Android-Based Comics: An Alternative Media to Improve Scientific Literacy

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Abstract

The students' scientific literacy nowadays is relatively low because the lack of media learning to improve scientific literacy. This research aimed to test the feasibility of developed Android-based comics on material style and motion to scientific literacy. This study used a research and development using ADDIE (analysis, design, development, implementation, evaluation) model. The subject of this research is students from grade VIII at one of the junior high school in Indonesia. The instruments of this research are validation sheets and student response sheets. The result of validation test in term of material expert acquired on average percentages of 93.26% and media experts at 97.08%. Moreover, the pretest of students' scientific literacy is 2.26, and the post-test of students' scientific literacy is 3.40, with the N-gain formula obtained a value of 0.72 with the category "High". Based on these results, it can be concluded that the developed Android-based comics as an alternative media are worthy to be used according to expert recommendation and students' responses. Android-based comics can be used to improve students' scientific literacy. The implications for future teaching appear to be that Android-based comics have clear value as an innovative tool.

Keywords: Scientific Literacy, Android-Based Comics, Learning Media

INTRODUCTION

P21 (Partnership for 21st Century Learning) develops a learning framework in the 21st century that demands students to possess knowledge and skills in the fields of technology, media and information, learning and innovation as well as life and career. According to this, the innovation of media-based learning information technology is absolutely necessary in the learning of physics and as a way to use technology in the educational world. Adnan et al (Adnan et al., 2017) suggests that learning media is one of the important elements in the learning process.

The development of information technology makes learning in schools more varied with many media that utilize technology and information (Baird & Fisher, 2005). Learning with the media in accordance with the development of technology in millennial era students is very good in improving the effectiveness of learning and students' digital literacy. The results of the study stated that the use of learning media has a positive impact on the learning process and results.

However, the results of the analysis of teachers and students at one junior high school Indonesia showed the existing learning media has not completely attracted the students' attention in learning. This condition could be seen in the students understanding that's not optimal. There are 20 items being tested that contain 5 problems and movements only get 40% correct answer. Furthermore, the need analysis of this study provided information that students need media learning as the companion to cover the shortcomings of existing learning media. Students' literacy skills are relatively low judging by the students' rare reading of physics books and understanding of concepts that is under the minimum completion criteria.

The low of Indonesian students' scientific literacy can be influenced by several factors such as the learning model applied by teachers and teaching materials used by students (Fakhriyah et al., 2019; Kelana, 2018).

Learning media is one of the important parts that must be implemented in the learning process. The multimedia usage can increase science-literacy skills especially content and scientific attitude. These domains are considered in medium category. Meanwhile, competency domains show very good categories. This is also supported by students' respone that multimedia is very good in the domain aspects of literacy and motivation. On the other hand, aspect of operating multimedia have good categories (Rubini et al., 2018). The development of learning media in a created virtual-laboratory has the

advantage of assisting students in improving their science-literacy skills because the presented media were in line with the materials, pictures and questions about science-literacy skill as well as simulation of laboratory works (Aulia et al., 2020).

The science development of is aligned with technological developments. According to Astuti et al (2019), the increasing of development of science and technology in the learning process encourages the renewal efforts in the outcomes of technological usage. It means that along with the technology development, learning media are also supposed to be developed. Therefore, it takes an innovation of media learning to be an alternative and renewal of pre-existing learning media. The developed learning-media must be able to answer the challenges of the previous media to attract students' interest in learning.

Based on the issues above, digital comics can be used as an alternative solution. Comic is a sequence of pictures or symbols that tells an idea to provide information for the reader. Comics have five advantages in learning, for instance: can motivate students during the learning process; consist of images as the media that can improve the learning quality; are permanent; can generate interest in reading and directing students to discipline reading especially those who do not like to read; are part of the popular culture (Lazarinis et al., 2015).

Comic as a learning media is a tool to convey instructional messages as well as a visual communication of learning medium. This learning context refers to a communication process between students and learning reseources (Ntobuo et al., 2018).

The selection of comic media as a learning media because comics consist of characters that have visual. Comic media is on point but still does not eliminate the core as a pleasant story that want to be told, more interesting, and can be heard in order students do not get bored and will enjoy the content. The comics usage in learning process of some selected schools are to educate, excite learning, be funny, and be well known by children and be adapted from their world (Lazarinis et al., 2015; Yulianti et al., 2016). Reading comics may allow the readers not only to be truly absorbed in his reading and but also can carry their imagination away even opposite their will (Rasiman & Agnita, 2014; Ravelo, 2013). The power of comics depends on the fact that they are entertaining, their characters are heroes and heroes that we may easily identify. In addition, the power of words and images has created a non-conventional atmosphere that helps readers read endlessly.

The selection of digital comics as problem solution because the images in comics visualize the situation between the figures so they are able to help students in understanding and reasoning to the learning materials. There are comics in the form of mobile applications that are paperless, have more than one feature such as online tests, animation, and material (Tsai, 2017). The application available in android as a learning medium can be used by students to study physics anywhere and anytime. This physics comic is also sought as enrichment material to strengthen the concepts and material for students to learn in class (Ramadhan et. al., 2019). So, this study aimed to test the feasibility of developed Android-based comics on material style and motion to scientific literacy.

METHOD

The research method in this study is research and development with ADDIE model. ADDIE is a development model consists of five stages namely: analysis, design, development, implementation, and evaluation (Anam & Hakim, 2017). First, the analysis stage provides problem identification and students' need analysis. Second, the design stage creates a comic design or storyline. Third, the development stage conducts validation tests of finished comic to material experts, media experts, and linguists. Forth, the implementation stage conducts small class trials to 8th grader students of one junior high school in Indonesia. This research was conducted to develop Android-based comics as media in science learning in term of style and motion material. The eligibility of product assessments are tested and assessed by the validator, i.e., media experts and material experts. The data analysis technique used in this study is a descriptive analysis by calculating the percentage of validation result value (I. A. D. Astuti & Bhakti, 2018).

$$percentage = \frac{amount\ score}{maximum\ score} \times 100\% \quad (1)$$

(1)

In the validation poll of media experts and material experts, ideal maximum criteria score is 4 while the ideal minimum score is 1. Further criteria in decisions making regard to the validation of Android-based comics as learning media can be seen in the Table 1.

Table 1. Criteria of learning-media category

Persentage	Category
80% - 100%	Very Good
60% - 79,99%	Good
50% - 59,99%	Intermediate
0 % - 49,99%	Poor

The validation aspect of media and material can shown in Table 2.

The validation aspect of media	The validation aspect of material
General Display • Media design is in accordance with motion material • Attractive media packaging • Attractive media design seen Special Display • Color selection in media • The use of image quality and size • Selection of font types and sizes accordingly • Media presentation • Media is easy to carry and move • Color clarity of print • Paper selection accuracy	Theory • In accordance with the indicators in the grid • Material compatibility with KD • There is no misconception Construction and Language • Formulated clearly • Use good and correct language • Communicative sentence formulation • The sentence used can be understood clearly

The next step is to test the student's response to the development of the media. Assessments are performed after the learning-media product is validated. The data analysis technique being used is descriptive analysis by calculating the percentage of validation result value. Similar to the expert validation test, student response tests has the ideal maximum score criteria which is 4 and the ideal minimum criteria score which is 1. The criteria of decision making for the student response test are available in Table 3.

Table 3. Criteria of student responses category to Android-based comics

Interval score	Category
0 – 19 %	Very week
20 % - 40 %	Week
41 % - 60 %	Enough
61 % - 80 %	Strong
81% - 100 %	Very strong

After tested to small class to find out student responses, a large class trial was conducted to determine the effectiveness of the Android-based comics on students' scientific literacy. There were before and after treatment. The data was analyzed to see the score of test results. The average test results were calculated the same way as calculating N-gain between Pretests and Posttest. Test N-Gain is a test that can give you an overview increase in the score of learning outcomes between before and after the implementation of a treatment.

RESULT AND DISCUSSION

The final products of this research and development are Android-based comics. This research and development is conducted only until the development stage. Based on the need analysis, existing learning-media has not been able to support the learning process. Teachers need learning media that provides simulation or image process of an incident. Additionally, teachers need different learning media to support a compelling learning process and increase students' interest and learning outcomes.

The design of Android-based comics is made to be interesting along with easy-to-understand content. Android-based comics contain core competencies and basic competencies, comic stories, illustrated materials, and evaluation. The source of presented material is from the 8th grader package book JUNIOR and other supporting books as reference to the drafting of Android-based comics. Once the comic design is finished, researchers create a structure chart of application navigation followed by creating design of the application display as a reference. The user interface design on media development consists of initial display design, main menu, core competencies and basic competencies, comic menu, Material menu, and evaluation.

The development of Android-based comics starts with the creation of the background, initial display and logos used as media identities. The next step is to create a Android-based comics. At this stage, development is using the Toondoo app. After this stage is completed, the created Android-based comics are inserted into the Andorid application online through MIT App Inventor. The look of the successfully developed Android-based comics can be seen in the Figure 1 and Figure 2.

Figure 1. Cover layout and indicator layout

On the Indicator menu there are basic competencies, indicators, and learning objectives according to the motion material.

Figure 2. Display of comic story content

The comic content displays the physics material in the form of stories that are easily understood by students. The story is made with simple language and is applied according to daily live. Thus, the physics material is attributed to the real world. The comic not only shows examples of physics and discussion, but also the practice of multiple-choice evaluations to check the students' understanding of physical material.

The results of the media development were tested by feasibility

test. This test is conducted by 6 (six) validators consist of media experts, expert specialists, and linguists as well as test students' responses to the developed learning-media. The results of the validation in regards to the material expert assesment on the product can be seen in the Figure 3.

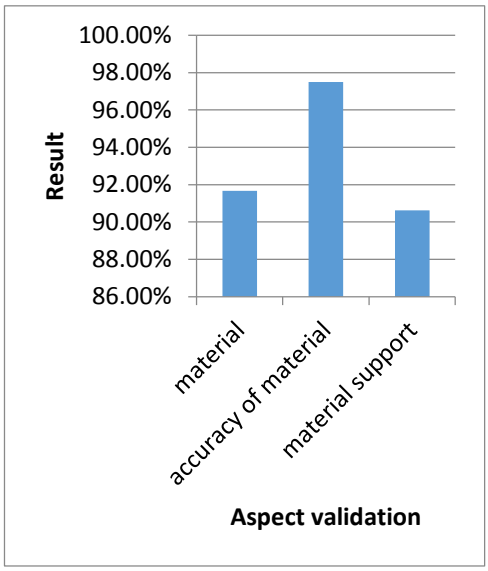

Figure 3. Percentage of Material Assesment

According to the validation results, material expert test obtaines percentage of material conformity percentage about 91.67%, accuracy of material 97.50%, and supporting material for study 90.62%. Thus, the average percentage of each indicator is 93.26%. Based on these criteria, this condition indicates that the developed learning-media is good/valid which means it is very worthy to be tested in the field.

The results of the validation of the media expert assesment on the product can be seen in the following figure 4.

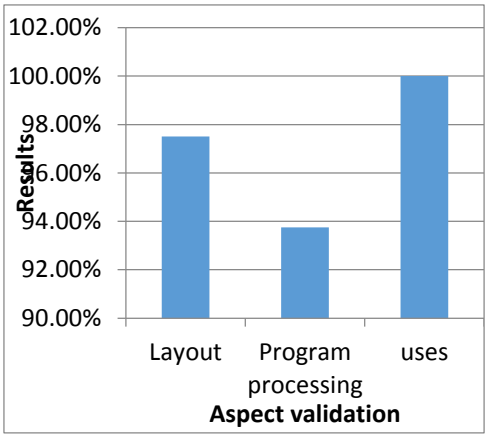

Figure 4. Percentage of Media Assesment

Based on the validation result, media experts test obtaines percentage of layout aspects 97.50%, program processing aspects 93.75%, and aspects of use 100%. Thus, the average percentage of each indicator is 97.08%. According to these criteria, this condition indicates that the developed learning-media is good / valid which means it is very feasible to be tested in the field. Based on expert assessment, the developed media has been very good when viewed from the aspect of assessment criteria and experts scoring by above 90%, meaning that this media is very suitable and worthy to be applied to students in the learning process. Good media can have a positive impact to the learning process, can improve learning outcomes, can attract students to learn and make learning not boring.

The results of trials on students can be seen in Figure 5.

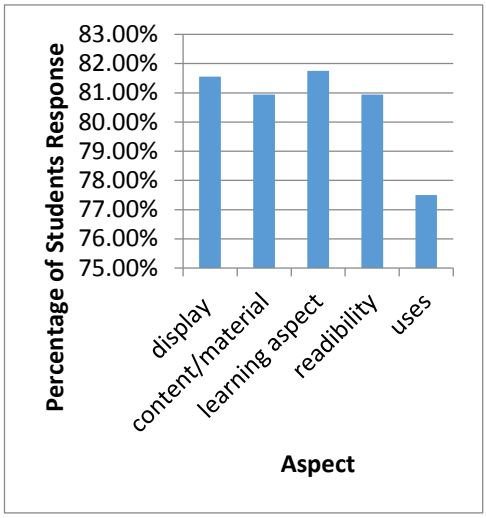

Figure 5. Percentage of Students Response

The result of student response about Android-based comics acquired percentage of display aspect of 81.56%, content aspect/material 80.94%, learning aspect 81.75%, readability aspect 80.94%, and aspects of use 77.50%. Thus, the average percentage of each indicator is 80.54%. Based on these criteria, this condition indicates that the learning medium is very well developed.

The result of good student response shows that students like Android-based comics. The media is used in schools according to the students need and is able to catch up with the development of the era. Almost all of the publications that focus on the use of comic strips found out that participants has showed positive attitudes and enjoyed the activities.

After a small class trial to see the student's response, the next step of the big-class trial is to test students' science-literacy skills. The students' science-literacy using Android-based comics gained average score before action 2.26 and a mean score after action 3.40. The improvement of students' science-literacy is determined from the analysis of the average value of pretests and postest based on the N-gain formula. The N-gain formula obtained a value of 0.72 with the category "High".

The results of the analysis showed that Android-based comics as one of the ideal alternative media in improving students' science-literacy skills. In Android-based comics, students will be accustomed to read the science material carefully so that students can understand the material very well. The comic strips are important as they highly support literacy and it's recommended for educators to create digital comics (Kiçikaya & Krajka, 2012). Digital educational comic allows learners' knowledge and ideas on various subjects to be synthesized in a form of digital comic (Arai & Tolle, 2011; Özdemir, 2017). Digital educational comic not only contains informative and emotive elements, but also engages the learners emotionally (Lamminpää et al., 2020; Zaibon et al., 2019).

Comics have powerful visual messages that convey the meaning of a story with short and clear form (Park et al., 2011; Wicaksono et al., 2021). Comic

is alternative instructional materials for teachers to attract students attention and help them studying easily and practically as it provides interesting illustration with simple language. It could also be used anywhere and anytime without teacher's guidance (Lesmono et al., 2018; Suhono & Sari, 2020). Comics can be used as a powerful learning-media to interpret the knowledge and application of science, because the use of comics in science learning is more stimulating and interesting than sole expalantion of science facts (Hosler & Boomer, 2011; Murtikusuma & Hermawan, 2019; Song et al., 2008).

Mastery of science-literacy skills is influenced by several factors such as the science learning approaches or methods used by teachers in building learning concepts . Development of interactive learning-media can affect the quality of learning and students' science-literacy (Schwartz & Rubinstein-Ávila, 2006; Wulandari & Wulandari, 2016).

Comics are suitable for every student level. For example, the early years classes should be more important starts with comics based its narrative in images to tell the story. These young students are more sensible to the visual appeal of this tool. By the time, the students acquire high level of codification and the text-based comic would be more suitable for them (Arroio, 2011).

Based on Nafis (2016), it shows the results of the study that Audio Visual Comics are rated for use in economic learning in both aspects of the subject, the media aspect and its effectiveness in the classroom. That digital comic gives the difference of display quite large and can be interpreted more than conventional comics using paper media. According to Puspitorini et al (Puspitorini et al., 2014), expressed his research results that the use of digital comic media is able to improve motivation, results of cognitive learning, and affective learning outcomes. Media used in the study of only digital comics media, but other media such as animated film media can be used to increase interest and learning outcomes, this is in accordance with the journal Istova and Hartati (Istova & Hartati, 2016), in his journal found that the class occurred that was treated with the use of the study of the media was increased.

Comics can make students think about science in different approach which these tools can introduce scientific issues in a visual, entertaining way by the visual appeal of the images. On this way learning science could be more interesting instead of just memorizing the subjects to get success doing exams. Comics use to media learning assessment of learning. Teaching materials using

comic media effectively used in learning class to improve the learning outcome, problem solving, and self-directing learning (Pardimin & Widodo, 2017; Taufiq et al., 2020; Yulianti et al., 2016).

In addition, comic books promote media literacy, encouraging students to "become critical consumers of media messages" (Vassilikopoulou et al., 2001). Analytical and critical thinking skills can be developed through comics (Krishnan & Othman, 2016; Lestari et al., 2021; Versaci, 2001). Answering of deeper questions about the combination of visual and textual force students to get familiarized with these two means of expression, uncovering the deeper meaning of a work and offering a profound insight. Learning Science by using digital Comics can practice students' reading interest and literacy science (Putri & Fida, 2018; Ranker, 2007). Students will love reading with the look of digital comics who are very interesting and can entertain the students (Kurniawati et al., 2017). The advantage of this android-based e-comic is that it can well understand story of science concepts, writing because it is associated with daily life (Akcanca, 2020; Suri et al., 2021).

CONCLUSION

Based on the results of the study, it can be concluded that Android-based comics as an alternative media is worthy to use. Expert material validation test results are obtained the average percentage of each indicator by 93.26%. Media expert validation test results obtained an average percentage of each indicator by 97.08%. While from the student response results about digital Comic media acquired an average percentage of each indicator amounted to 80.54%. The selection of digital comics can be used as a solution for increasing interest and learning results of the science of the students because of the image-side comics that can visualize the situation between the figures so that it is expected to help students in understanding and give reasoning to the learning materials.

Android-based comics can be used to improve students' scientific literacy. By using Android-based comics can improve students' science literacy, it can be seen from pretest and posttest score were gained from 2.20 to 3.40. The implications for future teaching appear to be that comics have clear value as an innovative tool.

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