

Development of android-based comics integrated with scientific approach in physics learning

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Abstract. This research aims to determine the feasibility of an android-based comics with scientific approach in physics learning. This research used the model of development ADDIE (Analysis, Design, Development, Implementation, Evaluation). The research data were obtained through product feasibility assessments by material and media experts as well as student questionnaire responses. The results of the research based on the assessment of media and material experts are included in the very good category. Students' response to the comics developed is also very good. Features in the comics contain the step of learning with scientific approach (Observing, Questioning, Data Collection, Associating, Communicating) to make students more active in learning. So, it is feasible for use in physics learning.

Keywords: *android-based comics, scientific approach, physics learning*

1. Introduction

The 21st century technology is developing rapidly in all sector including education. The education sector expects learning that integrates technology with literacy and knowledge skills [1], [2]. The technology is now growing rapidly namely smartphones. Smartphones have been known at various ages and backgrounds, students are no exception. Students as technology users are capable of operating smartphones such as android [3]. However, this use has not been optimally utilized in learning like physics. When in fact the use of this android can overcome the limitations and problems in learning [4], [5].

Physics learning at the high school level often contain an abstract concept, difficult to understand and require high understanding such as to material of momentum and impulse [6]. Difficulty in understanding material causes students to be passive and do not have the motivation to learn. Students will also tend to show lack of seriousness in learning. Thus, media that attract and facilitate learning are needed in accordance with technological developments or learning 21st century. This learning media can be in the form of an android-based comic.

Android-based comics have been well-known among teenagers including high school students [7]. In addition to entertainment, comics can also be used as learning media [8]. Android-based comics are practical and can be read anywhere and anytime [9], [10]. Comics make students feel not easily bored studying the material because it contains images and text that is easy to follow. [11]. The subject matter of the comics is also packaged in interesting stories that cause students to be motivated to learn and understand the material in depth [12], [13]. If students have been motivated to learn, students will actively participate in learning [14] So that learning will be student centered according to 2013 curriculum objectives [15].



The 2013 Curriculum emphasizes the use of scientific approach [16]. The scientific approach has stages that include observing, questioning, data collection, associating, and communicating [17]. Each step in the approach to be able to train higher-order thinking skills [4]. So, students can develop thinking skills such as critical thinking and solving existing problems.

Android-based physics comics combine technology, knowledge, and literacy into learning media. This comic can be integrated with scientific approach so that it is in line with 21st century learning and curriculum implementation in 2013. This comic is effective and efficient because it is easily operated on the android platform anytime, anywhere offline or online. Android-based physics comics with scientific approach to the material momentum and impulse will be developed using the ADDIE model development method. Furthermore, comics will be tested for the feasibility in terms of material and media by experts and students' responses to the comics. Therefore, it will be produced android-based comics with scientific approach that is feasible for use in learning.

2. Research method

This research is included in development research. The research refers to the design of ADDIE models that includes five stages: Analysis, Design, Development, Implementation, and Evaluation [10].

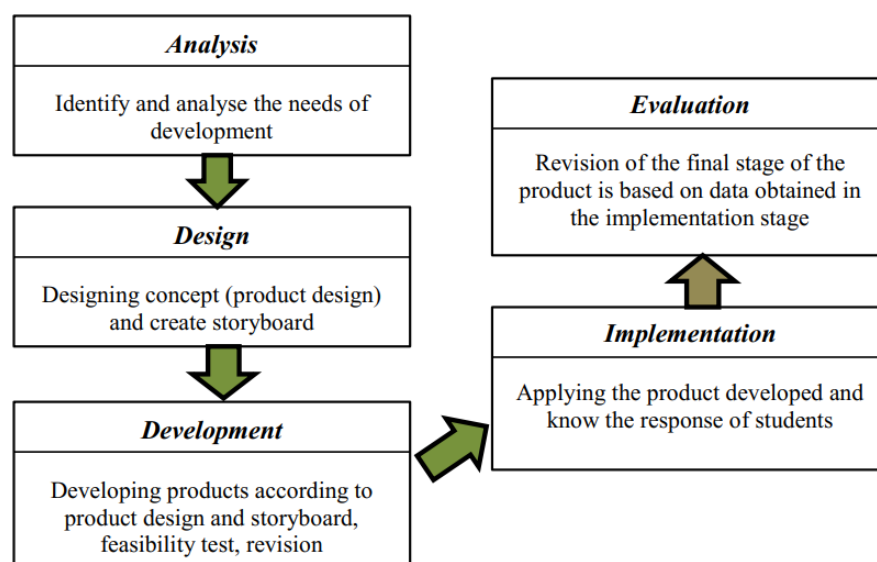


Figure 1. The stages of developing the ADDIE models.

Data collection techniques used are documentation, interviews, assessment of product feasibility, and questionnaire responses of students. Documentation and interviews are used to obtain data about the needs of development. Feasibility assessment is conducted to determine the feasibility of the product from media and material experts. While the questionnaire responses of students to determine the response of students to products that are developed.

Assessing the feasibility of the product by material and media experts, as well as students' response is analyzed using percentages:

$$P = \frac{f}{N} 100\% \quad (1)$$

P is the percentage score, f is the percentage tuned frequency, and N is the total data amount. The percentage score is then stated in the feasibility criteria in table 1 [18].

Table 1. Feasibility criteria of the product.

Score of assessment/questionnaire	Criteria
80 % - 100 %	Very good
60 % - 79.99 %	Good
50 % - 59.99 %	Enough
0 % - 49.99 %	Not good

3. Results and Discussion

This research result product in the form of android-based comics with scientific approach. Products are developed through several stages such as the ADDIE models. Product that has been developed will be known for feasibility based on material and media experts. Besides, product is tested in learning to know the response of students to the developed media. The following describes the results of the stages of product development according to the ADDIE models along with the results of the assessment of feasibility and responses of students.

3.1. Result of the analysis stage

This stage produces several analyzes as shown in table 2. This analysis is used as a basis for designing android-based comics that will be developed.

Table 2. Results of analysis of comic development needs.

Needs	Result
Feature that according to the approach	Comics, video, sheets discussion, review
Software for development	CorelDraw X7 and android studio
Material that according 2013 curriculum revision	Momentum, impulse, relationship of momentum and impulse
Characteristics of high school students	Students are included in the formal operational stage which can understand abstract concepts within certain limits

3.2. Result of the design stage

Design development is based on the analysis that has been done. Comic developed on android contains syntax scientific approach. Syntax scientific approach (observing, questioning, data collection, associating, communicating) [16] in the comics media is designed as shown in figure 2.

Figure 2 shows that each step of the scientific approach will be contained in the media's feature. These features include feature apersepsi, feature komik, feature student worksheet, and feature review. Feature apersepsi contains videos that can stimulate students to observing and questioning. Feature komik contains comics that students will read as a step-in data collection. Feature student worksheet contains questions related to the material that students will use to discuss (associating) and the results of the discussion are communicated in front of the class. Feature review was designed as a students' response to the comic developed. Thus, features with scientific approach are designed to make the learning centered on students according to the revision 2013 curriculum so that students will be more active in learning.

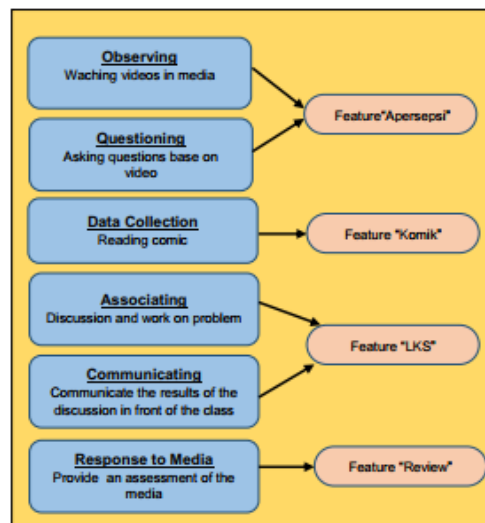


Figure 2. Android-based comic component design with scientific approach.

Comics that will be developed is named Coroid Physics. Coroid Physics associate physics of material (momentum and impulse) with physical phenomena that exist in daily life. Coroid Physics also uses good and polite daily conversation language, making it easier for students to understand the material in the comics.

Stories designed in Coroid Physics train readers to find their own concepts based on problems experienced by the characters. Moreover, the story in the comic also contains several representations including verbal and mathematical representation. This story is later made into storyboard.

3.3. Result of the development stage

The development stage is making product with reference to the storyboard that was made in the previous stage. Development is done by using CorelDraw X7 and Android Studio. This stage produces an .apk application and can be downloaded at Playstore. The application has a size of 10 MB and has main menu display like figure 3.

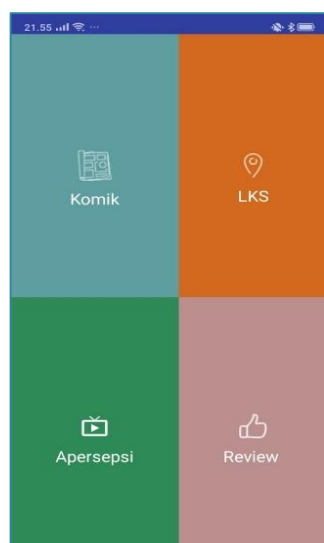


Figure 3. Main menu.

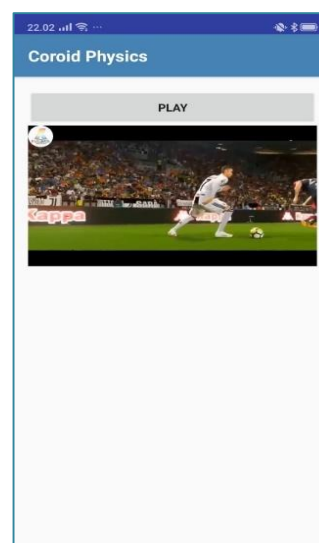


Figure 4. Feature "Apersepsi".

Feature "Apersepsi" like figure 4 contain video about the concept of impulse when a player kicks the ball. This is according with the stage of the scientific approach that is observing. At the end of the video

also includes a disclaimer that the students submit questions with video that has been seen. This section is according with the scientific approach of questioning.

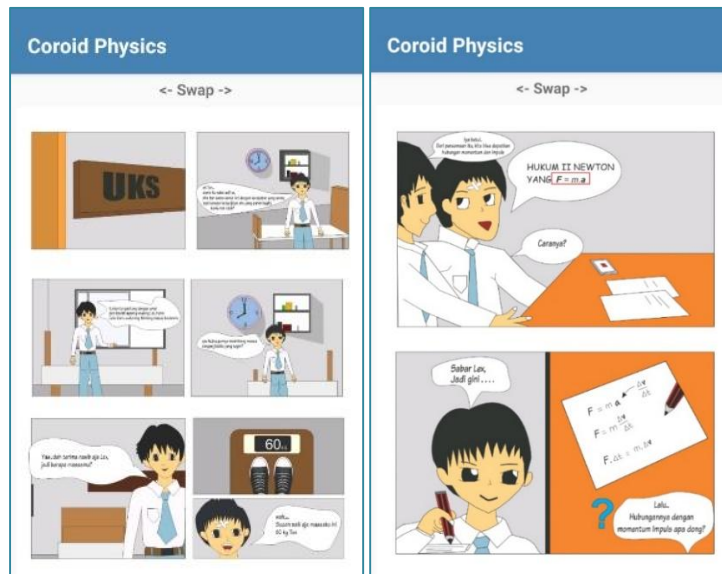


Figure 5. Feature “komik”.

Feature such as figure 5 contains momentum and impulse material is packed in the story. This feature consists of several pages. If the students will read the next page, then *swap* on the screen. Students can also zoom in image and text by tapping the desired part on the screen. In this feature, learners will obtain the physical concept of momentum and impulse according to the scientific approach stage, namely data collection.



Figure 6. Feature “student worksheet (kolom diskusi)”.

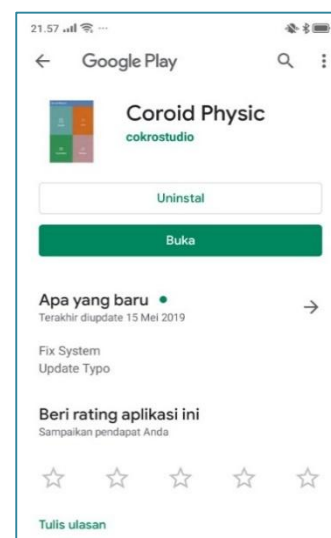


Figure 7. Feature “review”.

Feature “LKS (kolom diskusi)” such as figure 6 has student discussion sheet to explore the understanding of the concept obtained. While the feature “review” such as figure 7 contains assessments, feedback and suggestions students or readers of the comics developed.

Coroid Physics that has been developed subsequently carried out testing between devices. It aims to obtain equality of views ranging from 4” to 7” and obtain information on failure to run as repair

applications. After being repaired, feasibility assessment is carried out on expert lecturers covering materials and media.

Table 3. Result of analysis Coroid Physics assessments by material experts.

Rated aspect	Score (%)	Criteria
Feasibility of contents	92.86	Very good
Feasibility of presentation	100	Very good
Feasibility of language	83.33	Very good
Average	92.06	Very good

Coroid Physics in terms of the materials in table 3 shows an average percentage of 92.06 with very good criteria so it is feasible to use in physics learning. Aspects of presentation has the highest score. This is because the comics are presented have references, scientific approach that leads to student's involvement, presentation of the concept as a whole, and their significance in the learning activities. While aspects of language have the lowest value because there are still some spelling errors in the sentence. Thus, experts give suggestions for improvement in some of these words.

Table 4. Result of analysis Coroid Physics assessments by media experts.

Rated aspect	Score (%)	Criteria
Quality of contents	100	Very good
Language	66.67	Good
Implementation	100	Very good
Visual display	100	Very good
Image display	100	Very good
Ease for use	100	Very good
Average	94.45	Very good

Coroid Physics that was developed in terms of media such as table 4 shows an average percentage of 94.45% with very good criteria and feasible to use in physics learning. But it need improvement on aspects of language because there are several explanations that still pose a double meaning.

The overall average Coroid Physics assessment in terms of material and the media developed are 92.26%. These results indicate that the media developed very good base on media and material expert as in research [18]-[20]. Therefore, Coroid Physics is feasible for use in learning.

3.4. Results of the implementation stage

The implementation stage is Coroid Physics testing on two classes with 22 students in each class. The results of students' responses to Coroid Physics are presented in table 5.

Table 5. The results of the questionnaire analysis responses of students in MIA 1 and MIA 3.

Rated aspect	MIA 1		MIA 3	
	Score (%)	Criteria	Score (%)	Criteria
Attraction	100	Very good	100	Very good
Theory	94.54	Very good	97.27	Very good
Language	80.68	Very good	92.04	Very good
Average	91.74	Very good	94.44	Very good

Table 5 shows that Coroid Physics is very good with response of 91.74% and 94.44% according to students as users of learning media as in research [19]. All students have high attraction with score of 100% towards Coroid Physics because display of comic is attractive. This led to the study of physics will not be boring [8]. In addition, with the inclusion of illustrations make the students more enthusiastic in learning and motivated to learn the material [20]. Thus, Coroid Physics can support students' participants learned the lesson of physics, especially the material momentum and impulse. However,

Coroid Physics needs to be fixed in the language because there are some sentences difficult for students to understand.

3.5. Result of evaluation stage

In the evaluation stage to be improved based on suggestions and feedback given by the students as the user of the product during the implementation stage. Revisions were done at this stage is improvement of several sentences to make it easier for students to understand the material.

4. Conclusion

Android-based comics with scientific approach is feasible to use in physics learning. Feasibility of products based on subject material experts included in very good category, media experts in very good category. While the response of students including very good category. Android-based comics integrated scientific approach that can encourage students to be more active in physics learning.

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