

Development of E-Comic as a Physics Learning Media for Class X Students on Momentum and Impulse Materials

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Abstract: This study aims to produce an interesting and valid learning media so that it is suitable for use in physics learning in the form of an e-comic for class X students on Momentum and Impulse material. The research method used is R&D (Research and Development) with the ADDIE development model (Analyze, Design, Development, Implementation, and Evaluation). The validity of the e-comic learning media was tested through aspects of material competence, aspects of material suitability, language aspects, display aspects, and usage aspects. The results of the validator's assessment of the material competence aspect are 4.33, the material suitability aspect is 4.33, the language aspect is 4.27, the display aspect is 4.43, and the usage aspect is 4.25. The validity of physics learning media in the form of e-comic in terms of all aspects is 4.32 with a very valid category. Thus, e-comic as a medium for learning physics for class X students on Momentum and Impulse material is declared valid and feasible to be used as a medium for learning physics.

Keywords: E-comic; Learning media; Momentum and impulse

Introduction

Education is a gradual process that is needed by someone in achieving knowledge (Sagita et al., 2022). Inriani et al. (2021), and Zulkifli et al. (2022) state that education is one of the factors to improve the quality of a country. The success of achieving educational goals at school depends a lot on what kind of learning process students experience as students (Slameto, 2003). One aspect that affects the success of learning in the classroom is the learning media used. Learning media has become a necessity in the learning process. The role of learning media in the learning and teaching process is an integral part that cannot be separated from the world of education. Learning media is anything that can be used to channel the sender's message to the recipient so that it can stimulate the thoughts, feelings, attention, and interest of students to learn. (Sadiman, 2014). The use of media is able to increase the efficiency of the learning process, because using the media is able to learn independently, not limited to a certain time, and is able to reduce the duration from before, and learning media can be said to be effective if it is able to enhance the

achievement of learning objectives, the level of achievement of these goals in the form of increased knowledge and skills and behavior development through the learning process (Daryanto, 2016).

Hidayat et al. (2017) Setiani et al. (2021), Azhar, (2008), and Danis et al. (2015) said that physics is a science that examines physical events that require the power to think, reason, analyze, and be scientific in order to understand concepts to solve problems in life around. Physics is often considered difficult because there are too many formulas and poly concepts. In one of the materials in physics subjects, namely Momentum and Impulse, students have difficulty understanding concepts so misconceptions often occur. Arista et al. (2013) stated that many complaints against physics subjects, therefore a sense of passion and love for physics must be grown in order to avoid boredom in students. In physics subjects, the availability of physics learning media is still very minimal, while in the current era, students are very dependent on using technology. The lack of interesting learning media for students results in students being less interested in learning physics. Therefore, the more interesting the learning

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media used by the teacher will increase the students' learning motivation.

Learning media is needed in learning because it can increase learning motivation and stimulate learning activities (Susanti et al., 2020). The learning process will be effective if it is supported by supporting media. Provision of dynamic, nurturing and dialogic media and training methods is necessary to optimally develop students' potential. That's because potential students are enthusiastic, supported by several media or facilities and infrastructure that support the interaction process that is currently being carried out. Due to their limitations, students are often unable to understand abstract things. To overcome this problem, learning media is needed as a bridge that clarifies and makes it easier for students to understand the messages to be conveyed in learning.

One of the learning media that can be used for teaching and learning activities is comics learning media. Comic itself is a reading that is favored by various ages, from children to adults. Comics are presented in the form of simple images and storytelling juxtaposed with images can increase the reader's passion. Images make the story easy to absorb, the text makes the comic easy to understand and the storyline makes the message or issue to be conveyed practical and memorable (Maharsi, 2011).

Comic learning media is proven to improve student learning outcomes. Irawan et al. (2019) Comic learning media is proven to improve student learning outcomes at SMK 1 PGRI Palembang with an average learning result of 82.09%. Danaswari et al. (2013) Teaching materials in the form of comics can improve student learning outcomes at SMAN 9 Cirebon with learning outcomes increasing from an average score of 57.13 to 75.88. In addition, based on research Hermawan et al. (2018) that learning using comics media is proven to be effective in increasing students' motivation and learning achievement towards the material being studied.

Azhar et al. (2021) and Zulkifli et al. (2022) Following the times, the electronic world is increasingly advanced and growing rapidly to the world of education. So that in carrying out the teaching and learning process not only use manual learning media, but also use digital learning media. Media as a teaching aid is growing so rapidly following technological advances. Various types of media are used according to the conditions and time, as well as the material to be delivered.

E-learning itself has several advantages including allowing for distance learning and can shorten the learning time target and can save costs. E-comic is a story that is conveyed using picture illustrations, or in other words e-comic is an electronic-based illustrated story. E-comic is a learning media that can be accessed by readers

anywhere and anytime, and can be used on any device, be it smartphones, laptops, or other desktops.

The use of these images is as a medium for story descriptions so that readers do not just imagine the shape of the story or the characters or locations that are the background of the story. The reader can see the physical form of the characters depicted in the story when explaining a statement. E-comic has several advantages that deserve to be used as learning media, such as building student interest, making the material more interesting, and helping students understand abstract concepts through storylines that cover the entire material. (Kanti et al., 2018). Therefore, learning media in the form of electronic comics needs to be developed to fulfill and complement previous research and answer students' and teachers' difficulties in learning.

Method

This research is a development research or R&D (Research and Development) using the ADDIE model development method, namely Analyze, Design, Development, Implementation, and Evaluation. Analyze phase researchers combine potential and problems with data collection based on the early stages of development research. The analysis is done by looking for information through literature studies about students' learning difficulties in studying Momentum and Impulse material. The Design phase begins with designing the Momentum and Impulse learning media for research. The design is made first in the form of a sketch image. The Development phase is an advanced stage of the product design stage. At this stage the design that has been made must be adjusted again to the needs to be achieved. At this stage the sketch is made with the help of Adobe Photoshop software, starting from making an outline to coloring which produces an output in the form of an image in PNG format. After the product is ready, the product is then published to the Webtoon and then given an assessment by the validator and validation of the product is carried out at least twice.

The data collection instrument used was a validity sheet. The instrument itself is a tool used to measure the observed natural or social events (Azhar, 2013). The validity sheet is given to the expert to determine the level of validity of the developed learning media. Aspects that are assessed on the validation sheet include aspects of material competence, aspects of material suitability, language aspects, display aspects, and usage aspects.

The types of data obtained in this study are quantitative data and qualitative data obtained from the results of the validator's assessment. Quantitative data in the form of validation values from e-comic learning media on Momentum and Impulse material. Qualitative data obtained from input criticism and suggestions from

the validator. The e-comic learning media on the Momentum and Impulse material for class X SMA is declared valid as a learning medium if all the assessment indicators on the validity instrument have an average value of > 3.40. The classification of the total validation assessment of the e-comic learning media used is as follows:

Table 1. Classification of total rating

Score Range	Range	Category
$\bar{X} > \bar{X}_i + 1.80 SB_i$	$\bar{X} > 4.20$	Very Valid
$\bar{X}_i + 0.60 SB_i < \bar{X} \leq \bar{X}_i + 1.80 SB_i$	$3.40 < \bar{X} \leq 4.20$	Valid
$\bar{X}_i - 0.60 SB_i < \bar{X} \leq \bar{X}_i + 0.60 SB_i$	$2.60 < \bar{X} \leq 3.40$	Less Valid
$\bar{X}_i - 1.80 SB_i < \bar{X} \leq \bar{X}_i - 0.60 SB_i$	$1.80 < \bar{X} \leq 2.60$	Invalid
$\bar{X}_i - 1.80 SB_i > \bar{X}$	$\bar{X} \leq 1.80$	Very Invalid

(Bahtiar, 2020)

Information:

- \bar{X}_i = $\frac{1}{2}$ (maximum score + minimum score)
- SB_i = $\frac{1}{6}$ (maximum score - minimum score)
- \bar{X} = average score

Result and Discussion

The product developed in this study is an e-comic as a physics learning medium for class X students on Momentum and Impulse material. This research is an R&D research with the ADDIE model development method. At the Analyze stage, it is carried out in two stages, namely needs analysis and task analysis. Needs analysis aims to determine the main problems faced in accordance with the development objectives. Based on the results of observations made by (Riyanti et al., 2019) at SMAN in Limapuluh Pekanbaru District, it was found that in the Momentum and Impulse material, understanding of concepts was still low and misconceptions in the medium category. Based on observations made by Priane et al. (2019) at SMAN 2 KS Cilegon, it was found that in the Momentum and Impulse material, students' understanding of concepts was low and misconceptions high. Observations made by Anggraini et al. (2018) that many of the tenth grade high school students still have misconceptions about the Momentum and Impulse material. At the task analysis stage, an analysis of the structure of the material is carried out by reviewing competencies in accordance with the curriculum. Then a concept analysis was carried out by making a concept map containing the main concepts that were arranged systematically. The final task analysis stage is the analysis of learning objectives by compiling learning objectives and

indicators and adjusting them to the demands of the curriculum.

At the Design stage, the design of the e-comic learning media is carried out by determining the title of the e-comic learning media, formulating and developing an outline of the material, making a storyline, and making a storyboard. The Development stage, it is adjusted to the needs that have been analyzed. Then the learning media that has been developed is validated. Validation of e-comic learning media filling out the validation sheet by the validator is carried out twice with criticism and suggestions for revision. The results of the validation on each aspect can be seen in Table 2.

Table 2. The average score of all aspects

Aspect	Average Score	
	Validation 1	Validation 2
Material Competence	2.56	4.33
Material Suitability	2.72	4.33
Language	3.53	4.27
Appearance	3.07	4.43
Usage	3	4.25
Average amount	2.98	4.32

Based on the result data in Table 2, the average number of all aspects in the first validation was 2.98 with a less valid category, so improvements were made to the e-comic learning media and a second validation was carried out. In the second validation the average number of validations is 4.32 with a very valid category. After the learning media was revised, the learning media were obtained as can be seen in Figure 1.

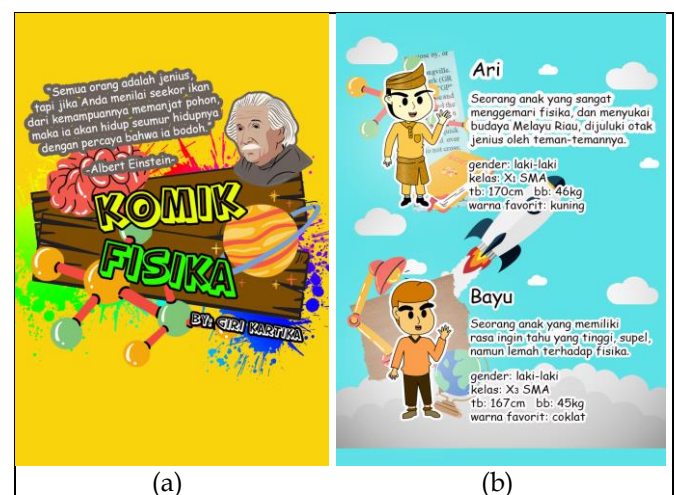


Figure 1. (a) cover of e-comic learning media, (b) e-comic learning media character introduction page

Figure 1 shows the opening page of the e-comic. Figure 1(a) is the cover page and Figure 1(b) is the introduction page for the e-comic characters Ari and Bayu. The form of the content of the e-comic material can be seen in Figure 2.

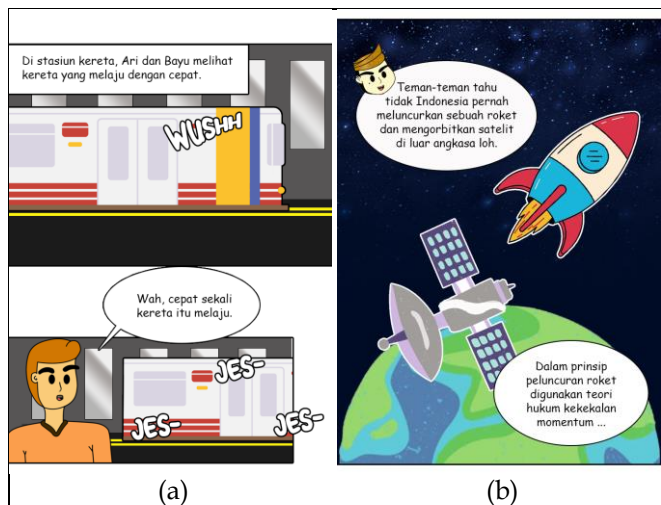


Figure 2. (a) introductory page of meeting material 1, (b) introductory page of meeting material 2

Conclusion

Based on the research that has been done, it is concluded that the development of e-comic as a physics learning medium for class X students on Momentum and Impulse material has an average score of 4.32 with a very valid category. So, e-comic as a physics learning medium for class X students on Momentum and Impulse material is declared valid to be used as a physics learning medium to help students understand Momentum and Impulse material.

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