THE INSTRUCTIONAL-BASED ANDRO-WEB COMICS ON WORK AND ENERGY TOPIC FOR SENIOR HIGH SCHOOL STUDENTS

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ABSTRACT

This study aimed to determine the validation of Andro-web comics on Work and Energy topic. To achieve the objective, this study was designed referring to ADDIE model, i.e, Analysis, Design, Development or Production, Implementation or Deliver, and Evaluations. The Andro-web comics could be accessed using a digital comic application, Webtoon. It is downloadable in Play store or App store. The Andro-web comics is compatible with all devices including mobile devices (phone, tablet, iPod, PDA, and smartphone) and PC/Mac. Based on the expert judgment, the Andro-web comics is suitable for learning. The Instructional-Based Andro-Web Comics is alternative instructional materials for teachers to attract students' attention and help them studying easily and practically as it provides an interesting illustration with simple language. It could also be used wherever and whenever without teacher's guidance. Both teachers and students could communicate on the comment column which is available in the application without time and place limitation.

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Keywords: Andro-web, comics, webtoon

INTRODUCTION

Instructional materials contain learning materials that could help teachers and students in implementing learning process (Bingimlas, 2009). Instructional materials available in schools are generally textbooks and Student's Worksheet. Thick textbooks containing heavy materials are less interesting and make students lazy to read. The existing Student's Worksheet also unable to attract students due to its monotonous layout and brief material presentation.

The development of ICT (Information Communication Technologies) in the education world offers the effectiveness of achieving communication goals and economic efficiency such as time, cost, and energy (Perbawaningsih, 2013). Learning using ICTs such as mobile devices (smartphones, mobile phones, iPods, and PDAs) could support the conception of learning and has been proven to increase visibility and significance in higher education (Livingstone, 2012). The use of mobile technology could also enrich students' learning experience and participation in learning process (García-Peñalvo&Conde, 2015; Fulantelli et al., 2015). However, these developments have not been maximally utilized by physics teachers in public schools in Jember.

The development of ICT currently affects interaction, learning style, and student's attitude (Slechtova, 2015). The results of the questionnaire distributed to 102 respondents in public schools in Jember indicated that 79.4% of the students use smartphones during the learning process to

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find additional materials. Therefore, it proves that ICT-based learning is highly required considering its great influence on modern learning.

Physics will be more enjoyable if it is packed in comics form. This is suitable with Hadi & Dwijananti's research (2015), who revealed that 76.47% of students were interested in using physics comics in learning process and 80.15% of students claimed that comics helped them in learning process. Abstract and complex concepts on physics, especially the topic of work and energy could be simplified through comics. Illustrative and applicable comics could be an alternative instructional materials for teachers to hold an important key of learning process which states that students must be able to relate the material studied with real life (Mulyono, 2012).

The use of comics as instructional materials could help increase student's learning interest and motivation and assists students in understanding the material easier and simpler (Williams, 2008; Lestari, 2016; Zain et al., 2013). The cartoon concept in comics is presented in an easy way to retain students' interest especially those with learning difficulties (Tatalovic, 2009). The interconnected images form the plot and make concepts easy to remember (Kumaran et al., 2009; Tatalovic, 2009).

The utilization of mobile devices such as smartphones and wireless devices in the development of commodity-based materials supports the storage of practical resources. Students can access information anytime and anywhere as needed (Lavin-Mera et al., 2009; Cavus& Ibrahim, 2009; Ligi & Raja, 2017). Students can also communicate with teachers and other students unlimited by space and time (Moura & Carvalho, 2010).

Some researchers have developed comics as instructional materials but in printed form (Tyas et al., 2015; Widyawati & Prodjosantoso, 2015). Along with the ICT development, the researchers developed the Instructional-Based Andro-Web Comics which is accessible on smartphone and personal computer as students use mobile phones and personal computers more often than the instructional materials they get at school.

Some researchers have also developed Android-based comics. Moreover, they used the most recent social media (Hadi & Dwijananti, 2015; Irwandani & Juariyah, 2016), but it is only available on mobile phones with an Android operating system and spends much internet quota since it contains autoplay video. On the other hand, the developed Instructional-Based Andro-Web Comics is not only available for mobile phones with the Android operating system, but also for mobile phones with the iOS operating system. Additionally, it is accessible for all personal computers including Mac, because people could retrieve it through a website.

The Instructional-Based Andro-Web Comics is accessible to all people regardless of age, background, social status, cultural status, or gender. The main advantage of Instructional-Based Andro-Web Comics is its accessibility based on the needs and users' desire especially students without time and place limitation. Therefore, the learning process could not only be conducted in the classroom but anywhere.

The formulated research problem is how the validity of Instructional-Based Andro-Web Comics was. Therefore, the purpose of this development was to create valid Instructional-Based Andro-Web Comics with ADDIE (Analysis, Design, Development or Production, Implementation or Deliver, and Evaluations) model.

METHODS

The data collection techniques used was validation. The instrument of data collection was validation sheet. The data obtained by giving validation sheet and the Instructional-Based Andro-Web Comics to the validators to be assessed its feasibility, accuracy, and efficiency.

This research belonged to the Research and Development producing the Instructional-Based Andro-Web Comics on work and energy topic for tenth-grade senior high school students. The research used ADDIE (Analysis, Design, Development or Production, Implementation or Deliver, and Evaluations) model.

The reason underlying the selection of the ADDIE was due to its clear and systematic development stages in overcoming learning source problems based on students' need (Wang & Hsu, 2009). The development design of ADDIE has already been applied by other researchers such as Fajriah and Anggereini, (2016); Sudarwati et al., (2017); Sulfiah & Sulisworo, (2016) in designing and developing comics as well as online-based learning.

These were the steps of the ADDIE model used in this study: (1) analyzing students' problems during learning process and analyzing the need for developing new instructional materials; (2) designing the written teaching material concepts that suited the characteristics, needs of students, and learning objectives; (3) creating teaching materials according to the design and making the instruments for its feasibility measurement. Also, it was then validated using the formulated

instructional materials standards; (4) implementing the Instructional-Based Andro-Web Comics on the actual conditions; and (5) assessing the product consisting of both formative and summative evaluation. The formative evaluation was to determine the shortcomings of the Instructional-Based Andro-Web Comics during the learning process done at the end of weekly face-to-face. While the summative evaluation was to measure the achievement of learning objectives implemented after the development test activities ended.

These were the data processing techniques used to measure the feasibility of Instructional-Based Andro-Web Comics: (a) Data recapitulation of the Instructional-Based Andro-Web Comics into tables including indicators (I_i) and value (V_{ji}) for each validator; (b) Determining the average validation result value from all validators, in which for each indicator used the following formula:

$$I_i = \frac{\sum_{j=1}^{n} V_{ji}}{n}$$

I_i = the average scores for the indicator i
V_{ji} = the data score of the validator data j to
     the indicator i
n = number of validators

c) Determining the average scores for each aspect;

$$A_i = \frac{\sum_{j=1}^{m} I_{ij}}{m}$$

A_i = the average scores of aspect i
I_{ij} = the average scores of the aspect i to indicator j
m = number of indicators in aspect i

d) Determining the score of V_a or the total score of the average values of all aspect;

$$V_a = \frac{\sum_{i=1}^{n} A_i}{n}$$

V_a = the total average scores of all aspects
A_i = the average scores of the aspect i
n = number of aspects

e) Furthermore, the total value or the mean value referred to as the following Instructional-Based Andro-Web Comics costing prevalence interval and intervals:

Table 1. The Validity Level of Instructional Materials

The Value of V_a	Validity
$1 \leq V_a < 2$	Not Valid
$2 \leq V_a < 3$	Less valid
$3 \leq V_a < 4$	Fair
$4 \leq V_a < 5$	Valid
$V_a = 5$	Very Valid

(Hobri, 2010)

RESULTS AND DISCUSSION

The Instructional-Based Andro-Web Comics is instructional materials which belong to interactive multimedia in the form of digital comics available in an application named webtoon. The production of Instructional-Based Andro-Web Comics placed on the Core Competency, Basic Competency, and Indicators adjusted to the students' characteristics and materials needed.

The development of Instructional-Based Andro-Web Comics is needed by students referring to the observation and questionnaire shared in public schools around Jember indicated that the students were more interested in studying using a smartphone than a textbook or student worksheet they owned. In the learning process, a half of students were lazy to bring heavy and thick textbooks; or, they just put it on their bag without reading them since it is less interesting. Thus, it required to develop an instructional material suitable for the development of ICT and students' needs just like the Instructional-Based Andro-Web Comics.

The Instructional-Based Andro-Web Comics could be an alternative choice for teachers and students to have effective, efficient, and practical instructional materials in achieving learning objectives. It was formulated to help students understand the materials easily without teacher's guidance wherever and whenever.

The Instructional-Based Andro-Web Comics consist of 12 episodes including the episode 1 about the character introduction; episode 2 about the introductory story; episode 3-8 about the materials on work and energy topic; episode 9 about the sample questions; and episode 10-12 about student discussion sheets. The Instructional-Based Andro-Web Comics could be updated anytime based on the research needs.

The steps to access Andro-web comics via smartphone and PC / Mac are:

a. On smartphones

1. Download the webtoon app on the playstore or app store.
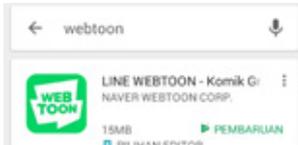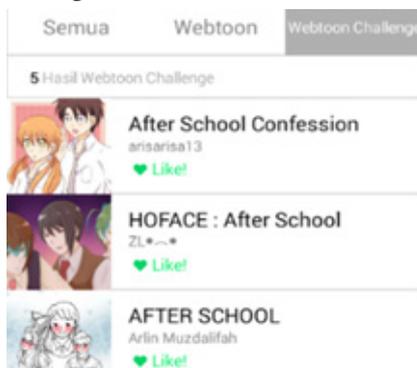

2. Open the webtoon app.
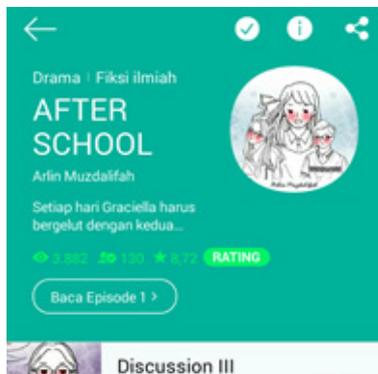

3. Click the "Challenge" option.

4. Click "Search". Then, type the comic title, "After School". If it is not found, type the name of the comic author, "Arlin Muzdalifah".

5. Click the button, "Webtoon Challenge" then select the target comic.

6. The Instructional-Based Andro-Web Comics entitled "After School" is accessible.

b. On PC / Mac
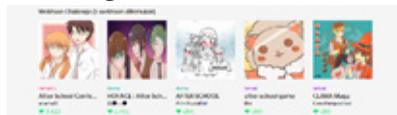
1. Type "Webtoon" into Google search.

2. Select the link as shown by the picture.

3. Click the "Search" button then type "After School".

4. Select the target comic.

5. The Instructional-Based Andro-Web Comics entitled "After School" is attainable.

The Instructional-Based Andro-Web Comics was validated by two expert validators and one user validator before being implemented to the development test. The expert validators are lecturers of Physics Education in Universitas Jember, while the user validator is a physics teacher at the school where the development test was conducted. There were 18 validation indicators divided into three aspects; the accuracy aspect, the feasibility aspect, and the efficiency aspect of the instructional materials.

The accuracy aspect consisted of 4 indicators, the feasibility aspect contained 11 indicators, and the efficiency aspect comprised 3 indicators.

Below is the validation results conducted by two expert validators and one use validator:

Table 2. The Validation Result of Instructional-Based Andro-Web Comics

No.	Indicator	Score
The Accuracy Aspects of Instructional Materials		
1.	The suitability of instructional materials with learning objectives	4,67
2.	The suitability of instructional materials with student's characteristics	4,67

3.	The suitability of instructional materials with student's learning resources	4,67
4.	The suitability of instructional materials with the learning environment	4,67
Proper Aspects of Instructional Materials		
5.	The ability of teaching materials in developing students' motivation	4,67
6.	The ability of teaching materials to attract students' attention	4,33
7.	The ability of teaching materials in creating student's pleasure	4,67
8.	The ability of teaching materials for tools to understand and remember information	4,67
9.	The ability of teaching materials to repeat what is learned	4,33
10.	The ability of teaching materials as a learning stimulus	4,33
11.	The ability of teaching materials for immediate feedback	4,33
12.	The ability of teaching materials in promoting good practice	3,67
13.	The ease of teaching materials in the practice of learning	4,33
14.	Security of teaching materials for students	4,33
15.	Quality teaching materials	4,67
The Efficiency Aspects of Instructional Materials		
16.	The efficiency of teaching materials in relation to time	4,33
17.	The efficiency of teaching materials in relation to cost	4,33
18.	The efficiency of teaching materials in relation to energy	4,33

The accuracy level of instructional-base Andro-web comics appeared in the indicator 1, 2, 3, and 4. The accuracy of instructional materials was used to determine the suitability of instructional materials with learning objectives, students' characteristics, learning resources, and learning environment. The accuracy aspect of instructional materials obtained the total score around 4,67. Based on table 1, the score was in valid criteria. These results indicated that the Instructional-Based Andro-Web Comics was suitable with the learning objectives, characteristics of students especially high school students' characteristics nowadays, school learning resource, and students' learning environment.

The feasibility level of Instructional-Based Andro-Web Comics arose in the indicator 5 to indicator 15. The feasibility aspect of the instructional materials obtained the total score around 4,39. Thus, based on table 1, the Instructional-Based Andro-Web Comics was valid. These results indicated that the Instructional-Based Andro-Web Comics could be used as learning stimulation that was able to attract students' interest and motivation, was easily and safely used as a tool to understand, remember, and repeat what has been learned,

The efficiency level of Instructional-Based Andro-Web Comics appeared in the indicator 16-18. The efficiency aspect of instructional materials achieved the score around 4,33. Thus, based on table 1, the Instructional-Based Andro-Web Comics was valid. This indicated that the Instructional-Based Andro-Web Comics was efficient in terms of time, cost, and energy both in the process of making and learning. In the creating process, it could save time, cost, and energy since it was made of paper and on applications like Photoshop CC. While in the learning process, it could save time, cost, and energy since the Instructional-Based Andro-Web Comics is accessible without time, place and cost limitation.

The ability of Instructional-Based Andro-Web Comics to improve motivation, attract students' attention, and create students' interest, obtained the score around 4,33 to 4,67. The score is similar to the research conducted by Alfiana (2012), that 89,93% of the students were motivated to learn using instructional materials in the form of comics during the learning process. Febriandika et al. (2016), also explained that the science module with comics as instructional materials could improve students' motivation and 85,47% of students interested and paid attention to the instructional materials.

The Instructional-Based Andro-Web Comics presents the friendship of 3 high school students in which they cooperate to solve their problems. This case is expected to stimulate class discussion and train students' cooperation skills resulting in livelier classroom activities. The contextual materials presented in the Andro-web comics is expected to increase students' awareness of science and inform them that the learned materials exist and are close to their life.

The validity of Instructional-Based Andro-Web Comics as a tool for students in understanding and remembering information achieved the score around 4,67 and was in the valid category. This result is in accordance with research conducted by Fatimah & Widiyatmoko, 2014; Wahab et al., 2017, which explained that students easily understand, remember and search informa-

tion contained in the comic as it presents a coherent illustration using simple language.

Joffe (2008), describes images as memorable, easily absorbed, and gives further effect to the reader by reading or viewing it over and over again. The images contained in the Instructional-Based Andro-Web Comics are observable and readable. Students could access it whenever they need the information. They could also find the desired information by clicking on the related episode/s without much effort to search.

The validity and eligibility level of instructional materials in promoting a matching exercise obtained 3,67 in which the validity level was in quite valid. Getting score around 3,67 was possible inasmuch as the Instructional-Based Andro-Web Comics must be accessed online, so, it requires a stable wireless network to run. However, it could be overcome by using mi-fi or mini wifi capable of reaching 31 devices.

Based on the validity level criteria of instructional materials, it was in the valid level with the score around 4,46. Therefore, it concludes that the developed Instructional-Based Andro-Web Comics could be used or implemented at schools.

CONCLUSION

The Instructional-Based Andro-Web Comics belonged to worthy criteria as instructional materials having the score around 4,67 on the accuracy aspect; 4,39 on the feasibility aspect; and 4,33 on the efficiency aspect. This meant that the Instructional-Based Andro-Web Comics could be implemented at schools.

A disadvantage of the Instructional-Based Andro-Web Comics is that it must be accessed online. The offline feature is not available since the developer is not a part of the NAVER WEBTOON employee. Therefore, the test of the Instructional-Based Andro-Web Comics should take place in an area full of supporting facilities such as a stable wireless network, mobile devices, and PC / Mac.

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