Developing physics learning media using 3D cartoon

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Abstract. This study focuses on developing physics learning media using 3D cartoon on the static fluid topic. The purpose of this study is to describe: (1) the validity of the learning media, (2) the practicality of the learning media, and (3) the effectiveness of the learning media. This study is a research and development using ADDIE model. The subject of the implementation of media used class XI Science of SMAN 1 Pulau Laut Timur. The data were obtained from the validation sheet of the learning media, questionnaire, and the test of learning outcomes. The results showed that: (1) the validity of the media category is valid, (2) the practicality of the media category is practice, and (3) the effectiveness of the media category is effective. It is concluded that the learning using 3D cartoon on the static fluid topic is eligible to use in learning.

1. Introduction

The Act No. 19 of 2005 Section 19 Article (2) states the educational process in the educational unit is organized in an interactive, inspiring, fun, challenging, and motivates learners to actively participate and provide enough space for innovation, creativity, and independence according to the talents, interests, physical, and psychological development of learners [1]. To stimulate the thinking ability of learners, teachers are required to be more innovative in every teaching and learning activity. Learning media as a means of teaching aids teachers can facilitate the delivery of information from the teacher to the learners with the stimulus interesting, so students will be easy in processing the received information. It could be packaged in a media that support a learning process in understanding the concept without limited space and time [2].

Learning media is a tool that serves to explain some of the overall learning programs that is difficult to explain verbally [3]. Media in the learning process tends to be interpreted as graphics tools, photographic, or electronically to capture, process, and reconstitute the visual or verbal information [4]. The utilization of learning media makes learners not to be bored; thus, they are more enthusiastic about learning [5].

The low level of preference for school ultimately became would have an impact on the students outcome to study identified the investing public caused by media elections to resolve months of learning which less appropriately. In this case, the teachers may not utilizing learn in an optimum manner. In the learning process, teacher often neglect of using the media, despite the fact that media serves to increase the preference for school students and in turn will improve the quality of education students.

Based on the observations in SMAN 1 Pulau Laut Timur, especially in physics learning, the acquired learning media is merely whiteboard. Hence, students appear to be bored and lack of motivated to keep learning. The whiteboard is only able to deliver a visual symbol. Based on Edgar Dale Cone
experience blackboard is still abstract [6]. Most students had difficulty learn physics because many charge material that should be learned in a semester. This resulted in the interest of learning to decrease, consequently study results obtained by students unsatisfactory. Meanwhile, physics is a lesson that contains many abstract concepts that it requires a learning tool that can make abstract concepts to be more concrete direction so that the material is more easily understood.

Various types of learning media need to be considered in the utilization and development. Film cartoon is a very capable media to attract the attention of students so that they can develop their interests and motivation and clarify abstract concepts. Cartoons can develop students' interest and motivation as well as clarify abstract concepts [6]. According to Sadiman, et al [7], the great cartoon is able to attract attention, affect attitude, and behavior. The Interest of a person to cartoons compared to the media another is also due to symbols certain in cartoons that cause jocularity, in addition, the contents of cartoons tell various phenomena in daily life. Cartoon film media has undergone many developments [7]. One of them is a three-dimensional cartoon (3D). One software that can be used to create a 3D cartoon is Muvizu. Creating a 3D cartoon with Muvizu is easy and intuitive, and it is equipped with the tools that help predetermined characters to be adjusted [8]. Media learning to learn physics still very limited to the print of textbook and learning monotonous, students become saturated and learning less attention. In this case, it takes some examples of the concrete object that draws so that it can reduce saturation and boredom in learning. To forced need a media interesting, in this case, the media animated cartoons.

Based on the above-mentioned consideration, the research and development using 3D cartoon learning media are conducted on the static fluid topic for senior high school students. This study aims to produce an eligible instructional media using 3D cartoon on the static fluid topic for senior high school students based on the validity, practicality, and effectiveness of the developed learning media.

2. Method
2.1. Type of Research
It is a research and development (R & D). R & D is an official procedure in order to develop a new product or perfecting existing products accountable. The steps of this study were carried out using ADDIE model. The ADDIE model steps are analysis, design, development, implementation, and evaluation. The research subjects in this study is a 3D cartoon movie instructional media and the subjects of the implementation were the students of the XI class of SMA Negeri 1 Pulau Laut Timur Academic Year 2015/2016 as many as 30 students. The object of this study is a feasibility media of this 3D cartoon movie learning media on the static fluid topic.

2.2. Data Analysis Technique
2.2.1 Validity. The media validity was measured through the validation sheet. Media validation was validated by three validators. Table 1 shows the validity criteria for the instructional media [9].

| Interval       | Category |
|----------------|----------|
| x > 4.21       | very valid |
| 3.40 < x \leq 4.21 | valid     |
| 2.60 < x \leq 3.40 | fairly valid |
| 1.79 < x \leq 2.60 | less valid |

2.2.2 Practicality. Student questionnaire responses are the instrument used to measure the practicality of learning material. The practicality learning criteria are shown in Table 2 [9].
Table 2. Criteria for practicality learning material.

| Interval          | Category          |
|-------------------|-------------------|
| $x > 4.21$        | Very practical    |
| $3.40 < x \leq 4.21$ | Practical        |
| $2.60 < x \leq 3.40$ | Fairly practical |
| $1.79 < x \leq 2.60$ | Less practical   |

2.2.3 Effectiveness. The effectiveness of learning material was measured from learning outcomes test through pre-test and post-test. The testing and inferred to know the effectiveness of the learning material. Analysis of the students learning result was done by using a normalized gain equation as follows [10].

$$
< g > = \frac{\% < s_f > - \% < s_i >}{100 - \% < s_i >}
$$

where are $< s_f >$ = Score from the post-test and $< s_i >$ = Scores from the pre-test. Table 3 shows the effectiveness criteria for pre-test and post-test.

Table 3. Effectiveness criteria for the learning material.

| Value              | Category         |
|--------------------|------------------|
| $(<g>) \geq 0.7$   | very effective   |
| $0.7 > (<g>) \geq 0.3$ | Effective    |
| $(<g>) < 0.3$      | less effective   |

Development media animated cartoons made in the research efforts to improve the liveliness learn through interesting, fun, and reduce saturation. For that media saturation developed have to valid, practical, and effective.

3. Result and Discussion

Development media animated cartoons made in the research is efforts to improve liveliness learns through interesting, fun, and reduce saturation. The developed media have valid, practical, and effective categories.

Table 4. Validity result of the learning media.

| Aspect             | Value | Criteria |
|--------------------|-------|----------|
| Media Design       | 3.3   | Valid    |
| Content            | 3.3   | Valid    |
| Media Appearance   | 3     | Valid    |
| Technical Quality  | 3.56  | Valid    |
| Reliability        | 0, 8  | High     |

The Validity of the learning media covers four aspects namely design of the media, content, media appearance, and technical quality. The aspect of the media design is categorized as valid. It shows that the media is developed from the maintenance, ease of use, and ability to operate in several movie player software programs are good. The content aspect category is valid. It shows that the material arrangement is in accordance with the syllabus, the presented material is appropriate, up to date, and systematically arranged. The appearance media categorizes the valid category. It shows that the developed media is interesting to the students. The technical quality is categorized valid. It shows that
the media developed for the figures selection and characters are appropriate, the language used in the presentation of the material is well and communicative, the dubber is appropriate to the character, the animation presentation is appropriate to the story, the media can clarify the material clearly, the setting makes the material clearer, and the questions are appropriate to the topic. In addition, the voice can be clearly heard and the animation appearance is clearly seen. The reliability of the developed media is 0.82. This suggests that the high category and the assessment of the validators are consistent. The criteria selection of the media must meet the criteria of appropriateness, ease, attractiveness, and usefulness [11]. It also meets the criteria for selection of the other media by [4], which is in accordance with the objectives to be achieved, the precision of supporting defenders distance and meet the technical quality. This media for receiving a recommendation of the people to be able to try out on students.

**Table 5. Practicality result from the learning media.**

| Aspect  | Value | Criteria |
|---------|-------|----------|
| Ease    | 3.96  | Good     |
| Benefit | 3.90  | Good     |
| Reliability | 0.84 | High     |

The practicality of the teaching media consists of two aspects, namely the ease and usefulness. The ease aspect is categorized as good. This proves that the learning media is easy to use, can be operated in various player applications, as well as easy to maintain. The benefit aspect is categorized as good. This shows that the media can facilitate learners to master the material, help them independently, make the learners remember the material better, help students to focus, make students interested in the material, and make students learn more quickly than usual according to the needs of students. This is in line with the opinion of Nieven in [12] that the learning media is practical if it is easy and useful to use for students. In addition, this result fulfilled the requirement or criteria of the media selection based on the ease aspect by [11] that is easy to use and operational. It is also in line with [6] opinion that the media can be used to accelerate the learning material. This media also fulfilled the media function according to Levied and Lentz [4] which includes the function of attention that attracts and directs students’ attention to concentrate, cognitive function to facilitate students understanding and recalling information. This is in line with the opinions presented by Arsyad [4] pertaining to an election media focusing on several components, that is the purpose of instructional what will be reached, material learning ran will discuss the degree to which the depth to which must be achieved, characteristic of students quantitatively and qualitatively, and consideration for the media to be developed.

**Table 6. The effectiveness of the learning media.**

| **N-gain** | **Category** |
|------------|--------------|
| 0.76       | High         |

The effectiveness of the learning media was analyzed using N-gain equation. Based on the results of pre your test and post the test then can be determined the more so or to an increase in the understanding of the related students. N-gain value based on the analysis is 0.74. Based on these results so, is likely to increase their level of understanding of students who indicated by the value of the gain. This shows that the media is selected to be used in learning. These results are consistent with what was said by [6] that media can improve the quality of learning in this case in terms of students learning outcomes. According to Ploom [13], the effectiveness is seen from the achievement of the students learning outcomes improvement.

As for weakness media animated cartoons in research is students need more controlled when learning held because sometimes they are fun see the cartoon picture without regard to the material that was delivered so as to cause a lack of concentration to material substance. In addition, have weaknesses
whether the contents of material and technology, so that expected can be used as a reference in subsequent development

4. Conclusion
Based on the implementation of the developed product, it is seen that the media validity is categorized as valid, the media practicality is good, and the media effectiveness is effective. In conclusion, this learning media is feasible to use.

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References
[1] Undang-undang RI No 20 2003 Sistem Pendidikan Nasional (Jakarta: Republik Indonesia)
[2] Anggraeni R D and Kustijono R 2013 J. Penelit. Fis. Apl. 3 11
[3] Hadibin M M, Purnama B E and Kristianto G 2013 Indonesian J. Comput. Science-Speed. 11
[4] Arsyad A 2014 Media Pembelajaran (Jakarta: Raja Grafindo Persada)
[5] Syafrudin C and Pujiyono W 2013 J. Sarj. Teknik Informatika 1 2
[6] Musfiqon 2012 Pengembangan Media & Sumber Pembelajaran (Jakarta: Prestasi Pustaka Karya)
[7] Sadiman A S, Raharjo and Haryono 2014 Seri Pustaka Teknologi Pendidikan Nomor 6-Media Pendidikan-Pengertian, Perkembangan, dan Pemanfaatannya (Jakarta: Raja Grafindo Persada)
[8] Kainz O, Jakab F and Kardoš S 2013 Proc.11th IEEE Int. Conf. on Emerging eLearning Technologies and Applications (Slovakia: IEEE). p 203
[9] Widoyoko EP 2016 Evaluasi Program Pembelajaran (Yogyakarta: Pustaka Pelajar)
[10] Hake R 1999 Analyzing Change/Gain Score (Online) Available on www.physics.indiana.edu/-sdi/AnalyzingChange-gain.pdf. Accessed September 28th 2016
[11] Mulyanta St and Marlon L 2009 Media Pembelajaran (Yogyakarta: Universitas Atma Jaya)
[12] Rochmad 2012 J. Kreano 3 70
[13] Hafiz M 2013 Ta`lab 16 32