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THE DEVELOPMENT OF COMICS AS LEARNING MEDIA TO IMPROVE STUDENT'S MOTIVAT IN MOMENTUM AND IMPULSES FOR HIGH SCHOOL

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Abstract

This study aims to: 1) develop interesting instructional media such as comics that can affect students' motivation, 2) determine students' motivation after using comics as learning media, and 3) determine the feasibility of comics and students' responses to momentum and impulses topic. The study was placed at SMAN 2 Medan and the participants were 20 science students in grade 10th. The type of research with a Pretest-Posttest group design model. The ADDIE model was used for preparing the instructional design of Physics Comic. The data on expert's validations, students' responses, and motivations were collected by using a questionnaire of experts' validation, student responses, and students' motivation. The result of this study is the product of momentum and impulses comic. The result of material validation is $\bar{X}$=4.25 in the good category and instructional media validation is $\bar{X}$=4.50 in the very good category. The assessment of students in the form of a response questionnaire is $\bar{X}$=4.38 in the very good category. It can be concluded that the momentum and impulses comic is feasible to use in learning and get positive responses from the students. Based on the results obtained, it can be concluded that the momentum and impulses comic is strongly feasible and very good so that it can be used in the learning process.

Keywords: Comic, Momentum and Impulses, Interactive media, Feasibility, Motivation

Technology and information advancements have a significant influence on human lives. Education is one of the effects of information and technology development. Education updates must be implemented in accordance with current circumstances. The objective is to raise educational standards so that students can successfully navigate new problems in the classroom. Thus, in order for the learning process to be successful and efficient, it must be planned, implemented, reviewed, and monitored. Education is a deliberate and organized attempt to establish a learning environment and learning mechanism in which students can actively improve their potential. A strong communication aspect is necessary for the learning process to communicate messages from teachers to students. The message communicated by the instructor would be well received by students if there is a strong communication aspect in the learning process. Learning media is a form of contact that can be used in the learning process. Learning media is one of the instruments in the learning process that helps students meet their learning goals. Learning media is a medium of communication, both written and audible, that can assist in the communication process during the learning process.

The use of media in learning exercises will facilitate students in accurately and efficiently understanding complex and complicated subject matter. The instructor will interact with students using the available media. Material that cannot be explained verbally by the teacher would be portrayed by the media used. For example, if the teacher's presentation includes photographs, a good medium to use is media that can display both images and words, such as comic books. The use of media in the classroom enhances students' interest in studying this content.

The educational process has traditionally seen students as objects to be filled with a variety of knowledge and instructional resources, which is quite a bit. The issue of meaningful learning is not adequately applied since the teacher-provided material is not grasped. Momentum and impulses are two subjects that demand discussion. Physics is a subject that is so pervasive in daily life that the majority of students are familiar with and experience it; nevertheless, the majority of students in the field are ignorant that this is a kind of physics. This is when students are typically exposed to studying content written on the inside pages of books in vocabulary that is complex and challenging for students to comprehend. Students are less interested in reading textbooks, like physics textbooks, due to the difficulty of the instructional materials provided. Yuliandari (2014) describes attempts to achieve exciting and creative learning, one of which is through the use of learning media in the teaching and learning process.

Since the teaching and learning process is primarily a communication process, the medium used in learning is referred to as learning media. Learning media is a portion of learning services, which include both software (learning materials) and hardware (learning tools). Meanwhile, according to Sudjana and Rival (2007), the primary role of teaching media is as a teaching aid that promotes the use of teachers' teaching methods. It is anticipated that the use of teaching media will improve the consistency of the teaching and learning environment, which in turn will influence the quality of student learning outcomes.

Achieving success in momentum and impulse learning requires meaningful learning experiences. Meaningful learning experiences are those in which learners obtain knowledge that is applicable and useful in their daily lives. Students are expected to be enthusiastic and take their learning seriously when they engage in meaningful learning. To offer a realistic environment for momentum and impulsivity, it is vital to adopt a learning medium that enables students to acquire knowledge not just theoretically, but also via more realistic learning experiences

As a result, there is a need for an effective solution for teaching momentum and impulses in an engaging and easy-to-understand way. One potential answer is to design media that is densely

packed with intriguing forms with the expectation that kids would learn on their own at home or school. Instructional media may serve as a motivator for students by focusing their attention and motivating them to engage with the material displayed (Rusman, 2012).

Learning media which can be developed in accordance with the development of science and technology is comic. A comic is a cartoon that expresses the character and acts out a story in sequence closely which is associated with the image and is designed to provide entertainment to the reader (Sudjana & Rival 2007) According to NTV Sekai Banzuke (global ranking), Indonesia is the second-largest manga reader (Japanese comics) behind Finland. In the United States, the average person who read comic books was 3.11, or around three books per person, but in Finland, the average person who read comic books was 3.59, or nearly four manga novels per person. Finland has a large manga/comic readership, owing to the fact that comics are employed as a form of education in Finland. The popularity of comic books encourages educators to explore this medium for educational purposes. Comics are already widely employed in a variety of disciplines, such as community education campaigns in the media. The comic is utilized in educational material since both the story and design are purpose-built to convey an educational message. According to Widyastuti et al, 2017 study "Learning Media Using Comics in the Linear Equation Framework," comics can be used as student worksheets. It is well known that comics are an excellent medium for use in and out of the classroom. It is also sufficient to save students from being bored. According to Nugrahani (2007: 43), virtual-based learning media is an effective tool for raising students' absorption and comprehension of lessons, especially difficult-to-accept learning without media intermediaries. Students would be most interested in learning resources that provide drawings that help them grow their creativity. Educational comics should be used to include visual-based learning media. According to Wahyuningsih (2015), students like to read picture story books like comics rather than textbooks because comics have a consistent and cohesive plot that is easy to remember.

In this study, the researcher chose to develop a physics comic. The researcher attempts to offer an alternative by creating physics comics to provide a more engaging physics lesson so that students are more interested in learning the content of momentum and impulses well. The comic will be made using ADDIE Method and with Corel Pro Studio Painter and Canva.

RESEARCH METHODS

This type of research is research and development (R&D). The development model refers to the ADDIE model which consists of the analysis, design, development, implementation, and

evaluation stage (Branch,2009) The model is one of the most widely used models to produce effective learning problems (Wang & Hsu, 2008). The model is suitable for developing educational products and other learning resources.

Figure 1 The Stage of Research

The analysis is the stage where we analyze the curriculum, student analysis, material analysis, and formulation of objectives is administrated. Analysis of the educational programs is to decide the most suitable curriculum in the study, where this study uses the 2013 curriculum. Student analysis is performed to identify issues that affect students, student needs, and student characteristics that will serve as the study's sample. Material analysis is performed in order to choose and regulate appropriate materials.

Meanwhile, design, the initial step at this point is to identify sources that can be used as content sources. Furthermore, comic learning will be intended to be made. During the media design process, the following tasks will be completed: summarizing the information, identifying characters in comics, sketching comics and drawing comics in picture format (jpg), and creating an overall storyboard. After that, create the comic's cover, read through the content, and add learning objectives. The final process is comic printing.

In the development stage validation was performed on previously created or planned comic media at this level of creation. Media experts, content experts, and physics teachers participate in the validation process. The consequences of the validation include product consistency, comments, and suggestions from the validators. It may be used to assess and improve media material.

Next in implementation, a researcher will be tested on SMAN 2 Medan. This stage would use a test instrument to assess student learning progress as well as a questionnaire to assess student learning Evaluation is the last stage where researchers aim to evaluate the product that has been developed according to the result of the implementation stage.

This research will be conducted at SMA Negeri 2 Medan. The research location was chosen because high school-level subjects are relevant to the research title. The time of this research is from January to February 2022. The population in this study were students of class XI MIPA SMA

Negeri 2 Medan for the 2021/2022 school year. The sample in this study were all students of class XI MIPA 1 and XI MIPA 2 SMA Negeri 2 Medan.

The research instrument was used to measure students' motivation after using comics as learning media in momentum and impulses. In the initial observation, the researcher also interviewed a physics teacher at SMA Negeri 2 Medan to find the problems during the learning process. The distribution of students' responses and motivation questionnaires was conducted to find out the responses and motivation of students towards the comic. The expert's validation and students' responses questionnaire will be analyzed using a Likert scale with 5 scales. Then, the results were categorized as shown in Table 1

Table 1 Rating Scale of Categories (Sugiyono, 2011)

Score Interval	Category
$X > 4.2$	Very Good
$3.4 < X \leq 4.2$	Good
$2.6 < X \leq 3.4$	Good enough
$1.8 < X \leq 2.6$	Not good
$X \leq 1.8$	Not very good

RESULT AND DISCUSSION

Comic Development Stages

The development of momentum and impulses comic is using the ADDIE model. In the analysis stage, the researcher observed students' and interviewed teachers. The availability of learning media in this school is usually from textbooks only. The potential is quite good because students are skilled in using gadgets. Students have a high willingness to learn with interactive media. The comic will be shared in softcopy and hardcopy. The result of the analysis stage shows that students need additional instructional media to support their learning, especially for momentum and impulse material. According to the syllabus, the content of the momentum and impulses comic includes identifying the notion of momentum and impulses, an explanation of the variation collisions, and identifying the concept of force. In the design stage, the researcher starts the design step using Corel Painter Essential Pro 8 and after the raw sketch, the researcher scan it and put it on Canva and continues the process such as adding the storyboard, speech balloon, background and changing the fonts types and color. After all the images are gathered together in Canva the end result is save the media in .pdf and .png format.

The Feasibility of Momentum and Impulses Comic

In the development stage, the comic was validated by instructional material experts. The expert validation is a lecturer of Physics Education at Universitas Negeri Medan, the goal of this step is to see how feasible is the comic. All suggestions and comments from the validators were used to revise the comic before students use the final product of the comic. The result of expert validation is explained below :

Table 2 Material Validation

Aspects	Average		Score
	Expert 1	Expert 2	
The material suitable with fundamental competencies	4	5	9
The suitability of the learning objectives	5	5	10
The suitability of learning materials	4	3	7
The accuracy in using Physics symbols	4	5	9
The attractiveness as a learning media	3	4	7
The language is easy to comprehend	4	5	9
Average score			**4.25 (Very Good)**

Table 3 Media Validation

Aspects	Average		Score
	Expert 1	Expert 2	
The accuracy of comic size	4	4	8
The attractiveness of designing comic	5	5	10
The simplicity of learning media	4	4	8
The blend of visual aspects	5	4	9
The clarity of the storyline	5	5	10
The accuracy of font and color	4	5	9
The ease of media	5	4	9
Average score			**4.50 (Very Good)**

The outcome of material validation includes aspects such as compatibility with fundamental competencies, compatibility of comics with learning objectives, compatibility with learning materials, accuracy in using physics symbols, attractiveness as a learning media, and language comprehension. Table 1 displays the results of the material expert validation, which received an average score of 4.25, placing it in the very good category. However, some features of media validation include the accuracy of comic size, the appeal of design comics, the simplicity of learning media, the blend of visual components, the clarity of storyline, the correctness of font and color, and the convenience of media. Table 2 displays the results of the media expert validation, which

received an average score of 4.50, placing it in the very good category. All professional ideas and criticisms were utilized to edit the comic before it was used by students.

The Increasing Student Motivation

To assess students' motivation, the researchers issued a motivation questionnaire. Ten statements comprise the students' motivation questionnaire. Table 3 shows the results of the students' motivation questionnaires before utilizing the comics for each sentence.

Table 4 The Result of Students' Motivation Before Using the Comic for Each Statement.

Statements	**Average Score**
I want to achieve the highest possible grade in physics class.	4,05
I want to be able to comprehend and apply the concepts presented in the book.	4,25
Understanding the substance of momentum and impulse is really essential to me.	4,50
Physics does not seem to be significant to me.	3,95
I enjoy learning with books	3,85
Learning using books increases my curiosity	4,30
Books have been enough to help me understand momentum and impulses	3,85
I feel satisfied if I can complete the assignments given by the teacher	3,95
I feel satisfied if the results obtained are my own efforts	4,00
I'm happy if I know the truth of the answers in working on the questions in the book	4,20
I'm happy if my score is higher than my friends	4,20
I'm not driven to get high marks in learning so far even though my friends get high scores	3,70
I study diligently until I get the maximum value in learning	3,65
The book really encouraged me to do my own test questions	4,65
I try to do my assignment well	4,45
The form of exercise presented in the book is interesting	3,75
I'm happy to get compliments every time I work on a problem	1,85
Books with illustrations are more interesting than textbooks only	4,25
For me studying physics with books is more interesting	4,20
Learning is more fun and less boring if you use books	3,90
Total average	**3,98**

A questionnaire was administered to students before and after they used the media. The purpose of the trial test was to determine the validity and reliability of the researcher's questionnaire also found an increase in motivation of students studying with comics as learning media. Each student was given a questionnaire, which consisted of two questionnaires.

Table 5 The Result of Students' Motivation after Using the Comic for Each Statement.

Statements	**Average Score**
After taking physics lessons with comics, I want to get the maximum score	4,45
I want to be able to understand and work on the problems in the comics	4,75
Being able to understand the material of momentum and impulse is very important to me	4,00
The first time I saw comic media I wanted to know more about its contents	3,75
Learning to use comics raises my curiosity	4,00
Comic based physics module can help me understand physics, especially momentum, and impulse	4,20
I feel that physics is not important to me	4,85
I feel satisfied if I get high scores in comic-based physics modules	4,00
I feel satisfied if the results obtained in answering questions in the comic-based physics module are my own efforts	4,05
I'm happy if I know the correct answer in working on every question presented in the comic-based physics module	3,85
After taking physics lessons with comics, I want to get the maximum score	4,00
I'm happy if my score is higher than my friends in solving problems in comic-based physics modules	4,35
I'm not driven to get high marks in learning with comic-based physics modules even though my friends get high scores	3,45
I studied diligently until I could answer all the questions in the comics	4,85
With the comic-based physics module, I am compelled to do my own daily test questions in the future	4,95
I try to do my job well	4,40
The form of exercise presented in the comic-based physics module is interesting	4,60
I'm happy to get compliments every time I work on a problem	4,20
Comic-based physics modules with illustrations are more interesting than textbooks in learning	3,75
Learning physics using comic-based physics modules is more interesting	4,90
Total average	**4,27**

From Table 4 we can see the result of the questionnaire after using the comic as a learning media in momentum and impulses. The average score for 20 statements is 4,27. The highest score on the statement is learning physics using comic-based physics modules is more interesting with a 4,90 average score. The increase in students' motivation before and after using the comic as learning media can be shown in Figure 2.

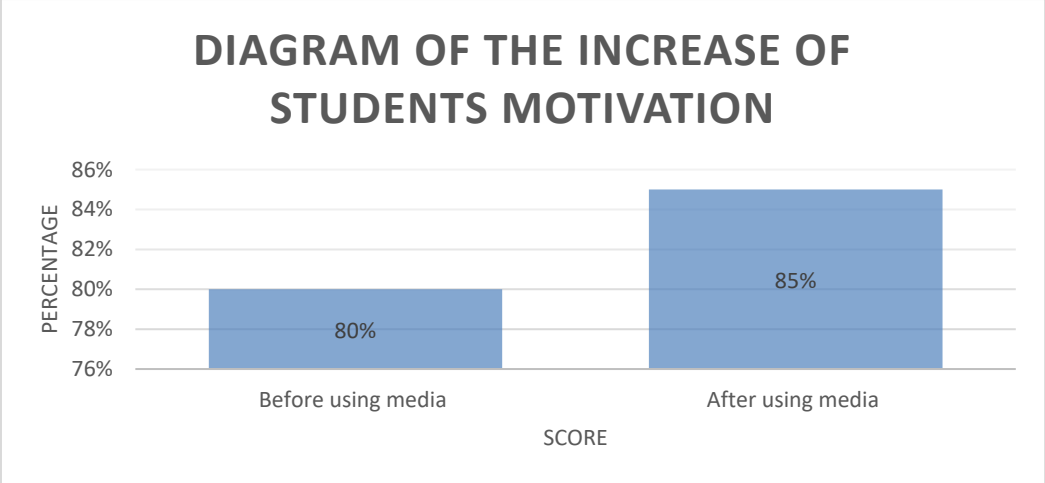

Figure 2 The increase in Students' Motivation before and after using comic

Based on Figure 1 the average score of students' motivation before using the comic is 3,98 meanwhile the score after using the comic is 4.27. On the percentage, there's a 5% increase in score from before and after using Comic. This result indicates that the use of the comic in momentum and impulses increases students' motivation. This comic also can be used as an alternative medium to learn physics. Based on the result the features in comics such as an interesting plot, attractive images, simple language, and the use of characters are helping the student to learn momentum and impulses in more fun and engaging way.

Table 6 The Result of paired t-test after using a comic.

							95% Confidence Interval of the Difference	
	t	Df	Sig (2-tailed)	Mean	Std Deviation	Std. Error Mean	Lower	Upper
Before-After	1,837	19	0.000	0.2925	0.7117	0,591	0.017	0.567

Table 6 displays the value of t =1,837 with Sig. (2-tailed)=0.000. These results indicate that using a comic with momentum and impulses improves students' motivation. This is supported by research undertaken by (Piaw,2012) who found that using comics can increase students' enthusiasm to learn in class.

CONCLUSION AND SUGGESTION

The momentum and impulses were comic has been developed by using the ADDIE model which consists of analysis, design, development, implementation, and evaluation stage. Based on the result of validation it can be concluded that comic is feasible to use in class for momentum and impulse material. Meanwhile, for the result of the student questionnaire we can see the result that the comic is help increasing the motivation of students while studying physics, especially in momentum and impulse material.

Comic presented physics concepts in a more understandable way, easy to understand and to remember. Therefore comics can be an alternative medium to learn physics concepts. The use of comics in learning can enhance students' intrinsic motivation and improve learning engagement. Comics can also improve students' visual representation and high-order thinking skills. It is also applicable if the comic is in different physics material such as Newton's law or electricity.

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