Development of Mathematical Comic-Strip Application as a Mobile Learning Media-Based Learning

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Abstract

The purpose of this study is to develop comic strip media as a learning media for mathematics so that it can create mathematical learning media by utilizing technology or called mobile learning, knowing the steps for developing learning media and designing m-learning learning media designs that are easy for students to understand. as well as knowing the quality of the Mathematical Strip Comic learning media that was developed through three test stages, namely expert validation testing, testing on teacher and student respondents, and evaluation for product revisions. In addition, a research and development development research approach is used in compiling work steps so that conclusions can be drawn that mathematical strips are learning media by utilizing image illustrations in loading the content of teaching materials that can attract students' interest and motivation in learning activities that are easier and more enjoyable. Assessment carried out by media experts, material experts, linguists, teacher respondents, and student respondents found that Comic Strip learning media is in a good category to be used as a support for mathematics learning.

Keywords: learning, comics, software, development, products

A. Introduction

Mathematics is one of the most important lessons in life. Ubaidah (2016: 54-55) states that one of the mathematical functions is as a vehicle to develop the ability to communicate using numbers or symbols. But in reality the effectiveness and efficiency of mathematics learning in Indonesia is still low. Research conducted by the Program for International Students Assessment (PISA) states that the results of the evaluation in 2016, Indonesia ranked 62nd for science, 63 for mathematics, and 61 for reading skills from a total of 70 countries (PISA, 2015). This states that the quality of education in Indonesia is still low, especially in the field of

mathematics. Even though, education is very important in shaping human resources (HR) that are qualified and have.

In addition to the limitations of the learning method used, the frequency of using instructional media in the classroom is still in a low or rare stage. Even in its application, some teachers only use conventional or non-digital learning media. Even though in theory, according to Faizal (in Hasbullah and Yogi, 2015: 89) learning media can help the learning process become more interesting and arouse the interest of students to explore a material. One of the learning media that can be developed is visual media such as comics combined with technology-based learning methods (mobile learning).

Comics are considered effective and efficient in improving the quality and effectiveness of learning, so the development of learning media for the application of the Comic Strip Mathematics application. The Comic Strip application will contain mathematics learning material as outlined in comics and presented vertically, in contrast to conventional comics that are still in the form of sheets and presented in many story windows. Whereas in Comic Strip, the presentation is more concise and light because Comic only takes minutes to read each material. Product development is carried out to obtain comic strip learning media that relies more on technology and is easily affordable for all students at present, one of which is through mobile devices so that an educational application in the form of digital comics will be created with an attractive visualization display for participants student. Not only for students, teachers also can also channel their creativity through the application. Thus, the application of Mathematical Strip Comics based on mobile learning aims to make it easy for teachers to deliver information to students.

B. Literature Review

Comics Strip according to Arjuna (in Pritandhari, 2016: 3) is a series of images that form a story based on the material being studied, presented in three to six panels or around it, and packaged in light stories, humor, and interesting to listen to every period until the story ends. Unlike comics in general, comic strips can be said to be more concise and lighter to read. This provides advantages in the form of time efficiency (in reading and in making it) and explanation in comics using simple and easy to understand language.

Comics Strip can be an alternative learning media, because learning media according to Sukiman (in Santoso, 2017: 26) aim to help smooth learning, provide efficiency in learning, and improve learning effectiveness so that the efficient comic strip will be compatible with the purpose of the learning media itself. To improve the accessibility of comic strips as learning media, it is packaged in the form of applications that are currently easy to access through smart devices (smartphones), so that their use is not limited to time and space (Ally, 2009: 1).

Maghfiroh and Herowati (2017) in their research entitled: "Media Development of Global Warming Science Comic Strips to Increase Motivation for Reading Class VII Students" found that comic strips can increase students' motivation and contribute 40% of their learning gain. In addition, Prithandari (2016) in his research entitled: "Application of Comics Strip as Learning Media Financial Management Courses", the same results were obtained in the form of increased interest in learning among students. Comics Strip not only has efficiency and effectiveness, comic strips also have an appeal and psychologically lead to learning motivation in students.

Mulyati (2016) in her research entitled: "Use of Comics Strip Media in Improving Skills in Writing Anecdotal Texts", comic strips were stated to be able to improve the ability to write texts, improve learning outcomes, and increase students' interest in learning. While Liu (2004) in his research entitled: "Effects of Comic Strips on L2 Learner's Reading Comprehension", it was found that comic strips also improved reading skills on the subject of English.

The four studies above illustrate that comic strips have compatibility with learning in science, management, or literature. The existence and contribution of comic strips in the educational comics category encouraged the use of comic strips in mathematics learning. The combination of comic strips, mathematics, and smartphone-based applications will produce a learning media with characteristics that are efficient, effective, lightweight, fun, and easy to use wherever and whenever (accessible).

C. Methodology

This development research model is using the Research and Development model with the ADDIE (Analysis-Design-Develop-Implement-Evaluate) instructional design model developed by Reiser and Mollenda in the 1990s. The design of the ADDIE development model can be seen in Figure 1.
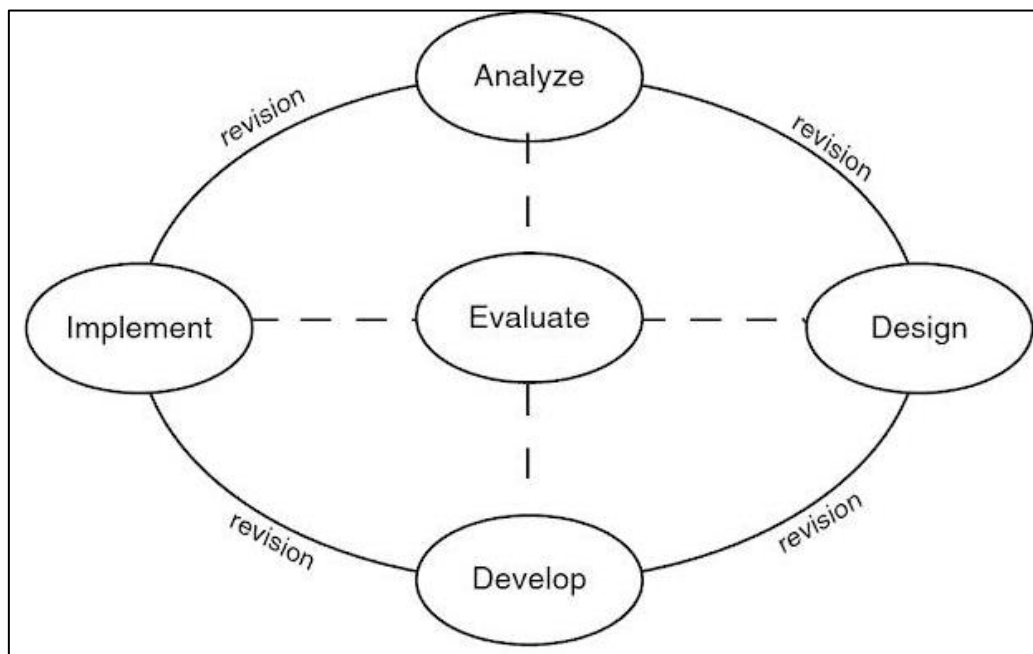
Figure 1. ADDIE Development Model Design, source: Branch (2009: 2)

The steps of product development will be explained as follows:

1. Need analysis

Analyze the need to see or identify problems that will be developed into a chart for conducting research. Needs analysis is aimed not only at observing what media the students want but also analyzing the needs of the availability of learning tools, teaching materials, and methods used by teachers to teach. The results of taking a need analysis know the desires of students on the learning media that will be developed.

2. Early Product Planning and Development

This development research uses the ADDIE learning design model. The first phase of ADDIE design is analysis, which is analyzing the needs of students on the learning media that will be used. The next step is design, which is the stage where researchers design learning media that will be created and adjust to the needs analysis. That is, the design of comic strip math learning media design is in accordance with the characteristics of students and the learning objectives to be achieved. The third stage is development (development), namely the process of making comic strip learning media. At this stage, everything that is needed or that will support the learning process must all be prepared.

3. Material and Media Expert Validation

At this stage, the product design results are given to a learning media design expert and learning material expert. Consultation to experts is done to get input related to the relevance or determination of learning material and the media to be used.

4. Revision

The comic strip learning media will be revised according to errors and shortcomings after being validated by learning media experts, material experts, and linguists.

5. Restricted test

Field learning or trials were conducted at (1) Amaliyah Middle School, (2) MTS Nurul Amanah, and (3) SMPI Mardhotillah using the revised comic strip media.

6. Reoprting model

After conducting analysis, making media design, and research, the next step is to calculate the results of research and make a research report. Data analysis techniques in this development research are using descriptive quantitative techniques and descriptive statistical analysis.

1. Management of descriptive analysis by analyzing questionnaires obtained from material experts and media experts.

2. Descriptive statistical analysis is to describe the object under study through sample data and used to process the data obtained in the form of criteria score analysis using a scale.

D. Findings and Discussion

1. Findings

The comic strip application that has been designed and developed can be seen in the final results in figure 2 below:
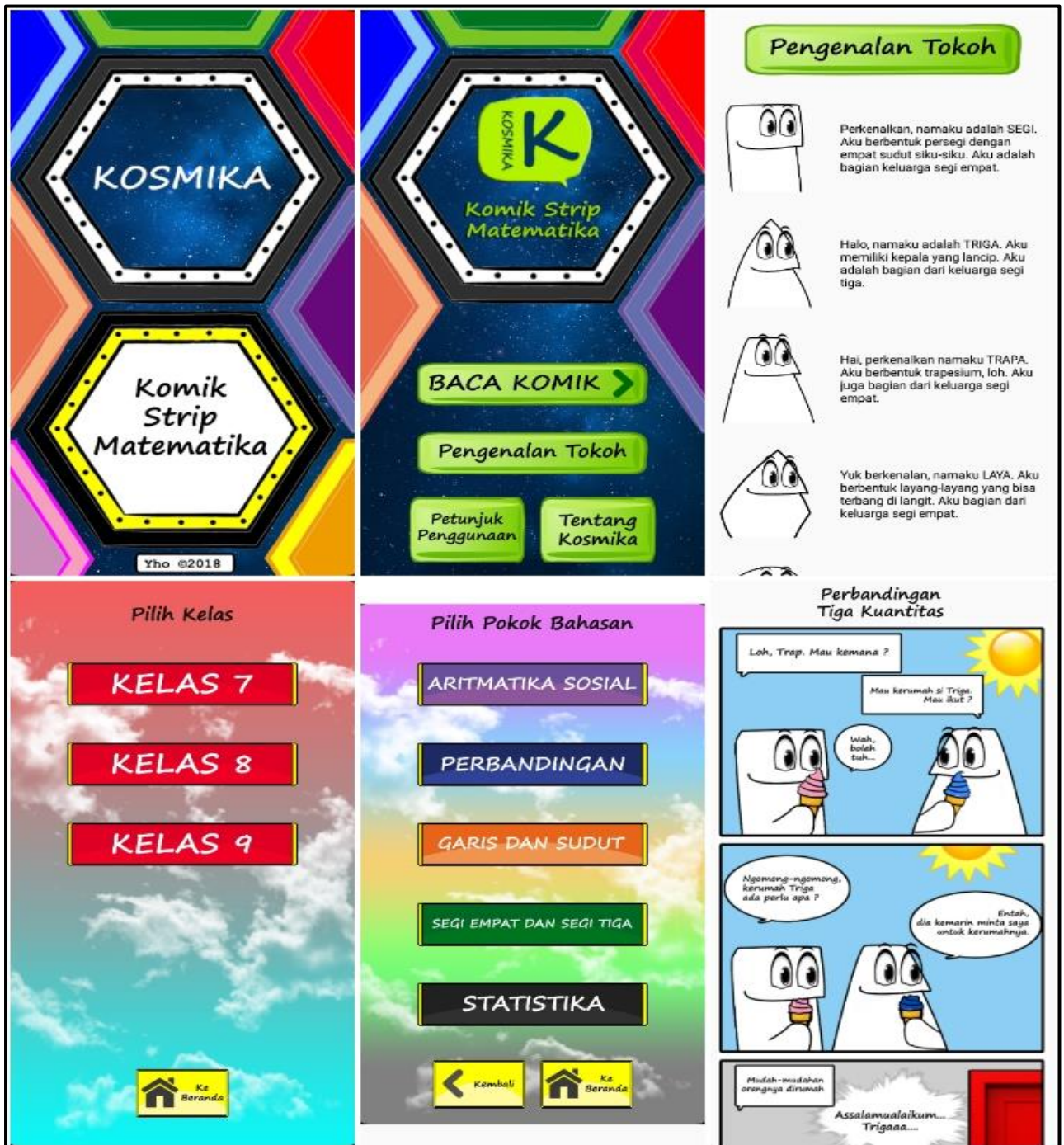
Figur 1. The design of the comic strip application

Comic strip application that has been designed and developed after being tested by experts and assessed by teacher respondents as well as students, the results are then compared with the assessment standards as follows:

Table 1. Scoring standard

Category	Score
Very Good	5
Good	4
Average	3
Bad	2
Very Bad	1

Source: Widoyoko (in Wardani, 2016: 332)

Table 2. Results of the comic strip application assessment

Expert validation	Score	Explanation
Media expert	4,93	Good
Material expert	4,75	Good
Linguist	4,00	Good
Respondent test	**Score**	**Explanation**

Teacher	4,43	Good
Student	4,24	Good
Mean score	**4,47**	Good

2. Discussion

Based on the table of the results of the above research, the assessment of experts and respondents to the Comic Strip application show that this application is in a good category to use. The evaluation carried out after the study found that the application of the Mathematical Comic Strip that had been developed was in the good category as a medium for supporting mathematics learning.

The development of the application of Mathematical Comic Strip that has been done with the ADDIE method starts from the stage of needs analysis, application design or design, the process of making comics and applications, and the implementation of research schools so as to create an Android-based learning media. The initial stage is the analysis (analysis) by conducting interviews with the subject of research so that the data obtained becomes the basis or foundation in making the product. After that, a product design formula (design) is designed by determining product components in the form of content, layout, and features needed. The design that has been created is then developed into a whole product in the design stage (development), all product components are made and put together so that the initial product is formed according to the design. This initial product will then pass the assessment by related experts (judgment expert) so that the deficiencies in the product that has been made and which must be repaired will be known. Improvements were made in terms of the aspects of media, material, and language so that learning media with good feasibility categories were obtained to be used in the field. If repairs have been made, the product is tested in the field. The results of the trials in the field are then evaluated and drawn conclusions on the products that have been developed.

The next step is to upload the Mathematical Comic Strip application to the Google Play Store so that all Android-based smartphone users can download this application for free. After the application is in the Google Play Store, the entire community of application users can provide ratings, comments and suggestions in the download page column. Thus, it is expected that application users not only come from the school's internal research location, but also can be used by many people. Further development is needed to create new stories that discuss mathematics lessons other than those that have been made. The new story title created will be sent via an update to the application with a small application size.

The main advantage of the application that has been made lies in the ease of access which does not require the internet to run this application. In addition, this application is compatible (can be used) on almost all Android-based smartphones without any obstacles and does not require devices with high specifications.

The implementation of this research has been attempted and carried out optimally, although it must be acknowledged and stated some limitations that still exist. The limitations referred to are mainly related to the technical implementation which can be identified as follows:

1. This study was only conducted on seventh grade junior high school students aged 12 to 13 years, conducted with subjects who were still limited in two sub-districts with twenty-two students. This limitation occurs because of limited time and place.
2. Research carried out only aims to determine the level of feasibility and function as a learning media, not tested for its effect on student learning achievement.

The Mathematical Strip Comic application is made only oriented to the interest of students to learn mathematics, not on the students' mathematics learning achievement.

E. Conclusion

The learning media for the application of Mathematical Strip Comics developed with the ADDIE development model include the stages of analysis, design, product creation, implementation or implementation, and evaluation. From the initial stages of making application products to the product test by media experts, material experts, and linguists, all three stated that the this application was in a good category to be used as a learning medium with some suggestions for improvement before being implemented in the field. This application that has passed the expert test and improvement stages is then carried out in the school research to get responses from students and teachers. The students and teachers' response to this application state that this application is in a good category to use. The evaluation carried out after the study found that the application of Mathematical Strip Comics that had been developed was in the good category as a

medium for supporting mathematics learning, so it was hoped that this application would become a solution to increase students' interest in learning mathematics in an easy and more enjoyable way.

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