

The Effectiveness of Cooperative Learning Model With Group Investigation (GI) Using Comic Media Towards Mathematical Literacy Ability of VIII Students at SMP Negeri 1 Punggelan

Nur Khasanah ^{1✉}, Heru Agni Setiaji²

¹Universitas Islam Negeri Prof. K.H. Saifuddin Zuhri Purwokerto, Purwokerto, Indonesia

²Institut Agama Islam Negeri Kudus, Kudus, Indonesia

✉ Corresponding email:
nurkhasanah71812@gmail.com

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Abstract: This study aimed to determine the effectiveness of the GI-type cooperative learning model assisted by comic media in improving the mathematical literacy skills of the eighth-grade students of SMP Negeri 1 Punggelan. This research was experimental research with a quantitative approach. The population in this study were students of the eighth grade of SMP Negeri 1 Punggelan and the samples used were taken by simple random sampling technique. The sample results obtained were students of VIII G and VIII H, consisting of 58 students. The instrument used in this study was a description test consisting of a pretest and a posttest. The results of this study showed that the average mathematical literacy ability of students who were subjected to the GI-type cooperative learning model assisted by comic media was better than those who were not subjected to it, as seen from the results of the N-Gain test, namely the experimental class obtained an average N-Gain value of 0.77 with high criteria, while in the control class, the average N-Gain value for the control class was 0.47 with moderate criteria. In the t-test, the two independent samples showed a significant result of $0.000 < 0.05$, meaning that there was a significant difference in students' mathematical literacy skills between the experimental and control classes. The GI-type cooperative learning model assisted by comic media was shown to be effective for increasing mathematical literacy skills with the average N-Gain test results obtained in the experimental class by 77% with effective criteria and in the control class by 47% with less effective criteria.

Keywords: Comic media; GI type cooperative learning model; Mathematical literacy ability.

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A. Introduction

Mathematics is a way to find answers to problems faced by humans, namely a way of using information, knowledge of shape and size, knowledge of counting. According to Content Standards (SI), the objectives of the mathematics subject show that the curriculum is structured with attention to aspects of mathematical literacy (BSNP, 2006). This is because mathematical literacy is very important for everyone because it can help someone to recognize the role of mathematics in the real world and make the necessary considerations and decisions. Mathematical literacy ability is the ability to formulate, apply, and interpret mathematics in various contexts. With mathematical literacy students can develop and apply mathematical knowledge in the real world. Mathematical literacy emphasizes to students that

mathematics does not only count and master the material, but also pays attention to reasoning in understanding mathematical material, using mathematical concepts, and solving mathematical problems in everyday life.

From the results of the 2018 PISA (Program for International Student Assessment) survey published by the OECD (Organization for Economic Cooperation and Development), it shows that the mathematical literacy abilities of Indonesian students have an average score of 379, while the average from the OECD is 489. ranked 74th out of 79 countries. This shows that the ability of mathematical literacy in Indonesia is still low.

Based on the results of preliminary observations at Grade VIII of SMP Negeri 1 Punggelan, it is known that students at SMP Negeri 1 Punggelan, Punggelan District, Banjarnegara Regency have low mathematical literacy skills. This can be seen from the results of the preliminary test during the observation obtained data that the average value of students' mathematical literacy ability at SMP N 1 Punggelan is 36.25. Some students still cannot understand mathematical concepts and solve mathematical problems related to real contexts. Many students are still passive in mathematics learning activities. Not infrequently students have not been able to answer the questions posed by the teacher while learning is in progress and feel embarrassed to ask the teacher if they have difficulty understanding the material.

This is possible because mathematics learning is still largely teacher-centered so that students' mathematical literacy skills cannot develop. Students should be able to develop their mathematical literacy by seeking information about learning materials and applying mathematical concepts and solving mathematical problems in various contexts by studying independently or in groups. Group learning can be done through a learning model.

The learning model that is suspected to be suitable for increasing students' mathematical literacy skills is the group investigation (GI) cooperative learning model. The use of appropriate learning models can provide a relevant influence on the success of learning mathematics. According to Fauzi (2019), group investigation is a type of cooperative learning model that emphasizes student activity in seeking information and solving problems regarding learning material in groups to increase students' understanding and critical thinking skills regarding subject matter so that it will increase students' mathematical literacy. . With this type of GI learning, students will be more flexible in seeking information in discussions and can ask their friends about material they have not understood. From this, students will seek the necessary information from various sources. This of course will foster students' interest in reading so that it will improve students' mathematical literacy abilities and students play an active role during learning activities.

To support the effectiveness of the GI type cooperative learning model, it is necessary to have learning media. The learning media is used at the implementation or investigation stage. At this stage, students collect information on subject matter from various sources, one of which is learning media. With the help of learning media, it can increase student enthusiasm for learning and make it easier for students to understand the subject matter. One of the learning media that can support mathematics learning to improve mathematical literacy is comic media. Comic media can be used as a source of information in the learning process. Comics not only provide entertaining information but can also be called learning comics if they contain educational information. One of the educational comic media is math comics.

Rosyida (2018) stated that reading comics can foster a critical attitude in children, stimulate interest in reading, provide direction to students who do not like to read so that they are disciplined in reading, and make it easier for students to capture the message or material presented. According to Gafoor (2013), this math comic has an interesting and easy-to-understand storyline. From its distinctive design so that it has great power to convey information that can stimulate student activity and creativity so that it will improve mathematical literacy abilities. The results of Yani Fitriyani's research stated that the use of mathematical comic media can improve mathematical literacy skills in understanding mathematical word problems (Fitriyani, 2021). Likewise the results of Nia Kurniati's research which stated that the average increase in the ability of mathematical literacy of students whose learning used cooperative learning models was higher than the increase in the ability of mathematical literacy of students whose learning used conventional learning models. (Kurniati, 2020).

Based on this background, the researcher is interested in conducting research with the title "Effectiveness of the Group Investigation (GI) Cooperative Learning Model Assisted by Comic Media on the Mathematical Literacy Ability of Class VIII Students of SMP Negeri 1 Punggelan".

B. Method

This type of research is experimental research with a quantitative approach. Quantitative research is research that presents data in the form of numbers and the type of data can be measured or calculated directly using statistical analysis. This study used the Pretest and Posttest Control Group research design. Before conducting treatment to the experimental class and the control class, the researcher gave a pretest first to determine the level of students' mathematical literacy ability, then was given a mathematical treatment. After carrying out the entire series of treatments, both classes were given a posttest to see an increase in students' mathematical literacy skills.

This research was conducted at SMP Negeri 1 Punggelan, Banjarnegara Regency in January 2023. The population is a generalization area which includes subjects or objects that have certain qualities and characteristics which will be studied further and conclusions sought by researchers. The population in this study were students of class VIII SMP Negeri 1 Punggelan which consisted of 9 classes with 255 students. The sample is part of the number and characteristics of the population (Yani Fitriyani, et al., 2021). In this study, the sampling technique used simple random sampling technique. This is because the sampling is done randomly or lottery and does not pay attention to the strata in the population. Of the nine classes in SMP Negeri 1 Punggelan, the researchers took two classes to be used as samples, namely class VIII G as an experimental class with a total of 29 students and VIII H as a control class with a total of 29 students.

Methods of data collection in this study using interviews and tests. This interview was conducted with mathematics teachers at SMP Negeri 1 Punggelan regarding the learning process and the level of mathematical literacy ability of class VIII students. While the test is used to measure the level of mathematical literacy ability. The test is carried out using essay test questions that have been adapted to indicators of mathematical literacy ability. The aim is

to measure the level of students' mathematical literacy abilities and obtain data about the mathematical literacy abilities of class VIII students of SMP N 1 Punggelan. This test was carried out twice, namely before receiving treatment (pretest) and after receiving treatment (posttest) in class VIII G and VIII H of SMP N 1 Punggelan. Before being used for research, the research instrument was validated using construct validity and content validity by experts. In addition, the research instrument was also tested for validity using the Pearson product moment correlation test. In addition, a reliability test was also carried out to measure the consistency of respondents' answers in answering the questions in the test.

To analyze the research data, researchers used the t test and the N-Gain test. The t-test was conducted to determine whether there was a difference in the average literacy skills of class VIII students of SMP N 1 Punggelan so as to determine whether the GI-type cooperative learning model assisted by comic media had a significant effect on students' mathematical literacy abilities. The formulation of the hypothesis is:

$$H_0 : \mu_1 = \mu_2$$

$$H_1 : \mu_1 \neq \mu_2$$

Information:

μ_1 : The average value of students' mathematical literacy skills subjected to the GI type cooperative learning model assisted by comic media

μ_2 : The average value of students' mathematical literacy skills who were not subjected to the GI type cooperative learning model assisted by comic media

The basis for decision making in the t test with a significant level of 5% or 0.05 is as follows (Rahma & Dharma, 2017):

If the probability value ≥ 0.05 then H_0 is accepted and H_1 is rejected

If the probability value < 0.05 then H_0 is rejected and H_1 is accepted

The N-Gain test was carried out with the aim of knowing the effectiveness of the GI type cooperative learning model assisted by comic media to increase the average mathematical literacy ability of class VIII students of SMP N 1 Punggelan. To find out whether the acquisition of an effective score or not in this study, the interpretation of the percentage of effectiveness for the average N-Gain Meltzer model (Rahma & Dharma, 2017):

Table 1. N-Gain Interpretation

Percentage (%)	Interpretation
N-Gain $\leq 40\%$	Ineffective
$41\% < \text{N-Gain} \leq 55\%$	Less Effective
$56\% < \text{N-Gain} \leq 75\%$	Effective Enough
N-Gain $\geq 76\%$	Effective

C. Results and Discussion

1. Results

a. Validity Test

In this study, test the validity of the instrument using construct validity and content validity. Construct validity is used to measure whether the research instrument contains the concept of the material used as the basis for preparing the instrument. Construct validity uses the opinion of an expert, namely Mr. Heru Agni Setiaji, M.Pd.

Where the instrument has been declared feasible to be tested or valid after several improvements have been made. Content validity is done by comparing the research instruments with the subject matter being taught. In this study, content validity was carried out by Mrs. Yuli Winarni, S.Pd as a mathematics teacher at SMP Negeri 1 Punggelan. The instrument was declared valid because it was in accordance with the material taught in class VIII, namely the Pythagorean theorem material.

In addition to testing the validity by the experts, the researchers also tested the mathematical literacy ability instrument by giving test questions to class IX students, totaling 26 respondents. From the results of the validity test of the mathematical literacy ability instrument that was carried out with the help of the Microsoft Excel application and SPSS version 23 with 26 respondents and a significant level of 5%, the researcher obtained the following data:

Table 2. Validity Test Results of Mathematical Literacy Ability Instruments

No	r_{count}	r_{table}	Information	Validity Interpretation
1	0,536	0,388	Valid	Good Enough
2	0,473	0,388	Valid	Good Enough
3	0,556	0,388	Valid	Good Enough
4	0,226	0,388	Invalid	Not Good
5	0,419	0,388	Valid	Good Enough
6	0,339	0,388	Invalid	Not Good
7	0,501	0,388	Valid	Good Enough

From the table it can be concluded that there are 5 valid instruments, namely test questions number 1,2,3,5 and 7 so that they can be used in research.

b. Reliability Test

After testing the validity, the research instrument was also tested for reliability with the help of the SPSS version 23 application, the following results were obtained:

Table 3. Reliability Test Results

Reliability Statistics	
Cronbach's Alpha	N of Items
.626	5

The results of the reliability test show that Cronbach's Alpha value on the mathematical literacy ability test is $0.626 > 0.60$, so it can be interpreted that the test questions have a fairly good consistency of the respondents' answers.

c. Normality Test

The normality test is a test used to determine whether the data is normally distributed or not. The data normality test uses the Kolmogorov-Smirnov method where assuming H_1 is accepted and H_0 is rejected. The data criterion is said to be normal if the significant number is the Kolmogorov-Smirnov Sig test. ≥ 0.05 . The following table shows the results of testing the data using the SPSS version 23 application

Table 4. Normality Test Results

Tests of Normality		
Kelas	Kolmogorov-Smirnov ^a	Shapiro-Wilk

		Statistic	Df	Sig.	Statistic	df	Sig.
NGain	Kelas Eksperimen	.112	29	.200*	.949	29	.172
	Kelas Kontrol	.141	29	.145	.945	29	.137

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the normality test, it appears that the significant value of the Kolmogorov-Smirnov test on the N-Gain score of the experimental class is 0.200 and that of the control class is 0.145. This means H_1 is rejected and H_0 is accepted. With the conclusion that both classes have a significant value of $0.200 > 0.05$ and $0.145 > 0.05$ so that the data is normally distributed.

d. Homogeneity Test

Homogeneity testing was carried out aiming to find out whether the experimental class and control class came from a number of homogeneous populations or not. The data criterion is said to be homogeneous if the significant number of N-Gain data ≥ 0.05 . The following table shows the homogeneity test results using the SPSS version 23 application:

Table 5. Homogeneity Test Results

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
NGain	Based on Mean	.809	1	56	.372
	Based on Median	.779	1	56	.381
	Based on Median and with adjusted df	.779	1	53.413	.381
	Based on trimmed mean	.826	1	56	.367

Based on the results of the homogeneity test, it appears that the significant value is $0.372 \geq 0.05$. This means that H_0 is accepted and H_1 is rejected, with the conclusion that the experimental class and the control class come from a homogeneous population.

e. T Test

The t test was used to determine whether there was a significant difference in the average mathematical literacy ability of class VIII students between classes that were subjected to the GI cooperative learning model assisted by comic media and those that were not subjected to it. In this t test using two independent samples t test. The criterion for the t test is that if the probability value (Sig.) ≤ 0.05 then there is an average difference. The following table results of the t test using the SPSS version 23 application:

Table 6. T test results

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	df	Sig. (2-	Mean Differe	Std. Error	95% Confidence Interval of the

					tail	d)	nce	Differe nce	Difference	
									Lower	Upper
NGain	Equal variances assumed	.809	.372	11.562	56	.000	.30327	.02623	.25073	.35582
	Equal variances not assumed			11.562	54.533	.000	.30327	.02623	.25070	.35585

Based on the results of the t test, it can be seen that the value of Sig. (2-tailed) namely $0.000 < 0.05$, then H_0 is rejected and H_1 is accepted, meaning that the average mathematical literacy ability of students who are subjected to the GI-type cooperative learning model assisted by comic media is not the same as students who are not subjected to the GI-assisted cooperative learning model comic media.

f. N-Gain Test

1) N-Gain Test of Experimental Class Mathematical Literacy Ability

The magnitude of the increase in the mathematical literacy skills of the experimental class was calculated using the N-Gain formula with the help of the SPSS version 23 application. Statistical data on the value of N-Gain on the mathematical literacy abilities of the experimental class are presented in the following table:

Table 7. Statistical Data of Experimental Class N-Gain Values

The Number of Students	29
Highest Score	0,91
Lowest Score	0,60
Average Score	0,77

Based on the table, it can be seen that the average N-Gain value of students in the experimental class is 0.77, which means that there is an increase in mathematical literacy skills after getting learning with the GI type cooperative learning model assisted by comic media.

The table of criteria for obtaining the N-Gain value to find out the level of increase in mathematical literacy skills is as follows:

Table 8. Statistical Data of Experimental Class N-Gain Values

N-Gain Value	Category	Frequency	Percentage (%)
$N\text{-Gain} > 0,70$	High	20	68,97%
$0,30 \leq N\text{-Gain} \leq 0,70$	Moderete	9	31,03%
$N\text{-Gain} < 0,30$	Low	0	0%
$N\text{-Gain} = 0$	No Increase	0	0%
$-1,00 \leq N\text{-Gain}$	Decrease Occurred	0	0%
Amount		29	100%

Based on the table, it can be seen that 20 students with a percentage of 68.97% scored in the high category and 9 students with a percentage of 31.03% scored in the medium category. Overall the average value of N-Gain in the experimental class is 0.77 which is included in the high category.

The following is a table of N-Gain interpretations in the experimental class to determine the effectiveness of a lesson to improve mathematical literacy skills:

Table 9. Interpretation of Experimental Class Effectiveness

Percentage (%)	Interpretation	Frequency
$N\text{-Gain} \leq 40\%$	Ineffective	0
$41\% < N\text{-Gain} \leq 55\%$	Less Effective	0
$56\% < N\text{-Gain} \leq 75\%$	Effective Enough	14
$N\text{-Gain} \geq 76\%$	Effective	15

From the table, it is known that the experimental class is quite effective for 14 students, and effective for 15 students. On the average percentage value obtained by the experimental class, namely 77%, it can be interpreted that the results are effective. Therefore, it can be concluded that learning using the GI type cooperative learning model assisted by comic media in the experimental class is effective for increasing the mathematical literacy skills of class VIII students.

2) N-Gain Test of Control Class Mathematical Literacy Ability

The increase in the mathematical literacy ability of the control class was calculated using the N-Gain formula with the help of the SPSS version 23 application. Statistical data on the value of N-Gain in the mathematical literacy ability of the control class is presented in the following table:

Table 10. Statistical data for control class N-gain values

The Number of Students	29
Highest Score	0,64
Lowest Score	0,27
Average Score	0,47

Based on the table, it can be seen that the average N-Gain value of students in the control class is 0.47, which means that there is an increase in mathematical literacy skills after getting learning with conventional learning models and not using media.

The table of criteria for obtaining the N-Gain value to find out the level of increase in mathematical literacy skills is as follows:

Table 11. Criteria for Obtaining Control Class N-Gain Values

N-Gain Value	Category	Frequency	Percentage (%)
$N\text{-Gain} > 0,70$	High	0	0%
$0,30 \leq N\text{-Gain} \leq 0,70$	Moderate	27	93,1%
$N\text{-Gain} < 0,30$	Low	2	6,9%
$N\text{-Gain} = 0$	No Increase	0	0%
$-1,00 \leq N\text{-Gain}$	Decrease Occurred	0	0%
Amount		29	100%

Based on the table, it can be seen that 27 students with a percentage of 93.1% got scores in the medium category and 2 students with a percentage of 6.9% got scores in the low category. Overall the average value of N-Gain in the control class is 0.47 which is included in the medium category.

The following is a table of N-Gain interpretations in the control class to determine the effectiveness of a lesson to improve mathematical literacy skills:

Table 12. Interpretation of Control Class Effectiveness

Percentage (%)	Interpretation	Frequency
$N\text{-Gain} \leq 40\%$	Ineffective	8
$41\% < N\text{-Gain} \leq 55\%$	Less Effective	13
$56\% < N\text{-Gain} \leq 75\%$	Effective Enough	8
$N\text{-Gain} \geq 76\%$	Effective	0

From the table, it is known that the control class was not effective for 8 students, less effective for 13 students, and quite effective for 8 students. On the average percentage value obtained by the control class, namely 47%, it can be interpreted that the results are less effective. Therefore, it can be concluded that learning that does not use the GI type cooperative learning model assisted by comic media in the control class is less effective in increasing the mathematical literacy skills of class VIII students.

2. Discussion

Based on the first hypothesis test to see the increase in students' mathematical literacy abilities before and after being given treatment, the N-Gain test was carried out for the experimental class and the control class. The experimental class obtained an average N-Gain value of 0.77 with high criteria, while in the control class the average N-Gain value for the control class was 0.47 with moderate criteria. This is also in accordance with the results of the independent sample t test output test (t-test) using SPSS version 23, showing the value of Sig. of $0.000 < 0.05$. These results indicate that the mathematical literacy skills of the students in the experimental class and the control class are significantly different due to different treatments in the two classes.

So it can be concluded that in experimental research conducted by applying the GI type cooperative learning model assisted by comic media, the average mathematical literacy ability of class VIII students who were subjected to the GI type cooperative learning model assisted by comic media was better than the average student who was not subjected to the comic media type GI cooperative learning model. GI type cooperative learning model assisted by comic media.

This is in line with the statement from Fauzi (2019), that group investigation is a type of cooperative learning model that emphasizes the activeness of students in seeking information and solving problems regarding learning material in groups to increase students' understanding and critical thinking skills regarding subject matter so that it will improve students' mathematical literacy. According to Trianto, the third step in GI cooperative learning is implementation or investigation. At this stage, students collect information on subject matter from various sources, one of which is learning media. One of the learning media that can support learning mathematics to improve mathematical literacy is the media of mathematical comics. Rosyida (2018) stated that reading comics can foster a critical attitude in children, stimulate interest in reading, provide direction to students who do not like to read so that they are disciplined in reading, and make it easier for students to capture the message or material presented. According to Gafoor (2013), math comic media has an interesting and easy-to-understand storyline. From its distinctive design so that it has great power to convey information that can stimulate student activity and creativity so that it will improve mathematical literacy abilities.

The results of Nia Kurniati's research stated that the average increase in the ability of mathematical literacy of students whose learning used cooperative learning models was higher than the increase in the ability of mathematical literacy of students whose learning used conventional learning models. (Kurniati, 2020). The results of Tarmizi Akbar's research (2021) also stated that the use of the group investigation type cooperative learning model to improve students' mathematical literacy skills obtained an average N-Gain value of 0.32 with moderate criteria. Then it is compared using the t test of two independent samples to produce a significant value of 0.002 which is less than a significant level of 0.05, then H_0 is rejected and H_1 is accepted.

To find out the level of effectiveness of the learning model carried out in the experimental class and the control class, it is done using the interpretation of the N-Gain test. In the experimental class, learning uses the GI type cooperative learning model assisted by comic media. Whereas in the control class, the learning did not use the GI cooperative learning model assisted by comic media. The results of the N-Gain test in the experimental class showed an average N-Gain value of 77% included in the effective criteria, while in the control class it showed an average N-Gain value of 47% included in the less effective criteria.

This is in line with the results of Fitri Isnaini's research (2020) which used the GI type cooperative learning model to increase students' understanding of mathematical concepts. In the experimental class, the average N-Gain value was 72% with high criteria (effective) and the control class was 38%. with moderate criteria (less effective). The results of Rosmita Sari Siregar's research (2022) also stated that learning through the group investigation model was effective in increasing numeracy literacy skills in mathematics subject on flat shape material in fifth grade elementary school students. Nailul Himmi Hasibuan (2022) in his research also states that codular-based comic learning media can increase the value of student learning outcomes by up to 62% and is effective for increasing mathematical literacy skills.

Therefore it can be concluded that the GI cooperative learning model assisted by comic media is effective for increasing the mathematical literacy skills of class VIII students of SMP Negeri 1 Punggelan.

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