development, because the purpose of the research is only limited to developing and producing a valid learning media application. So the research that has been carried out only reaches the development stage with the evaluation stage carried out at each stage.

Evaluation

The evaluation was carried out to measure and assess the learning products resulting from the response questionnaire of experts and students to determine the level of validity and practicality of the product. Revisions are made by the results of evaluations or needs that have not been met by digital comic learning media.

Results and Discussion

This research and development resulted in a product in the form of digital comic learning media on class X trigonometric material that is valid and practical to use. The model used in this research and development is ADDIE which stands for *Analysis, Design, Development, Implementation, and Evaluation*. The following is a presentation of the results of the research and development that has been carried out.

Analysis

At this stage, several analysis activities and the results of the analysis are carried out. These activities include: (1) Needs analysis, obtained the problem that some students do not have LKS, and printed books are available in the school library but there are still many students who do not take advantage of the printed books. Because the printed teaching materials are sufficient for explanation, the material is still difficult to digest even though it is detailed in it. As for the LKS teaching materials, they are more practical, but there is no understanding of the concepts, and students still find it difficult to understand the material. Therefore, teachers use learning media during online learning to help teachers explain the material to students in the form of learning videos. However, the learning media used by teachers still has shortcomings such as the media has a long duration, not as well as sample questions and practice questions that only contain material explanations, are less interesting and boring. So that students need interesting learning media that is not boring, there are sample questions, and practice questions, and the media can be accessed anywhere. (2) Analysis of students, information was obtained that students want to use learning media in trigonometric material because students find it difficult to understand trigonometric material so students want to use media to help students understand trigonometric material. (3) Analysis of the school

environment, information was obtained that SMA Negeri 2 Sekampung has computer laboratory facilities and the school also allows students to bring smartphones to school.

Design

The design stage is related to product design and product manufacturing. The product design stage consists of plot design, character design, story script making, and mastery design. The content of comic learning media *digital* These are as follows.

- a. The main cover is the initial display that appears when opening the app. The cover display is presented in Figure 1.



Figure 1. Main Cover

- b. The main menu contains buttons for other menus including instructions, KD and indicators, materials, evaluations, and profiles. The main menu display is presented in Figure 2.



Figure 2. Main Menu

- c. The instruction menu contains instructions for using the application that makes it easier for students. The display of the instructions is presented in Figure 3.



Figure 3. Instructions

- d. The KD menu and indicators contain basic competencies, indicators, and learning objectives. The KD and Indicator displays are presented in Figure 4.



Figure 4. KD and Indicators

- e. The material menu contains buttons that go to the angle measurement material menu and the trigonometry comparison material menu on a right triangle. The display of the material menu is presented in Figure 5.



Figure 5. Material Menu

- f. This evaluation or quiz menu contains questions that cover both materials. The display of the practice questions is presented in Figure 6.

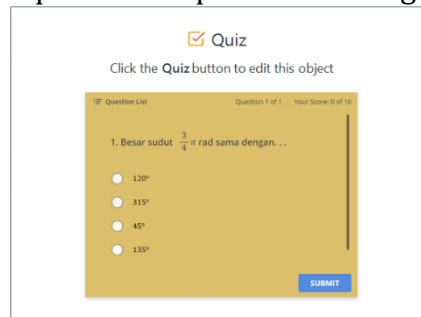


Figure 6. Evaluation of Quiz

- g. The profile menu contains the identity of the author or developer, explaining the author's educational history. The profile display is presented 7.



Figure 7. Profile

Development

The *development* stage is the stage that describes the results of the product that has been designed and developed. The presentation of the development results is as follows.

a. Material Expert Validation Results

The data on the results of the validation of the material experts was obtained from the assessment of the material through a questionnaire conducted by the material validator. The validator consists of two experts, namely lecturers and educators who are competent in their fields.

The assessment of material validators includes three aspects, namely, the feasibility of content, language, and presentation. From these three aspects, results were obtained which were then calculated based on several categories of product validity. The results of the assessment of the three aspects by the validators are presented in the following graph.

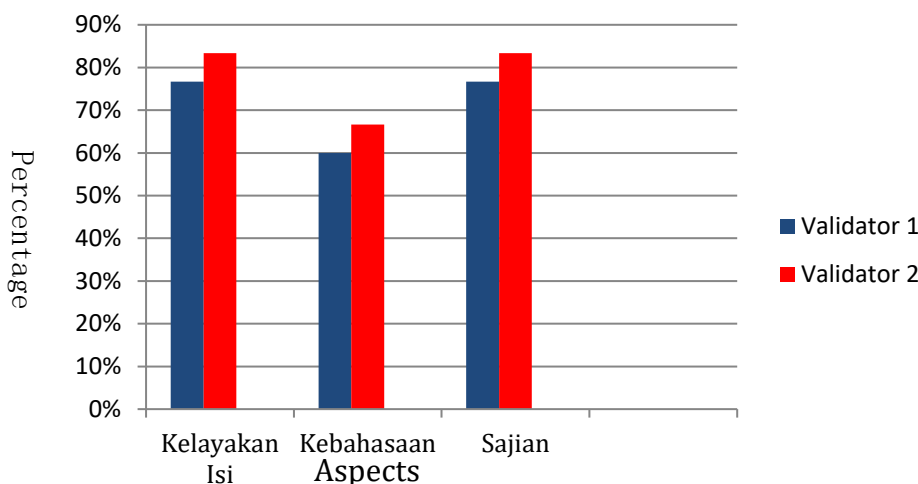


Figure 8. Material Expert Assessment Chart

Based on Figure 8, in the aspect of content eligibility, the percentage of assessment by validator 1 was obtained at 76.66% with the valid category, because there was a revision that had to add the purpose of the trigonometry material on the product and the assessment by validator 2 of 83.33% with the category of very valid. After all, there was no revision in the aspect of content feasibility in Validator 2. In the linguistic aspect, the percentage of assessment by validator 1 was obtained at 60% with a fairly valid category, because there was a language that was not good for high school students so it had to be revised and an assessment by validator 2 of 66.66% with a valid category, because there was a bad language like validator 1 so it had to be revised. And in the aspect of presentation, the percentage of assessment by validator 1 was obtained at 76.66% with a valid category and the assessment by validator 2 was 83.33% with a very valid category, because the sub-sub-sub-material that collapsed and the material presented was appropriate. So that the average final percentage of the three aspects by the two material validators was obtained at 74.44% which means that it is included in the valid category, because

several aspects must be revised based on the suggestions and comments of the validators.

b. Media Expert Validation Results

The data from the validation results of media experts was obtained from media assessments through questionnaires conducted by media validators. The validator consists of two experts, namely lecturers and educators who are competent in their fields.

The assessment of media validators includes two aspects, namely, visual aspects, and integration. The results of the assessment of both aspects by the validators are presented in the following graph.

The trial resulted in the percentage of assessment contained in Figure 9.

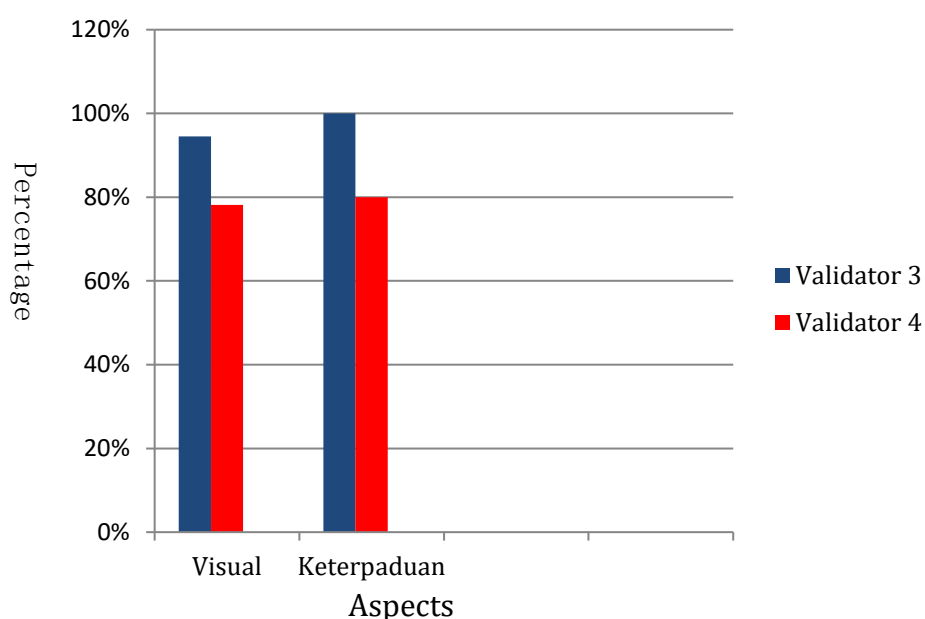


Figure 9. Percentage Of Assessment Contained

Based on Figure 9, in the visual aspect, the percentage of assessment by validator 3 was obtained at 94.54% with a very valid category, because there was no revision from validator 3 and an assessment by validator 4 of 78.18% with a valid category, because there were buttons that were not clear and the distance between the buttons was too close so it had to be corrected. Furthermore, in the integration aspect, the percentage of assessment by validator 3 was obtained of 100% with a very valid category and an assessment by validator 4 of 80% with a valid category. So that the average final percentage of both aspects by the two material validators was 88.18% which means that it is included in the very valid category, because several aspects must be revised based on the suggestions and comments of the validators.

c. Results of Student Responses

The digital comic learning media that has been validated and declared feasible, was then tested on 9 students of class X Science 3 SMA Negeri 2 Sekampung. The trial resulted in the percentage of assessment contained in Figure 10.

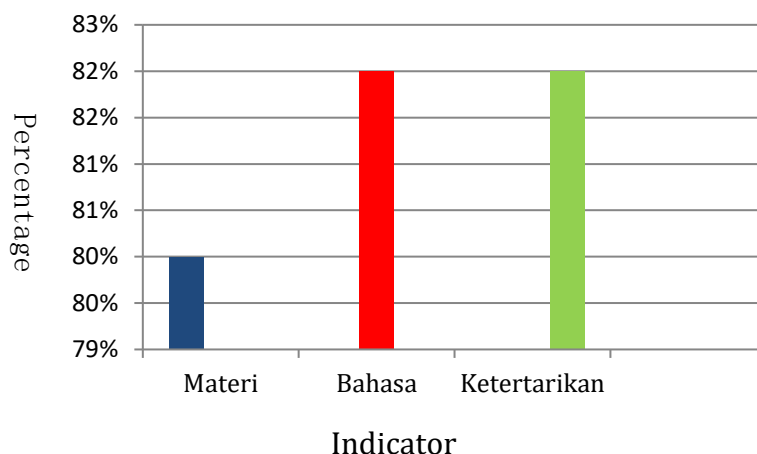


Figure 10. Student's Response Assessment Graph

Based on Figure 10, there are three indicators assessed by students to measure the practicality of the tested product. These indicators include material, language, and interest. As presented in the figure, it is known that in the material indicator obtained the average percentage of 9 respondents is 80% with the practical category, then in the language indicator the average percentage of assessment is 82% with the very practical category, and in the interest indicator, the average percentage is 82% with the very practical category. So that the final average percentage of the three indicators is 81.33% with the category of very practical. In this trial there were no comments and suggestions that led to product revisions. From the results of this percentage, the products that were tested were included in the practical category for use.

Implementation

In this study, the implementation stage was not carried out because the goal was only to focus on developing and producing valid and practical digital comic learning media.

Evaluation

In this study, the evaluation was carried out at the development stage. At this stage of development, validation is carried out by experts and also trials to see the students' responses. The results of the evaluation were obtained from the validation questionnaire and the student response questionnaire to determine the level of validity and practicality of the product. The results obtained are based on data, computers, and suggestions which will then be analyzed and revised as needed.

The ADDIE development model is a reference used to develop digital comic learning media in class X trigonometry material. The development of this digital comic learning media has received a very valid assessment and is very practical to use. The assessment received a percentage of validation of material experts consisting of two validators, namely lecturers and teachers, of 74.44% which was included in the valid category and the percentage of validation of media experts which also consisted of two validators, namely lecturers and teachers who were competent in their fields, which was 88.18% which was included in the very valid category, from the four validators received a percentage of 81.31% which was included in the valid category and also the results of the response questionnaire test students carried out by 9 respondents of class X students of Science 3 SMA Negeri 2 Sekampung was 81.33% and was included in the very practical category. Thus, it can be concluded that the digital comic learning media in the trigonometric material of class X that is developed is valid and practical to be used in the learning process.

The product developed has several advantages so that it receives a very valid assessment from material experts and media experts and also gets a very practical assessment from the results of the student response questionnaire. These advantages are that the product is developed in the form of digital comic learning media, which contains trigonometry material in the form of comics which is very interesting because there is a storyline that connects between the panels and the digital comic learning media can also be accessed through *smartphone* Students so that it is easy to take anywhere because the media is in digital form and is suitable to be used as a companion teaching material from the main teaching material, besides that in this comic story Islamic values are inserted such as forming an angle of prayer movements so that in addition to the material there are Islamic values in it. This is in line with the research of Yuliana et al (2017) which states that the accounting digital comic media developed is feasible to be used in the learning process.

In addition to the media containing material in the form of comics and digital comics that can be accessed anywhere, the compilation of digital comic learning media developed is also an advantage of this product. Learning media are made and processed according to development steps with the ADDIE model (*Analysis, Design, Development, Implement, Evaluation*). Each development step has its own function and goals that have been carried out in this research. The functions and objectives of these steps include, at the analysis stage the aim is to find out the problems and needs needed so that it can be determined what solutions are suitable to meet these needs and the results have been obtained that the problems obtained are that there are several obstacles, especially when the learning process is carried out online. One of the obstacles is that during learning the teacher cannot convey the material optimally due to the limitations of the media used by the teacher. Teachers use learning media in the form of learning videos that the teacher records themselves which only contain explanations of the material and have a long duration and sometimes teachers also use videos on YouTube. This makes learning less than optimal because some students cannot *download* the learning videos provided by the teacher due to memory and quota limitations so that it is difficult to see the videos sent by the teacher. In addition, the learning media provided by the teacher

does not contain sample questions. So that it makes it difficult for students to understand the material.

The next stage is the design stage which aims to design products and make digital comic learning media products. Designing products aims for plot design, character design, story script creation, and material design. Meanwhile, the creation of the product aims to make text balloons and create displays that are contained in digital comic learning media. The display contained in the digital comic learning media contains the main cover, main menu, instructions for using the media, KD and indicators (Basic Competencies, Indicators, Learning Objectives, and concept maps), Materials (angle measurements, and trigonometric comparisons on the right triangles), practice questions, and developer profiles. Then the next stage is development which aims to realize a product that is still in the form of digital comic learning media that has been validated by validators and tested to students and the results are presented in the form of graphs.

Furthermore, the implementation stage, this stage is not carried out because in this research it only reaches the valid and practical stage because there are several obstacles such as time and conditions in the research. (Hanum et al., 2017) about the development of newsletter learning media on the basic laws of chemistry. The research is only carried out at the development stage because the research is only to develop proper learning media and also research conducted by Melda et al., (2019) namely in the research and development of this module is only carried out up to the development stage (*Development*). This is due to limitations in terms of time and cost in the research and the research carried out is only to find out the feasibility and practicality of the product developed. And the last stage is the evaluation at this stage aims to measure and assess the product obtained from the results of validation and also the student response questionnaire.

In addition to these steps, this digital comic learning media is made with several supporting applications such as *the scanning* application which functions to make manual comic images digital, the *color* application functions to color *the background* and thicken the lines, *Microsoft Office PowerPoint 2010* which functions as an application for creating text balloons and designing the content and display of digital comic learning media, *Ispring suite 9* which functions as a quiz or practice question creation and PPT file converter to HTML5, and also *website 2 apk builder pro 2.1* which functions as an HTML5 to apk converter application that can be installed and operated by students.

Digital comic learning media is a digital format that not only displays the storyline, but in it, some animations or images connect between the panels so that it is easier for readers to follow and understand each storyline. In addition, digital comic learning media can also be a substitute for teachers in learning activities both in the classroom and outside the classroom because the learning media can be accessed or opened on the smartphones of each student. This is as conveyed by Warliah et al., (2018: 91) stated that comic media is one of the learning resources that can help students and can replace the position of the teacher in learning activities both in the classroom and outside the classroom. With its advantages, the digital comic learning media on trigonometric material obtained by assessment participants is very valid and practical to use.

Conclusion and Advice

Based on the results of the research and development carried out, it was concluded that the digital comic learning media product on class X trigonometry material was declared very valid and very practical to use. The average percentage of product validity by material experts and media experts was 81.31% and the average percentage of product practicality by students was 81.33%.

From the research and product development that has been carried out, the researcher has several suggestions, namely: (1) It is hoped that this product can be developed again at an effective level. (2) It is necessary to develop more digital comic learning media with more complete materials and more varied practice questions. (3) It is hoped that the product display design can be developed again to be more attractive. (4) It is hoped that this product can be developed again for other research methods. (5) It is hoped that the address of the existence of this product can be easily searched through special platforms such as Play stores and others.

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