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Development of Android Comic Media for the Chapter of Newton's Gravity to Map Learning Motivation of Students

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Abstract. This research was designed to map students's learning motivation by developing comic physics media. This study used the ADDIE development model. The subjects tried in this study were students in one senior high school in Yogyakarta at the grade of 10th science. Data collection instruments were in the form of students' motivation observation sheets and students' learning motivation questionnaire. The data obtained were analyzed quantitatively. The results showed that (1) Android-based physics comic media on the Newton's Gravity chapter was an innovation in the world of education that utilized TPACK (Technological Pedagogical Content Knowledge). (2) Comic media can be and are suitable for use in physics learning for senior high school, and (3) comic media can be used to map the learning motivation of high school students.

Keyword: Comic; Android; TPACK; Motivation.

1. Introduction

Technological developments are influential to smart phone addiction which can reduce productivity, divert attention, make users compulsive and vulnerable to negative consequences [1], [2], [3]. Excessive use of smartphones for games, information retrieval, entertainment, enjoyment motives, mood settings, hobbies, and suitability are smartphone dependency factors [4], [5].

The key to the success of physics learning is shown in the educational technology used, because physics is a subject that contributes a lot to the scientific and technological development of society [6], [7]. Learning needs to be integrated by utilizing technology. The use of TPACK (Technological Pedagogical Content Knowledge) by teachers is important to understand and overcome contextual factors in the use of technology in education for effective teaching [8], [9].

Problems in physics learning, among others, are the number of textbooks as media. Textbooks are less interesting to read, even though students are more interested in reading comics than academic books [10], [11]. Comic has humor and narrative features that allow many perspectives, visually and verbally. It is an innovative potential media for science communication and can convey the message of life, however, the empirical studies exploring comics are very rare [12-15].

There needs to be learning innovation for students to learn. In line with the demands of times and the progress of science and technology are increasingly encouraging efforts to renew the use of technological results in learning that can increase learning motivation. The learning model innovation is needed in the implementation of learning which can switch over the traditional learning model towards independent learning. This article presents innovations of smartphone-based comic-assisted learning models using the Himawari reader application. This smartphone-based comic-assisted learning model



is combined with learning models that support physics learning processes such as discussions. So that physics learning becomes maximal to motivate students. The purpose of this article is the development of android-assisted comic media on chapter of Newton's gravity to map the learning motivation of students.

The rest of this paper is organized as follow: Section 2 presents literature review. Section 3 describes the proposed research method. Section 4 presents the obtained results and following by discussion. Finally Section 5 concludes this work.

2. Related Works

Technological Pedagogical Content Knowledge (TPACK) is a form of knowledge that emerges and transcends the three core components (content, pedagogy, and technology). The importance of developing TPACK by teachers is to understand and overcome contextual factors from the use of tablet computers in education for effective teaching with technology [8], [9].

Comics are one of the leading educational media that are good for increasing knowledge [16], [17], [18]. Comics are art that can present a story, describe procedures, teach a theory, present a hypothesis, answer questions, and involve the reader. Comics can be used in learning because they can convey information, increase motivation and interest in reading, and are a superior learning tool compared to other learning tools [12-25].

Comics have humor and narrative features, allowing many perspectives, visually and verbally, to be considered as innovative potential media for science communication and can convey the message of life [12-15]. Unlike textbooks, stories and comics allow many perspectives, visually and verbally, and apply beginning, end, climax moments, and focal points, as well as the complexity of complicated stories, textbooks, virtual reality simulations [12]. Learning using comics that includes illustrations and written content is an effective intervention to increase knowledge. Comic learning is an innovative communication media that can be used to achieve goals [15].

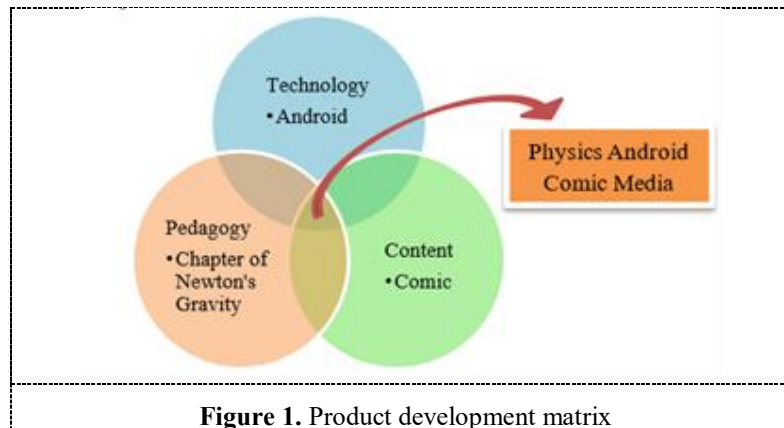
Mobile learning (m-learning) uses android by combining some strategies which provides wider opportunities in mobile technology, improve students' learning abilities, high-level thinking skills, motivations, and enable students-centered learning processes [26], [27], [28]. The use of Physics Mobile Learning media products that are assisted by Android can improve the divergent thinking skills of students and HOTS in physics [29]. The development and use of android-based media and comic media in learning can improve students' learning motivation [30], [31], [32].

Good coordination is a key factor to increase students' motivation which is associated with academic achievement, namely higher learning levels and retention of new knowledge [33-36].

3. Proposed Method

The type of research developed is ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Analysis is done by analyzing students, curriculum, and material. The design begins with compiling of lesson plans, assessment instruments, and comic design (characters, backgrounds, and materials). The Development phase is by creating comics, validating lesson plan, Instruments, and Comics. Implementation is doing the learning and assessing, and distributing questionnaires. The last stage is Evaluation by evaluating the lack of comics.

The study was conducted in one of the senior high schools in Yogyakarta on April 19th, 2018. The research subjects consisted of 18 senior high school students at the grade of 10th science. The product developed refers to the three main components of TPACK namely the content, pedagogy, and technology shown in Figure 1.



The type of data produced in this study is quantitative data. The instruments used in this study were expert validation sheets, students' motivation observation sheets, and students' motivation questionnaires. The results of the assessment data are scores which are then converted into a scale of 5 according to the Likert scale.

The feasibility of the media to be used in learning is analyzed from the media quality category. The media is considered feasible if they get a minimum of good quality categories. The media quality category is obtained from the media validation data by the validator. Data assessment of media quality is quantitative data with a scale of 1-5. Data were analyzed using percentage of success. Measurement of learning motivation variable of students is done in 2 ways, namely questionnaire and observation. Observation data are based on observations of students' achievement of indicators of increasing learning motivation. While the results of questionnaire data are in the form of a Likert scale. Furthermore, the data were analyzed using the percentage of success.

$$P = \frac{f}{N} 100\%$$

On the formula above, P means the percentage of success obtained by dividing between f and N then multiplies with 100%. Meanwhile, the number of subjects in certain categories is symbolized with f , while N means frequency of total number of subject.

Furthermore, we determined the length of the interval class in each category consisting of five categories. The grouping of values in each category is presents in Table 1.

No	Interval %	Category
1	$80,01 \geq x \leq 100$	Excellent
2	$60,01 \geq x \leq 80,00$	Good
3	$40,01 \geq x \leq 60,00$	Fair
4	$20,01 \geq x \leq 40,00$	Less
5	$0,00 \geq x \leq 20,00$	Worst

4. Result and Discussion

This section presents the results obtained and the following by discussion.

4.1. Result

4.1.1. Product Development Results

The product was developed in the form of physics comic media equipped with video on the chapter of Newton's Gravity. The comic can be read through the Himawari Rider application on a smartphone or Android. The appearance of android comics can be seen in Figure 2.





Figure 2. Comic display on page (a) 1; (b) 2; (c) 3; (d) 4; (e) 5; (f) 6.

4.1.2. Media Validation

Aspects assessed at the media validation stage consist of aspects of presentation of android content, language and comic. The assessment results of these aspects can be seen in Table 2.

Table 2. Media Validation

Aspect	Score	Percentage (%)	Category
Presentation of contents	32	91,42	Excellent
Language	23	92	excellent
Android comics	15	100	excellent

4.1.3. Motivation

Assessment of students' learning motivation after learning using comic media is done by questionnaire and observation.

4.1.3.1. Questionnaire

Motivation mapping based on the questionnaire given to students is presented in Figure 3.

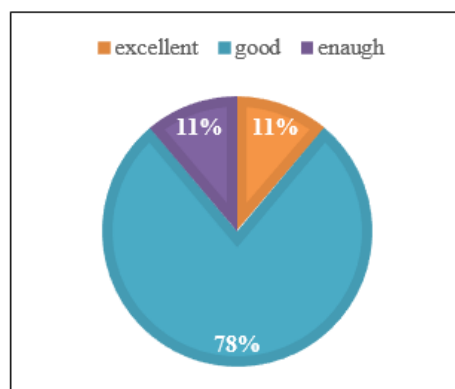


Figure 3. Mapping of Students' Learning Motivation

Table 3. Mapping Learning Motivation Based on Students' Questionnaire

Indicator	Percentage(%)	Category
The willingness of students	71.93	Good
An active learning strategy is available	79.65	Good
Competition in learning physics	65.26	Good
Satisfaction gained in learning	82.1	Excellent
A pleasant learning environment is available	81.75	Excellent

Questionnaires were given to students after learning using Newton's Gravity Physics Comic media. The results obtained show that the motivation of students after using the Newton's Gravity Physics Comic media in learning is 11% in the excellent category, 78% in the good category, and 11% in the fair category. The questionnaire contains several motivational indicators with the percentages obtained are shown in Table 3. Based on the results of the questionnaire data, it was found that on the indicator that there is a willingness of students to get a percentage of 71.93%, available active learning strategies obtained a percentage of 79.65%, competition in learning physics obtained percentage of 65.26%, satisfaction obtained in learning gained a percentage of 82.1%, and the availability of a pleasant learning environment obtained a percentage of 81.75%.

4.1.3.2. Observation

Motivation mapping based on observations made by the teacher is presented in Figure 4.



Figure 4. Students's Learning Motivation Based on Observations

Table 4. The Mapping Learning Motivation Based on Students' Questionnaire

Indicator	Percentage(%)	Category
The willingness of students	85.80	Excellent
An active learning strategy is available	90.74	Excellent
Competition in learning physics	66.7	Good
Satisfaction gained in learning	86.42	Excellent
A pleasant learning environment is available	82.72	Excellent

Observations were carried out by the teacher when learning using Newton's Gravity Physics Comics Media took place. The results obtained indicate that the motivation of students when using Newton's Gravity Physics Comic media on learning is 56% in the excellent category, and 44% in the good category. These observations contain several motivational indicators with the percentages obtained are shown in Table 4. Based on data observation, it is found on the indicator that there is a willingness of students to get a percentage of 85.80%, available active learning strategies obtained a percentage of 90.74%, competition in learning physics obtained a percentage of 66.7%, Satisfaction gained in learning gained a percentage of 86.42%, and the availability of a pleasant learning environment gained a percentage of 82.72%.

4.2. Discussion

Android-based physics learning media that functions to map motivation is developed using the Sigil computer program. The media is in the form of physics comics equipped with videos. Learning media products produced in the form of *epub* files. Files in this format can be opened via the Himawari reader application on Android devices. Android-based physics learning media products have several characteristics, namely: (1) products in the form of files that can be read using an Android device; (2) the product supports senior high school physics learning in chapter of Newton's gravity; (3) products can be used inside or outside physics learning at school; and (4) the product presents an explanation of the material, and the questions exercises presented in an interesting and interactive manner.

Comic media developed was validated before being implemented for learning. The comic media was used in learning on Newton's gravity chapter at the grade of 10th science. The learning model carried out using the inquiry approach with the discussion method. The discussion was conducted by a group of 4 students. Students read comics on their android devices and then complete the worksheets and questions available in comics in groups. The teacher as the facilitator observes each student and assesses based on the observation sheet. Students then fill out a questionnaire when learning using comic media has been completed. Based on the results of observations and questionnaires, there are several differences in

results, it can be due to several factors, among others, the teacher has difficulty assessing at any time what is done by students one by one, and the seriousness of students in filling out the questionnaire. The development of comic media by utilizing technology such as android can be used as learning innovations. This cannot be separated from the key to the success of physics learning shown in the educational technology used, because physics contributes to the scientific and technological development of society [6], [7]. In addition, learning media by utilizing Android provides various learning application programs that can be accessed by everyone [27].

The results of product validation and implementation show that the media is suitable to be used in physics learning in senior high school on Newton's Gravity chapter. Comics are one of the media that is often used in life, comics not only function as entertainment devices, but are also used in education [16]. The implementation results show that comic media can be used to map students' learning motivation. This is because learning using comic media with android-assisted comics is a new learning experience for students. Development and use of android-based media and comic media, in learning can improve students' learning motivation [30], [31], [32].

5. Conclusion

The development of physics comic media on Newton's gravity chapter has been carried out in accordance with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. This research is only limited to the Implementation stage. Based on the discussion above, we can conclude that: (1) android-based physics comic media on the material Newton's Gravity chapter in learning is an innovation in education that utilizes TPACK. This media can and is suitable for use in physics learning for senior high school at the grade of 10th and can be used to map the learning motivation of senior high school students, (2) physics comic media can be developed further in learning for other physics materials. However, (3) the physics comic developed has not been disseminated. We believed that (4) the development of physics comic media into innovation in practical learning can be used and read wherever and whenever. It can also be a substitute for a package book because it already contains illustration videos, materials, sample of questions and discussions, and exercise questions. Physics comics developed can be disseminated via social media, as well as playstore on android. Finally, this research needs to be continued by developing other physics comics that can be accessed on social media or playstore on android. Further research needs to be completed with pretest and posttest in order to measure students' abilities.

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