Development of math education comics through digital android

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Abstract. This research aims to develop mathematics education comics through digital android. This type of research is a combined RND research from Brog and Gall and MPI. The product was developed through several stages by manually designing, scanning, providing colour with photoshop, giving text balloons after that the process of digitizing android is done using PowerPoint, Ispring and Web2APK which can be operated through android, gadgets offline and online. The evaluation of this product was assessed by several experts namely experts in language, material, graphic design and colleagues. Data collection techniques using a questionnaire and then analyzed descriptively quantitative. The results of the assessment of experts get good criteria from several expert validators, language, material, and graphic design conclude that this product is feasible to use.

1. Introduction

Along with advances in technology, facing the industrial revolution 4.0, it is necessary to have innovations in developing various kinds of education, especially in mathematics education. But what happens in the field are many obstacles in making mathematics education through digital android. Mathematics is a fundamental thing that we must learn, because in the application of mathematics is very influential in everyday life. Often children are lazy in reading or have difficulty understanding math, this is because what they read is very monotonous, so children feel bored, and children feel not interested in the reading they read. Lots of media that can be used in learning. Widodo defines learning media as one of the learning tools that supports the success of the learning process [1]. Many materials are not designed for learning, but can be used for learning, for example newspaper clippings, comics, films, soap operas, advertisements, or news. According to Dupire comics are the main cultural objects that are used in several different contexts and have different purposes for example for advertising, education, holidays and others [2]. Comics are reading material that is in great demand by children, especially with the animated images in the comic. Azman explains that in making comics that need to be considered is by entering characters, text, and images [3].

Comics are very suitable to be used as learning media, because comics have animated images that are favored by students, in addition to that the storyline contained in the comic collapsed so that they are easily understood. In line with the opinion of Mayer and Moreno that learning using multimedia can help effectiveness in the learning process. Seeing the development of today's Android children is one of the main factors in the process of finding information, especially in the process of learning mathematics [4]. The current generation of students is the digital generation, the YouTube generation or the next
generation, who have grown up in an environment where students continue to be exposed to digital technology and are accustomed to using various media, short written texts, images and videos for fun and sometimes for learning [5]. Development of android mobile technology is currently so fast, one of the mobile devices currently commonly used is cellular phones.

Marianthi [6], using digital comics and the web in classrooms is a new challenge, because basically it is multimedia media, namely text, and images are the power of computer and internet technology. The application of Android-based digital teaching materials is one of the developments of mobile learning that has advantages, namely in the operation that is easy to use, practical in use so it does not take up space in the system to install this application.

Based on the results of interviews obtained the average learning conducted in the Semarang region still using conventional teaching materials. The lack of willingness and limitations possessed by educators has resulted in the process of providing material using printed teaching materials. In line with this, the need is needed for a new innovation, namely the development of teaching materials using comics in mathematics education through digital android.

2. Methods
In this development the authors use the RND method. The development stage of mathematics education comic teaching materials through digital android is adapted and integrated from the steps of Brog and Gall and MPI. The results of adaptation get three steps in the development of a preliminary study, development of teaching materials and evaluation of teaching materials.

3. Discussion

3.1. Preliminary studies
Observation was carried out by identifying the needs that exist in the field related to teaching materials used in the field. Herbs argues that comics can be semiotic resources in learning to teach and suggest how information technology can support experiences with comics [7]. The process of existing activities in the field, there are still many educators using conventional teaching materials, it is because of their lack of skills in developing digital-based teaching materials. In addition the characteristics of students today are likely to use technology as a tool during the learning process. In addition to learning mathematics in Yunus research explained that the use of digital comics as a language learning tool is one of the most effective ways to teach ESL writing to students who have low ability in English [8]. In line with Yunus's research, Widayanti in his research explained that the Islamic Web as a visual aid is more effective in teaching English, especially reading comprehension rather than presentation through animated video [9].

Seeing this situation, we need a new innovation in learning mathematics, namely the presence of comic teaching materials that are designed by looking at the characteristics of current students, namely digital-based Android teaching materials.

3.2. Development of teaching materials
Maharsi explains that there are eleven stages in making comics, including delivering comics, that is making synopsis, making story lines, making verbal characters, making visual characters, sketching layouts, asking, coloring, adding text balloons with computers, making covers, laying out pre-printing, and finishing or checking again [10]. As yang been described Maharsi, the authors developed a comic mathematics education through digital android with multiple stages. Stages in product development by manually designing, scanning, layout settings, providing color with photoshop, giving text balloons after that the process of digitizing the android is done using PowerPoint, Ispring and Web2APK which can be operated through android, gadgets offline and online.
Figure 1. The scanned comic design.

Figure 2. Giving a text balloon to the comic.
Figure 3. The process of giving color to images.

Figure 4. Detail color selection on the background.

Figure 5. The digitalization process on ppt.
3.3. Evaluation of teaching materials

The evaluation stage of teaching materials is done by testing the feasibility of the teaching materials, namely the feasibility test by linguists, material experts, graphic design experts and peers. The four validators provide judgments based on predetermined criteria. The four validation data were analyzed using the Lawshe formula to determine the Content Validity Ratio (CVR) which means the value of the content validation ratio with category (1) if the CVR value <0 then the item is declared not good; (2) if the CVR value = 0, then the item is declared unfavorable; (3) if the CVR > 0, the items are declared good. The validation data of peer and material experts is presented in the following figure 7:

![Figure 7. Validation results of peers, material experts, graphic design and language experts.](image)

The four validators provide input on the teaching materials that have been made. These inputs include the coloring must be brighter, the writing system used is adjusted to the EYD and musical accompaniment to digital comic teaching materials to be noticed. After getting comments from the validator, the authors revised the teaching material. In addition to providing input on teaching materials that have been made, the validator also provides an assessment with good and valid criteria, meaning that teaching materials on digital-based android mathematics education are feasible to use.

4. Conclusion

Based on the results of the discussion of the development of this product, the writer draws the conclusion that there is still a lack of motivation in developing digital-based teaching materials in accordance with current developments, so there is a need for teaching materials on android-based digital mathematics education comics. After all T (2017: 437) Explains that the use of comics in teaching mathematics can prepare students for twenty-first century competencies. The development of digital android based mathematics education comic teaching materials requires in-depth research on the content of the material to be delivered up to the display in accordance with the characteristics of the user, so that the
teaching material becomes interesting and easy to understand teaching material. Inputs and suggestions obtained in the development of mathematics education comic teaching materials are generally in the form of writing in the use of EYD, the sound accompaniment is adjusted to the user's character. Overall, this product can be declared feasible to use and obtain a valid category.

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