

LEARNING PHYSICS THROUGH COMICS MEDIA: AN ENHANCEMENT OF NEWTON LAW TOPICS ON ONLINE LEARNING

Syarif Eko Zahartian¹⁾, Muhamad Yunus²⁾, Nurul Fitriyah Sulaeman³⁾

¹²³ Faculty of Teacher Training and Education, Mulawarman University

email: syarifekozahartian@gmail.com

Abstract

*Comics are visual media to convey messages entertainingly so that they can be used in education and have become a tool that can promote the enjoyment of learning. This study aims to explore students' learning outcomes on Newton's Law material when using comic-based learning media. This study uses a quasi-experimental design method in the form of a non-equivalent control group design. The population in this study are all students of class X MIPA of SMAN 1 Muara Badak in the 2021/2022 academic year, where the sample used is class X MIPA 2 as the experimental class and class X MIPA 3 as the control class. The experimental class applies comic-based learning media, and the control class uses conventional learning media. The data were collected using pre-test and post-test and then analyzed using the *n*-gain and independent *t*-test analysis. This study has established that comic-based learning media is better than conventional learning media. The results showed a significantly different learning outcome between the experimental and the control classes with the acquisition of sig-2 tailed 0.000. In addition, the results of the assessment also showed an increase in student learning outcomes, seen from the results of the *n*-gain test, where the experimental class showed a higher accumulation of 0.3779 and entered the average category compared to the control class, which was only 0, 1090, which is in the low category. Based on these results, comics could be a supportive media to learn physics at the high school level.*

Keywords: Comics, Newton's Law, Physics, Science Comic Book

1. INTRODUCTION

Physics education is one part of national education essential in developing science today. However, at this time, the physics learning process used in the classroom is still conventional, especially in a pandemic condition like the current one, where teaching and learning activities have become online. This condition results in students being less motivated and less able to think critically in problem-solving (Izzatunnisa et al., 2021; Wegasari, 2021). It's seen in Indonesia's low PISA score in the science performance category. In the 2018 PISA results for the science performance category, Indonesia was ranked 71 out of 80 countries, down from 62 in 2015 (Hewi & Shaleh, 2020).

In connection with the demand for improving the quality of intellectual and critical thinking human resources through education, it is necessary to increase the mastery of knowledge in the science and

physics education level at every level of education (Putra et al., 2021). Many supporting factors can affect student learning outcomes in the learning process, one of which is learning media (Agustin et al., 2021; Meirlin et al., 2021). Each teacher's ability to decide the variety of teaching media used in learning activities is essential (Avrilliyanti et al., 2013).

The learning media used should be able to make the learning process effective even though the students are learning independently. The learning media must also overcome problems where students find it challenging to understand the concepts of the material being taught and must increase student motivation in learning to improve the student learning outcomes (Rohman & Amri, 2013).

The learning media in our research is learning media in the form of comics. Comics are visual media to convey messages in an entertaining and fun way so that we can use

them in the field of education and which have become a tool that can promote the formation of values and attitudes (Daryanto, 2010). Among the various print media, comics are believed to be a possible means of conveying scientific information, including the fascination, excitement, and usefulness of science because the unique features of comics can attract a lot of people's attention, interest, and pleasure (Tatalovic, 2009).

Using comics in education dates back to the late 1940s. Hutchinson (1949) reports a study of teachers' attitudes toward the use of comics in schools (Aleixo & Sumner, 2017). Research on cartoons and comics in science education shows that using graphic illustrations can better understand scientific phenomena than conventional textbooks (Affeldt et al., 2018). The visual representations in the comics will make the concepts displayed more concrete and easier for students to understand. This will help students understand the idea of more than one presupposition, which will improve learning (Chu & Toh, 2020).

A study conducted by Lin & Lin (2016) shows that the combination of scientific language combined with visual representations and humor in science comics engages people who excel at intermediate levels more than people who excel at high levels. The effect of learning to use comics media on mediocre students is also higher than using media that uses text writing.

Research conducted by Ahsani et al., (2015) also showed differences in students' cognitive and psychomotor learning outcomes before and after comic-assisted inquiry-based science learning. The analysis of cognitive learning outcomes showed an increase in the medium category, while psychomotor learning outcomes showed an increase in the low category. Another study conducted by Susanti et al., (2019) also showed increased student learning outcomes in the medium category with an n-gain value of 0.54 after using physics comics teaching materials. This is in line with the research conducted by Wahyuni & Lia (2020) regarding the development of Physics comics based on Palembang local wisdom, whereas many as 64% of students finished working on physics questions, and the *post-test* showed an increase of 28.71 when compared to the *pre-test*.

Although several researchers have studied the use of comics in science learning, similar studies at the high school level are still very rare. Therefore, research on student learning outcomes after using comics for learning is essential.

2. RESEARCH METHOD

This type of research is quasi-experimental using a non-equivalent control group design.

Table 1. Research Design

Group	Pre-Test	Treatment	Post-Test
Control	O ₁		O ₂
Experiment	O ₃	X	O ₄

(Sugiyono, 2015)

The researcher conducted this research at SMA Negeri 1 Muara Badak, in the odd semester of the 2021/2022 school year. The population in this study was all students of class X MIPA SMAN 1 Muara Badak, which consisted of 3 classes. Using the purposive sampling technique, the sample used class X MIPA 2 as the experimental class and class X MIPA 3 as the control class.

The data were collected in pre-test and post-test and then analyzed using the n-gain and independent t-test analysis. The n-gain analysis is to see the improvement in student learning outcomes after being given treatment, and the independent t-test is to see whether there were differences in the learning outcomes of the experimental and control classes.

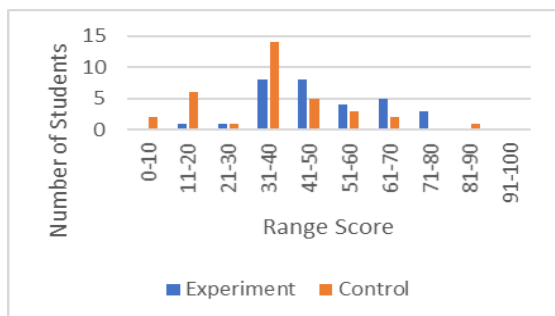
Table 2. N-Gain Interpretation

N-Gain Score	Interpretation
$\langle g \rangle \geq 0,7$	High
$0,7 \geq \langle g \rangle \geq 0,3$	Average
$0,3 > \langle g \rangle$	Low

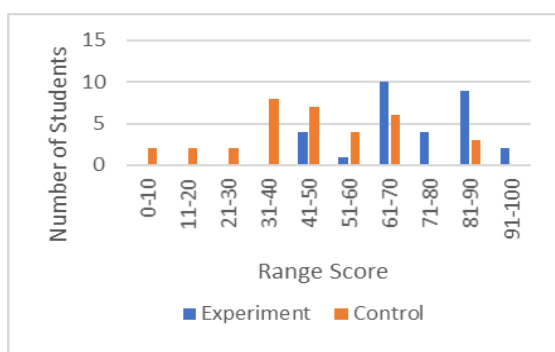
(Purwanto, 2009)

3. RESULT AND DISCUSSION

The results of the *pretest* and *post-test* of the experimental class and control class in this study can be seen in the following figure:



Picture 1. Pre-test Data



Picture 2. Post-test Data

Then, the data processing of the pretest and post-test was carried out control so that the descriptive statistical data is obtained in the Table 3 and Table 4:

Table 3. Pre-test Statistic Descriptive

Statistic Descriptive	Group	
	Experiment	Control
N	30	34
Max	75	81.25
Min	18.75	6.25
Mean	49.38	35.85
SD	15.69	17.08

Table 4. Post-test Statistic Descriptive

Statistic Descriptive	Group	
	Experiment	Control
N	30	34
Max	100	81.25
Min	43.75	6.25
Mean	71.46	45.96
SD	14.74	20.52

The table shows the average pretest result of the experimental class is 49.38, and the average control class's initial learning result is 35.85. Then obtained, the standard deviation for the experimental class and control class of 15.69 and 17.08.

The average post-test result is 45.96 for the control class and 71,46 for the experimental class. Then obtained, the standard deviation for the experimental class and control class of 14.74 and 20.52.

To know how the quality of improving student learning outcomes in the experimental and control class after learning using comic physics and conventional learning media, the n-gain test was carried out. The result of n-gain score can be seen in the Table 5:

Table 5. N-Gain Results

Group	N-gain	Interpretation
Experimental	0.3779	Average
Control	0.1090	Low

Based on the table, we can see that the n-gain score obtained by the experimental class students is 0.3779, showing that the experimental class has an average increase in learning outcomes. On the other hand, the n-gain for the control class students is 0.1090, meaning that the class has a low increase. Thus, we can conclude that the improvement of student learning outcomes using comic physics learning media is more significant than the control class using conventional learning media.

After getting the results of the n-gain value, the researcher continued with the normality test to find out whether the data were normally distributed or not. This test needs to be done as a preconditioning test before conducting the independent t-test. The result of normality test can be seen in the Table 6:

Table 6. Normality Test Results

Score	Group	df	Sig.
	Experiment	30	0.297
Control	34	0.405	

Based on the table 6, the probability value in the data significance column, the final test value for the control class is 0.405, and the experimental class is 0.297. Because the probability value of the two groups is more than 0.05, we can say that the posttest data of the control class and the experimental class are normally distributed.

Because the results stated that the data were normally distributed, an independent t-test was conducted. This test determines whether or not there are differences in posttest learning outcomes in the experimental and control classes. The results obtained in the table 7:

Table 7. Independent t-test Results

		Levene's Test for Equality of Variances	t-test for Equality of Means	
		Sig	df	Sig (2- tailed)
Score	Equal variances assumed	0.077	62	0.000
	Equal variances not assumed		59.667	0.000

Based on the table 7, we can see that the probability value (*sig.2-tailed*) with the t-test is 0.000. Because the probability value is less than 0.05, then H_0 is rejected, or there are differences in the results of the post-test test between the control class and the experimental class.

This study aims to explore students' learning outcomes on Newton's Law material when using comic-based learning media. Before treating physics learning using comic-based learning media, pretest in the control class and the experimental class. Class X MIPA 2 is the experimental class, and class X MIPA 3 is the control class.

Based on the pretest results, we can see that student learning outcomes were relatively low. It can be seen from the pretest result—that the mean for the experimental class is 49.38, and for the control, it is 35.85. Several factors can cause this condition, such as teaching and learning activities carried out

remotely, and the learning media are still conventional.

After the data were collected from the students' pretest results, the research continued by giving a treatment control class. The physics learning process uses conventional learning media in the control class, while in the experimental class, the physics learning process uses comic-based learning media.

Student learning outcomes increased after being given different treatments in each class. The increase in student learning outcomes is also seen in the average post-test obtained. We gave the experimental class treatment by applying physics comics as a medium of learning to get an average score of 71.46. While in the control class that uses conventional learning media, there is also a change in the average value increase, namely 45.96. Based on these data, we can conclude that the learning outcomes of the experimental class using comic physics as a learning medium are superior to that of the control class.

This fact is also supported by the calculation results of the N-Gain test and independent t-test. The experimental class n-gain test results showed a higher increase of 0.3779, which was included in the average improvement category, compared to the increase in the control class, which was only 0.1090, which is included in the low category. Then from the independent t-test, we can see that the probability value is smaller than the 5% significance, namely (*sig.2-tailed*) 0.000. So it can be said that there is a significant difference between student learning outcomes using comic physics learning media and conventional learning media.

The difference in learning outcomes between the experimental and the control classes is inseparable from the learning media applied to each of these classes, where the experimental class uses physics comics as learning media. The physical comic learning media itself uses images as a medium in delivering material. With visualization, it will make it easier for students to catch abstract things or formulations that they want to convey, coupled with a combination of verbal and nonverbal language, it can speed up the reader to understand the content of the message they read (Kim et al., 2012).

As is well known in the brain, there are many devices for processing visual information than the other senses. As a result, each learner will learn more quickly if they can see what they are learning (Meier, 2002). Visualization in the form of pictures and then assembled into a story in this physics comic will also make students interested in reading it. It will create an exciting and fun learning atmosphere to make students not get bored quickly learning. In addition, visual learning can train visual thinking skills, a learning style where students become better at understanding and storing information by associating ideas, words, and concepts with pictures (Raiyn, 2016).

There are several disadvantages of using physics comics media as learning media. First, not all students can learn with a visual style because everyone has their learning style. Therefore, so we cannot use comics as learning media. Second, students who have never read comics before will find it difficult and confused when reading them.

Nevertheless, the use of physics comics learning media in the learning process has improved learning outcomes for students, and this is in line with previous research.

4. CONCLUSION

Based on the results and data analysis from the research, we can conclude that student learning outcomes on Newton's Law material have increased after learning with physics comic media. In addition, there is a significant difference in the learning outcomes of the control and experimental class students after the application of comics media in the learning process, where the experimental class learning outcomes are higher than the control class learning outcomes. Therefore, before learning with physics comics learning media occurs, the teacher should condition the class first and tell them how to use or read comics.

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