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Research Article

The folklore-based comic to increase students' motivation in physics learning

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Abstract

The use of interesting instructional media such comics can affect students' motivation. However, insufficient instructional media can demotivate students in learning. The purposes of this study were to produce a folklore-based comic, to determine the feasibility and students' response to the comic, and to describe the increasing of students' motivation after using the comic. The study was conducted at Senior High School 1 Muaro Jambi and the participants were 25 science students of grade 11th in 2019. The type of research was used pre-test and post-test single group design model. The ADDIE model used for prepared instructional designs of folklore-based comics. The folklore-based comic instructional designs validated by material and instructional media experts before being implemented to students. The data of experts' validations, students' responses and motivations were collected by using questionnaire of experts' validation, students' responses, and students' motivation. The result of this study is Newton's law comic based on Indonesian folklore, Orang Kayo Hitam, that originated from Jambi region. The result of material validation is $\bar{X}$=3.77 in the good category and instructional media validation is $\bar{X}$=3.62 in the good category. The assessment of students in the form of response questionnaire is $\bar{X}$=4.31 in the very good category. The gain value of students' motivation after using the comic is 0.39 in the medium category. It can be concluded that the folklore-based comic is feasible to use in learning and get positive responses from the students. The comic also can be used as an alternative medium to increase students' motivation significantly ($t_{(24)}$=-5.185, p<.005) and assist them to understand Newton's law concepts easier.

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Introduction

Instructional media are all tools and devices which can be used to record, store, transmit, preserve, and to retrieve information in teaching and learning. It includes books, textbooks, supplementary reading materials, audio visuals, etc. (Hanachor & Needom, 2015). Instructional media determine students' participation in learning (Edd, 2015). The use of instructional media can improve students' understanding and stimulate students' interest (Widodo, 2018; Lana et al. 2019). In physics learning, instructional media make abstract concepts can be visualized. Therefore, it can assist students to understand the concepts easier (Chiu et al. 2015; Chang et al. 2008). It is necessary to apply appropriate and interesting instructional media in order to increase students' motivation (Fadieny & Fauzi, 2019).

The use of comics as instructional media has been widely used to improve learning (Matuk et al. 2019; Spiegel et al. 2013; Hosler & Boomer, 2011). Comics are visual media to convey information that combines pictures and text which are arranged in a storyline (Sukmahidayanti, 2015). The use of comics as a learning medium has important role to increase students' interest and it can bring students into a pleasant atmosphere and create excitement in learning (Pardimin & Widodo, 2017; Stanton et al. 1887). As reported in (Lin et al. 2015) the use of comics can enhance the readers' interest and enjoyment, while the use of traditional textbooks decreased their interest and

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enjoyment in reading. More readers were interested in learning via comics than via traditional textbooks. For high school students, comics can be a source of insight, reflection, and critical thinking in science domain (González et al. 2015).

Comic Features

Comics have many features that can assist students in learning. Cartoon concept and interconnected image of comics presented complex concepts in a more understandable way, easy to understand, and to remember (Tatalovic, 2009; Kumaran et al. 2009). The combination of visual representation and scientific explanation in comics is deemed as an effective tool to communicate science. Humor perspective in comics can enhance students' intrinsic motivation and improve learning engagement (Lin et al. 2015). Because of their attractive visual, overall appeal, and humorous perspective, comics have been used as instructional media for many decades in learning.

Comics make a complex idea easier and simpler to understand because the visual representation feature of comics can help the readers to understand an idea. Characters in comics can guide and engage the readers with the comics and make them understand and remember the idea (McDermott et al. 2018). The humor and story plot features of comics are memorable than usual rules for students (Ozdemir, 2017). The use of analogies in comics to deliver abstract ideas can assist the readers to make a connection between something that they can relate to abstract idea that may be difficult to understand (McDermott et al. 2018).

Folklore-based Comic

This research is different from previous studies because the storyline of comic will be developed based on Indonesia folklore, entitled Orang Kayo Hitam. Our reason to use Orang Kayo Hitam as storyline of the comic was that this folklore is local wisdom of students' region and close to the students' learning environment. This folklore has some story scenes related to the concepts of Newton's law such as the activities of pushing, pulling, rowing a canoe, and riding a horse, etc. The use of folklore as storyline makes the comic become more interesting (McDermott et al. 2018). Previous study showed the use of culture-based comics can increase students' responses in learning. The combination of cultural contents and comic in learning can enhance students' motivation and learning achievement (Ntobuo et al. 2018). Culture-based learning can encourage students to construct and make connections between knowledge and reality in their environment (Setiawan et al. 2017). It can assist students to understand the relationship of what they are learning and their life-world (Aikenhead & Jegede, 1999).

Besides using folklore as the storyline of the comic, we also use mobile application to develop the comic. There are some mobile applications that can be applied to develop the comic, such as Medibang Paint, Ibis Paint X, Adobe Illustrator Draw, etc. All of the applications have different uniqueness and properties. We use Medibang Paint application because it is easy to use. Medibang Paint is a free digital painting program and comics maker application with a variety of features such as brushes, fonts, backgrounds, and many other features. Medibang Paint application is also available on various Windows and Android platforms. To use this application on Android is also fairly easy for beginners, and can be used at any time.

Problem of Study

Based on analysis of the students' needs, observation of students' activities in learning, and interviewing the physics teacher in Senior High School (Sekolah Menegah Atas, SMAN 1 Muaro Jambi), learning media available in the school are generally in the form of textbooks and students' worksheets. These media are less interesting and make students bored and disinterest in learning. They also find difficulties in understanding the concepts of Newton's law. Most students like to read comics and tend to use interesting instructional media, full of illustration, and colorful. Therefore, they agree if Newton's Law material is displayed in comic form in order to motivate them in learning.

Motivation is an important aspect required for learning process. Highly motivated students have positive thinking and more positive attitude towards physics learning (Eryilmaz et al. 2010). The use of appropriate and interesting instructional media can increase students' motivation (Fadieny & Fauzi, 2019). Pictorial instructional media such comics can be an alternative instructional media to increase students' motivation (Nikmah et al. 2019). In this study, the formulations of the problems are:

- How are the stages used to develop folklore-based comic?
- Is the folklore-based comic feasible to use in learning?
- What are the student's responses to the folklore-based comic?
- How the folklore-based comic increase students' motivation?

Method

Research Design

The type of research is research and development (R&D). The developing model refers to the ADDIE model which consists of analysis, design, develop, implement, and evaluate stage (Branch, 2009). The model is one of the most widely used models to produce effective learning products. It was chosen because of its clear and systematic development stages in solving learning source problems (Shiang & Hui, 2009). The model is also suitable for developing educational products and other learning resources. The procedures of development of this research are shown in Figure 1.

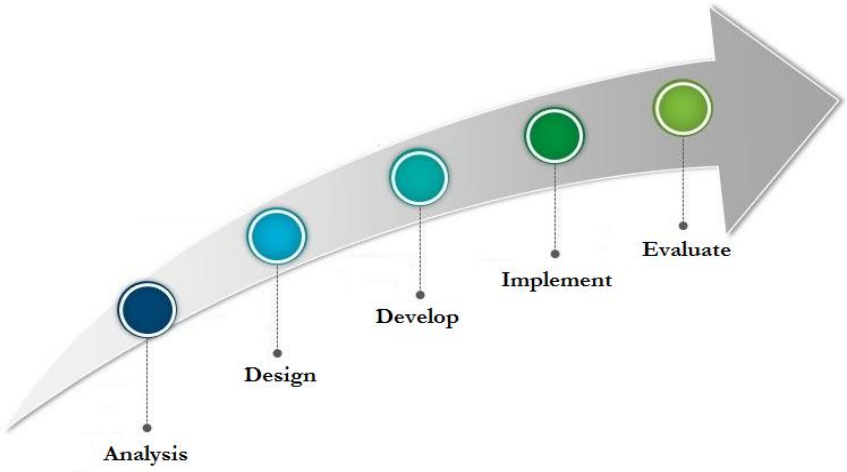

Figure 1.
The Stages of Research

Analysis; the first stage of the ADDIE model called analysis. In the analysis stage, the researchers gather information about students' needs and problems during learning process by distributing the needs questionnaires, observing students' learning activities, and interviewing the teachers.

Design; in design stage, the researchers designed the comic based on the results in analysis stage and set learning objectives. The design stage was to make sure the product can be used to solve the problems obtained in the analysis stage. In this stage, the researchers design initial sketches of the comic such as the characters of the comic, storyboard, speech balloon, background, and font types.

Develop; In the development stage, the researchers create the product according to the design stage. In this stage, the researchers examine the feasibility of comic through the validation of media and instructional material experts. The expert validators are lecturers of Physics Education in Jambi University, this is done in order to find out how feasible the comic to use in learning. All suggestions and comments from the validators were used to revise and improve the comic before being implemented to students.

Implement; the implementation stage was carried out by distributing folklore-based comic to students on the topic of Newton's law. After the students read the comic, the researcher distributed questionnaires to find out students' responses and motivation after using the folklore-based comic. To find out the increasing of students' motivation, the researchers calculated using the N-Gain equations.

Evaluate; evaluation is the last stage that aims to evaluate the product that has been developed according to the results of implementation stage.

Participants

The subjects of this study were 25 science students at grade 11th Senior High School 1 Muaro Jambi in 2019. The subjects were selected using a purposive sampling technique. In the initial observation, the researcher also interviewed a physics teacher at Senior High School 1 Muaro Jambi 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 folklore-based comic.

Data Collection

The research data were obtained from the results of expert validation questionnaires, students' response questionnaire, and students' motivation questionnaire.

Expert Validation Questionnaires

Expert validation questionnaires consist of material validation questionnaire and instructional media validation questionnaire. The expert validation questionnaires were adopted from (Ilyana, 2016). The questionnaires were a Likert scale with 5 scales consisted of very valid (5), valid (4), quite valid (3), less valid (2), and not valid (1). Material validation questionnaire consist of 5 aspects i.e., the clarity of comic, the suitability with the learning objectives, the suitability with learning material, the accuracy in using the physics symbols, the attractiveness as a learning medium. Instructional media validation questionnaire consists of 6 aspects i.e., the accuracy of comic size, the accuracy of layout, the attractiveness of image, the simplicity of learning media, the blend of visual aspects, the clarity of storyline.

Students' Response Questionnaire

The students' response questionnaire was a Likert scale with 5 scales consisted of very feasible (5), feasible (4), quite feasible (3), less feasible (2), and not feasible (1). The students' response questionnaire consists of 12 statements as shown in table 5. The students' response questionnaire was adopted from (Ilyana, 2016).

Students' Motivation Questionnaire

The students' motivation questionnaire was a Likert scale with 4 scales consisted of completely agree (4), agree (3), disagree (2), and completely disagree (4). The students' motivation questionnaire consists of 12 statements as shown in table 5. The students' motivation questionnaire was adopted from (Deashara, 2016).

Data Analysis

The experts' validation and students' response 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 (Walyani, 2015)

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

Students' motivation is measured through a motivation questionnaire. The increasing of students' motivation is calculated using gain equation (Hake, 1998)

$$g = \frac{Sf - Si}{100 - Si} \quad (1)$$

g is the gain score obtained, Sf is the posttest score and Si is the pretest score. The interpretation of the gain in each aspect observed could be done with the gain score categories as the basis, shown in Table 2.

Table 2.

Category of Gain Score (Hake, 1998)

Gain Score	Category
g > 0.7	High
0.3 ≤ g ≤ 0.7	Medium
g < 0.3	Low

We used the paired t-test to see the significance of increasing student motivation before and after using the folklore-based comic. Before performing the paired t-test, data normality was tested using Shapiro-Wilk (Maxwell, Delanay & Kelley, 2017).

Procedure

The stages of research consisted of the analysis, design, develop, implement, and evaluate stage. The implementation of folklore-based comic was conducted on 25 science students of grade 11th of Senior High School 1 Muaro Jambi

for 2 weeks, 25 November to 10 December 2019. Documentation of the implementation stage can be seen in Figure 2.

Figure 2.
The Implementation of Folklore-based Comic

Results and Discussion

Folklore-based Comic Development Stages

Newton's law comic based on the folklore Orang Kayo Hitam was developed using the ADDIE model. In the analysis stage, the researchers spread students' needs questionnaire, observed students' activities in learning, and interviewed the teachers. The results of the needs questionnaire showed that students need additional instructional media to support their learning, especially for Newton's Law material. We also found that the available learning media in schools were generally in the form of textbooks and students' worksheets. These media are less interesting and demotivate students in learning. Therefore, these problems make some students find difficulties in understanding the concepts of Newton's law.

Jambi region has many folklores that are quite well known by the community such as Orang Kayo Hitam, Angso Duo, Panglima Syawal, and so on. However, the researchers chose Orang Kayo Hitam as the basis of the comic because the story scenes of Orang Kayo Hitam are the most suitable to explain Newton's Law concept than other folklores. The scenes in the comics can be related to Newton's law concepts such as the activity of pushing and pulling, rowing a canoe, etc, as shown in Figure 3. The activities related to Newton's Law concept will be explained in more detail in another section of the comic in order to emphasize the concepts, as shown in figure 4.

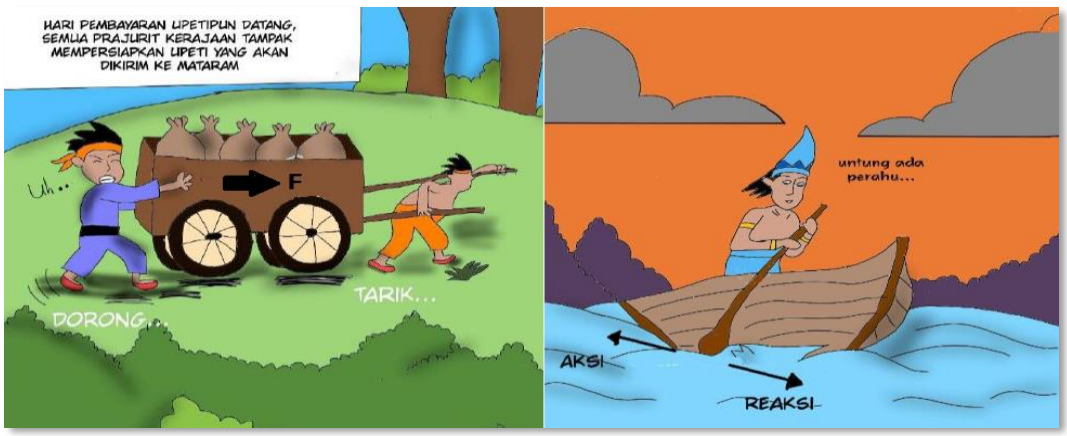

Figure 3.
Some Scenes of Orang Kayo Hitam Folklore Relate to The Concept of Newtons' Law

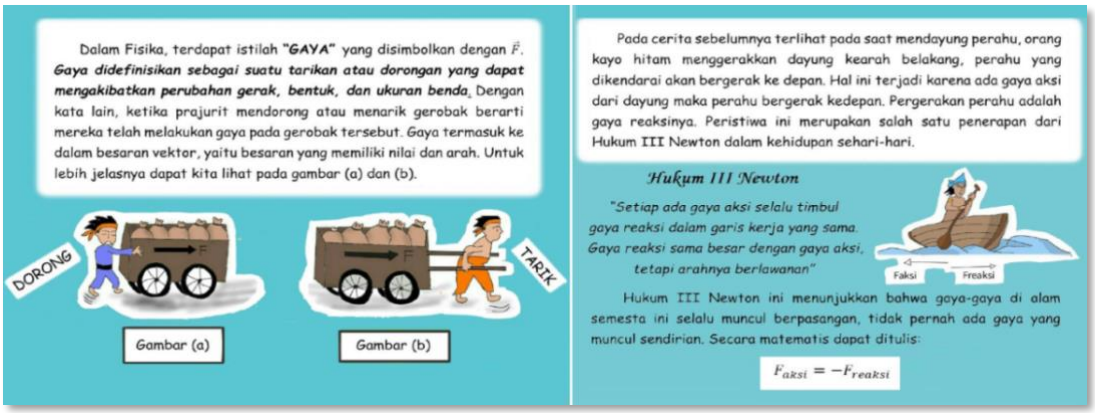

Figure 4.
Explanation of Force Definition and Newton's Third Laws

The comic was developed based on the students' needs referring to the results of initial observation. The material in the comic was developed according to the learning objectives. In general, this comic contains Newton's law materials, including the definition of force, Newton's first law, Newton's second law, Newton's third law, gravity and normal force, friction force, and circular force. This comic also has example problems to help students to understand Newton's law concepts. In the design stage, the researcher design initial sketches of the comic such as the characters of the comic, storyboard, speech balloon, background, and font types. After all of the images are selected, it will proceed with the coloring process. Medibang paint application provides complete features such as color variations, pencils, speech balloons, and fonts that make it easy for the users.

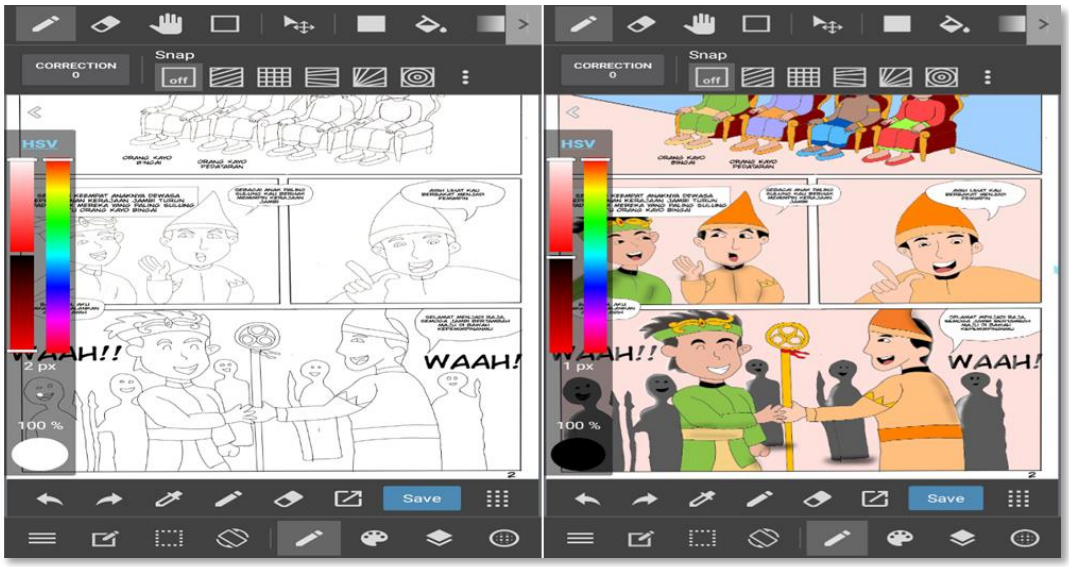

Figure 5.
The Process of Drawing and Coloring Using Application Medibang Paint

The Feasibility of Folklore-based Comic

In the development stage, the comic was validated by instructional media and material experts. The expert validators are lecturers of Physics Education in Universitas Jambi, this is done in order to find out how feasible the comic is developed, and whether comic is worthy to be used as learning medium. All suggestions and comments from the validators were used to revise the comic before being implemented to the students. The result of expert validation is explained in table 3 and 4.

Table 3.
Material Validation

Aspects	Average		Score
	Expert 1	Expert 2	
The clarity of comic	4	2.7	3.35
The suitability with the learning objectives	4	2	3
The suitability with learning material	4	3	3.5
The accuracy in using the Physics symbols	4	4	4
The attractiveness as a learning medium	5	5	5
	Average score		**3.77 (Good)**

Table 4.
Instructional Media Validation

Rated aspect	Average		Score
	Expert 1	Expert 2	
The accuracy of comic size	4	2.7	3.35
The accuracy of layout	4	3	3.5
The attractiveness of image	4	2.7	3.35
The simplicity of learning media	4	3	3.5
The blend of visual aspects	4	3	3.5
The clarity of storyline	5	4	4.5
	Average score		**3.62 (Good)**

The result of material validation consists of some aspects i.e. the clarity of comic, the suitability of comic with learning objectives, the suitability of comic with learning material, the accuracy in using the symbol of physics, and the attractiveness of comic as a medium of learning. Table 3 shows the results of the material expert validation get an average score of 3.77. Based on the conversion of the scale in Table 1, these results are in the good category. Validation of instructional media expert consists of some aspects i.e. the accuracy of comic size, the accuracy of layout, the attractiveness of image, the simplicity of learning media, the blend of visual aspects, and the clarity of storyline. Table 4 shows the results of media expert assessment, the media expert validation got an average total score of 3.62. Based on the conversion of the scale in Table 1, these results are in good categories. All suggestions and comments from the experts were used to revise the comic before being implemented to students. Based on the results of the validation of material and instructional media experts, the comic is declared feasible to be implemented to students.

Students' Responses of Folklore-based Comic

After the comic is declared feasible by the experts, the researchers distributed students' response questionnaire to see the responses of students after they used the comic. There capitulation of students' responses was shown in Table 5.

Table 5.
Recapitulation of Students' Responses

Statements	Average score
I understand Newton's Law material in the comic	3.88
I can relate Newton's Law material delivered in the comic	3.44
I can understand the contents of comic easily	4.16
The comic is interesting to read	4.48
The size of comic is appropriate	4.24
I can read the comic easily	4.36
I like the pictures in comic	4.84
I like the characters in comic	4.56
I like the choices of color in comic	4.40
I understand the storyline of folklore in comic easily	4.52
I understand the use of language in comics easily	4.44
The sentences in the comic are brief and concise	4.44
Total average	**4.31**

Table 5 shows the results of students' responses. The students' response questionnaire consists of 12 statements as shown in table 5. The average of all statements is 4.31 in the very good category. The result indicates that the comic can be used as an alternative medium to learn Newton's law concepts. The comic can assist students in understanding Newton's law concept due to its colorful and interesting image, simple language to deliver the concepts, and good storyline. This is in line with the research conducted by (Toh et al. 2016) that revealed the interesting illustrations and simple language of comics can assist students to understand abstract and complex concepts easier. Moreover, (Kennepohl & Roesky, 2008) stated that the visual representation and narrative features in comics deliver scientific information in an attractive, accurate, and comprehensible way. Difficult concepts should be presented in a more understandable way, so learning through comics might be preferable (Tilley, 2008). Therefore, comics are considered as an alternative medium in learning (Kennepohl & Roesky, 2008).

The use of folklore as storyline makes the comic become more interesting and assist students to understand the concepts easier. This is supported by the research conducted by (Ntobuo et al. 2018) stating that the combination of cultural contents and comic in learning can enhance students' interest, learning achievement, and motivation. Moreover, the use of cultured based comic is able to foster students' interest and preserve local wisdom (Haroky et al. 2020). The culture-based learning can encourage students to make connections between knowledge and reality in their learning environment (Setiawan et al. 2017). It also can assist students to understand the relationship of what they are learning and their life-world (Aikenhead & Jegede, 1999).

The Increasing of Students' Motivation

The researchers distributed motivation questionnaire to see students' motivation. The students' motivation questionnaire consists of 10 statements. The results of the students' motivation questionnaire before and after using the comics for each statement can be seen in Table 6 and Table 7.

Table 6.

The Result of Students' Motivation before Using the Comic for Each Statements

Statements	Average score
I did the Newton's law material problems immediately	2.68
There are things that stimulate my curiosity if I study without using media	2.24
I re-studied the material that was given by the teacher outside of class time	2.48
For me learning without using instructional media is quite interesting	2.80
I have a target to get above average scores	3.52
I am happy when the teacher gives points when I can do assignments in front of the class	3.24
I am happy when teachers, parents, and friends appreciate my learning efforts	3.56
I love reading books and excited about doing exercises in Newton's law material	2.56
In class, I'm sleepy or not focused because learning without instructional media is boring	2.64
I am passionate about taking Newton physics lessons	2.64
Total Average	**2.84**

From table 6, we can see the average score for statement I did the Newton's law material problems immediately is 2.68, there are things that stimulate my curiosity if I study without using media is 2.24, I re-studied the material that was given by the teacher outside of class time is 2.48, for me learning without using instructional media is quite interesting is 2.80, I have a target to get above average scores is 3.52, I am happy when the teacher gives points when I can do assignments in front of the class is 3.24, I am happy when teachers, parents, and friends appreciate my learning efforts is 3.56, I love reading books and excited about doing exercises in Newton's law material is 2.56, in class, I'm sleepy or not focused because learning without instructional media is boring is 2.64, and the average score for statement I am passionate about taking Newton physics lessons is 2.64. The total average for all statements is 2.84.

Table 7.

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

Statements	Average score
I did the Newton's law material problem immediately	2.92
There are things that stimulate my curiosity when learning to use comic media	3.08
I will review the material given by the teacher outside of class time by using comic media	2.96
For me, learning by using comic media is quite interesting	3.32
I have a target to get above average scores	3.60
I am happy when the teacher gives points when I can do assignments in front of the class	3.48
I am happy when teachers, parents, and friends appreciate my learning efforts	3.69
Comic media makes me happy in reading and motivate me to do exercises about the Newton's law material	3.12
With the presence of comic media in the classroom, I am not sleepy or my mind is not focused because the varied lessons are not boring	3.32
I am passionate about taking part in the Newton's law lesson by using comics	3.40
Total Average	**3.29**

From Table 7, we can see the average score for statement I did the Newton's law material problem immediately is 2.92, there are things that stimulate my curiosity when learning to use comic media is 3.08, I will review the material given by the teacher outside of class time by using comic media is 2.96, for me, learning by using comic media is quite interesting is 3.32, I have a target to get above average scores is 3.60, I am happy when the teacher gives points when I can do assignments in front of the class is 3.48, I am happy when teachers, parents, and friends appreciate my learning efforts is 3.69, comic media makes me happy in reading and motivate me to do exercises about the Newton's law material is 3.12, with the presence of comic media in the classroom, I am not sleepy or my mind is not focused because the varied lessons are not boring is 3.32, and the average score for statement I am passionate about taking part in the Newton's law lesson by using comics is 3.40. The total average for all statements is 3.29.

The increasing of students' motivation before and after using the folklore-based comic can be shown in Figure 6.

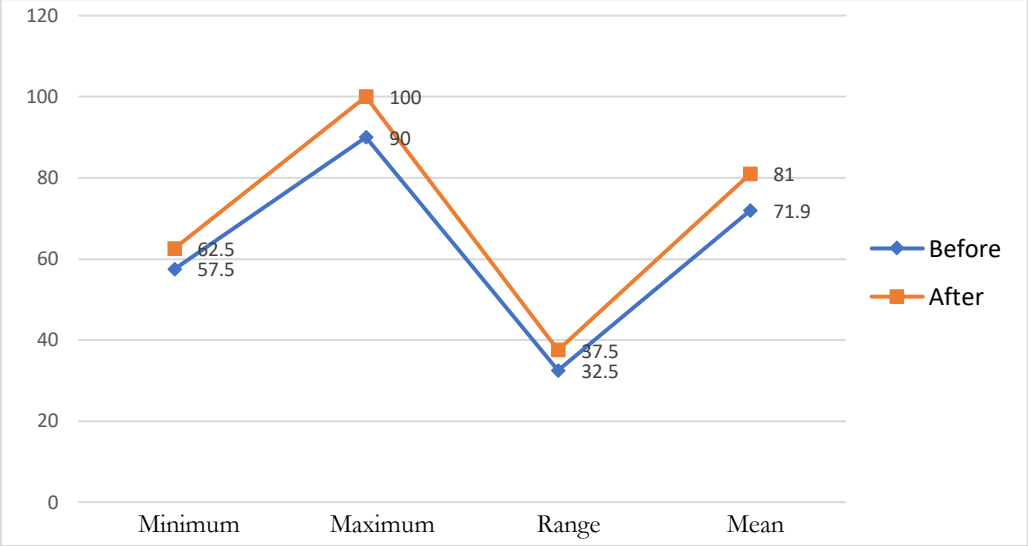

Figure 6.

The Increasing of Students' Motivation before and after Using Folklore-based Comic

Based on figure 6, the mean score of students' motivation before using the comic is 71.9 and the mean score of students' motivation after using the comic is 81. The increasing of students' motivation can be calculated using N-Gain equation (Hake, 1998). From N-Gain equation we get the gain value 0.32 in the medium category. The paired t-test was used to see the significance of increasing students' motivation before and after using the folklore-based comic. Before performing the paired t-test, data normality was tested using Shapiro-Wilk. According to the Shapiro-

Wilk normality test, Sig. value before using the comic is 0.322 > 0.05 and Sig. value after using the comic is 0.320 > 0.05. These show that the students' motivation data before and after using coming are normally distributed. Then, we used the paired t-test to see the significance of increasing student motivation. The results are shown in table 8.

Table 8.

The Result of Paired t-test before and after Using Folklore-based Comic

							95% Confidence Interval of the Difference	
	t	Df	Sig. (2-tailed)	Mean	Std. Deviation	Std. Error Mean	Lower	Upper
Before After	-5.185	24	.000	-9.100	8.776	1.755	-12.723	-5.477

The results in table 8 shows the value of t = -5.185 with Sig. (2-tailed) = 0.000. When compared with $\alpha = 0.05$, the value of Sig. (2-tailed) is smaller than α. It means there is a significant increase of students' motivation after using folklore-based comic. These results indicate that the use of the folklore-based comic increases students' motivation. This is supported by the research conducted by (Piaw, 2012) who stated that the use of comics can enhance students' motivation in learning. Motivation is an important aspect leading to students' success in learning. The use of appropriate and interesting instructional media in learning affects students' motivation (Fadieny & Fauzi, 2019). Highly motivated students have positive impact on students' attitudes toward physics learning (Eryilmaz et al. 2010). The combination of humor, narrative text, and visual representations in comics can improve students' interest and motivation in learning. Therefore, pictorial instructional media such comics can be an alternative media to motivate students in learning (Lin et al. 2015; Hosler & Boomer, 2011; Kennepohl & Roesky, 2008).

Conclusion and Recommendations

The Newton's Law comic based on the folklore has been developed by using the ADDIE model which consists of analysis, design, development, implementation, and evaluation stage. Based on the result of material and instructional media validation, it can be concluded that the comic is feasible to use in learning Newton's law concepts. This comic also can be used as an alternative medium to learn Newton's law concepts. Based on the result of students' response questionnaire, the features of comics (e.g. colorful and interesting images, simple language, the use of characters, and interesting storyline) can assist students to understand the concepts easier. Based on the result of N-Gain calculation and paired t-test, we can conclude that the folklore-based comic can increase students' motivation significantly.

Comics presented physics concepts in a more understandable way, easy to understand, and to remember (Tatalovic, 2009; Kumaran et al. 2009). Therefore, comics can be as an alternative medium to learn physics concepts. The use of comics in learning can enhance students' intrinsic motivation and improve learning engagement (Lin et al. 2015). Comics can also improve students' visual representation and higher-order thinking skills (Haroky, 2019). For further studies, the authors gave suggestions to investigate the effects of folklore based-comic on students' conceptual understanding, learning engagement, visual representation skills, and higher-order thinking skills. It is also necessary to apply folklore based-comic on different physics materials, such as momentum and impulse, work and energy, etc.

Limitations of Study

This study has some limitation, we only investigated the effect of comics on student motivation with a limited sample size. For future studies, it is suggested to investigate others related aspects such as conceptual understanding, learning engagement, visual representation skills, and higher-order thinking skills, etc. Further studies with larger sample sizes are needed to get more generalized conclusions.

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the time to be interviewed about the learning process in class, and to the students who were willing to become research subjects.

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