

Development of Comic Media to Improve Problem Solving Abilities and Interest in Learning Mathematics Subjects of Elementary School

Firmansyah *

* Pendidikan Guru Sekolah Dasar, Fakultas Keguruan dan Ilmu Pendidikan Universitas Papua

f.firmansyah@unipa.ac.id

Irfan Irnandi **, Nahrin Najib Siregar ***, Ebeneser Wacner Simamora***, Indriyani***,

** Pendidikan Matematika Fakultas Keguruan dan Ilmu Pendidikan Universitas Papua

*** Pendidikan Guru Sekolah Dasar, Fakultas Keguruan dan Ilmu Pendidikan Universitas Papua

** i.irnandi@unipa.ac.id

*** e.simamora@unipa.ac.id n.siregar@unipa.ac.id

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ABSTRACT

Solving mathematics problems will be greatly influenced by the teacher's ability to deliver mathematics learning material. Teachers must be able to develop materials using various media which are expected to help students achieve mathematics learning goals. This research aims to develop Class IV Mathematics Comic Media with Fraction Material that is valid, practical and effective to improve elementary school students' problem solving abilities and interest in learning mathematics subjects. This research method is development research or Research and Development (R & D). The procedure used is to simplify the Borg & Gall development model which consists of 10 steps, in this research it will be limited to step seven. The research subjects chosen were class IV students at SD Negeri 02 Amban for the 2023/2024 academic year. Data collection techniques used in this research include questionnaires, validator assessment sheets, and problem solving ability tests. The data analysis techniques used in this research consist of three, namely validity, practicality and effectiveness data analysis. The research instruments consisting of learning implementation plans, student worksheets, comic media, problem solving ability tests, and learning interest questionnaires that have been developed are in the very good category based on the assessments of the three validators. Practicality obtained a positive response from students of 88.6%, which is in the very practical category. Comic media is effective in increasing elementary school students' problem-solving abilities and interest in learning mathematics subjects based on the following criteria: a) Students' problem-solving abilities are better than the problem-solving abilities of Control class students; b) The average problem solving ability of Control Class students is 60.31, while the average problem solving ability of experimental class students is 72.50. c) There is an influence of interest in learning on students' problem solving abilities.

Keywords: Comic Media, Problem Solving Ability, Interest in Learning

ABSTRAK

Pemecahan masalah matematika akan sangat dipengaruhi oleh kemampuan guru dalam menyampaikan materi pembelajaran matematika. Guru harus mampu mengembangkan materi menggunakan berbagai media yang diharapkan dapat membantu siswa mencapai tujuan pembelajaran matematika. Penelitian ini bertujuan untuk mengembangkan Media Komik Matematika Kelas IV Materi Pecahan yang valid, praktis dan efektif untuk meningkatkan kemampuan pemecahan

masalah dan minat belajar mata pelajaran matematika siswa sekolah dasar. Metode penelitian ini yaitu penelitian pengembangan atau Research and Development (R & D). Prosedur yang digunakan adalah dengan menyederhanakan model pengembangan Borg & Gall yang terdiri dari 10 langkah, pada penelitian ini akan dibatasi hingga langkah ke tujuh. Subjek penelitian dipilih adalah siswa kelas IV SD Negeri 02 Amban Tahun Ajaran 2023/2024. Teknik pengumpulan data yang digunakan pada penelitian ini meliputi kuisioner, lembar penilaian validator, dan Tes kemampuan Pemecahan Masalah. Teknik analisis data yang digunakan pada penelitian ini terdiri dari tiga yaitu analisis data kevalidan, kepraktisan dan keefektifan. Instrumen penelitian yang terdiri dari Rencana Pelaksanaan pembelajaran, Lembar Kerja Siswa, Media komik, tes kemampuan pemecahan masalah, Angket minat belajar yang telah dikembangkan berada pada kategori sangat baik berdasarkan penilaian ketiga validator. Kepraktisan diperoleh respon positif mahasiswa sebesar 88,6 %, berada pada kategori sangat praktis. Media komik efektif meningkatkan kemampuan pemecahan masalah dan minat belajar mata pelajaran matematika siswa sekolah dasar berdasarkan kriteria : a) Kemampuan pemecahan masalah siswa lebih baik dari kemampuan pemecahan masalah siswa kelas Kontrol.; b) Rata-rata kemampuan pemecahan masalah siswa Kelas Kontrol yaitu 60,31 sedangkan rata-rata kemampuan pemecahan masalah siswa kelas eksperimen 72,50 .c) Terdapat pengaruh minat belajar terhadap kemampuan pemecahan masalah siswa.

Kata Kunci: Media Komik; Kemampuan Pemecahan Masalah; Minat Belajar

INTRODUCTION

Innovation in the education sector will always be carried out as an effort to improve the quality of national education. In the process of changing from the Integrated Curriculum to the Independent Learning Curriculum, several aspects of the learning process also underwent changes, for example the assessment system in the form of assessments and characteristic surveys. In the learning process, the Merdeka Belajar Curriculum has a policy of prioritizing active learning through developing creativity, innovation and critical thinking in solving problems in the process. This change process has a positive impact on improving the quality of education (Achmad *et al.*, 2022; Sadewa, 2022)

Mathematics is one of the lessons taught in schools to students and plays an important role in shaping human thinking patterns, especially in everyday life (Ituga and Alman, 2023). Nisa and Wandani (2023) stated that mathematics is taught from elementary schools to universities, contributing to achieving national education goals and educating Indonesian people who are productive, creative and innovative. Mathematics is needed by all students because it encourages practical and critical thinking in solving problems and helps them understand other fields of study such as economics, accounting and physics. Whether we realize it or not, mathematics has been and will always be used in many activities and daily life (Nurulaeni and Rahma, 2022); (Sarwoedi *et al.*, 2018); (Sholihah and Mahmudi, 2015)

Mathematics learning that occurs in class does not give students the opportunity to think. The thinking process in mathematics can solve problems by simply calculating numbers and formulas, so that students can understand and apply it in everyday life. So far, the knowledge of Mathematics that has been embedded in the minds of students is confusion and difficulty in solving problems, this is because Mathematics is abstract in nature so it is difficult to accept in the minds of students (Indaryati and Jailani, 2015). Quality learning is built by several components, namely educational objectives, students, educators, curriculum, learning materials, approaches, methods, media, learning resources and evaluation (Ratnasari, 2017). From these components a learning activity will be formed which is characterized by the interaction of students, educators and learning resources (Kurino *et al.*, 2023).

Solving mathematics problems will be greatly influenced by the teacher's ability to deliver mathematics learning material. Teachers must be able to develop material that is expected to help students achieve mathematics learning goals. Indicators for stages of solving mathematical problems according to Pratiwi and Alyani (2022) namely: 1) stating the indications contained in the question; 2) Develop a procedural plan for solving problems; 3) answer problems based on planned strategies; 4) summarize the answers and recheck the results that have been obtained. Teachers must choose material that is in accordance with the curriculum, subject characteristics, and requirements for solving learning problems (Hasanah, 2020; Lestari, 2018). Problems that occur in the mathematics learning process are related to teaching materials. The teaching materials used in mathematics learning are less contextual even though mathematics learning is often used in everyday life. Some teaching materials are also lacking in visualizing abstract learning material according to students. Teachers should be wiser in selecting teaching materials that are easy, practical, contextual, and with attractive visualizations as a form of creativity and innovation in various learning media.

The implementation of meaningful mathematics learning requires adequate supporting facilities such as the availability of learning media. Learning media makes abstract material more real. Creative use of media can facilitate and increase learning efficiency (Kurniawati and Nita, 2018). The application of learning media can facilitate communication in the learning process (Arsyad and Fatmawati, 2018; Masruri *et al.*, 2020). Learning media will make learning more interesting (Kusumaningrum and Wahyono, 2019); (Moto, 2019); (Mahardika, Wiranda and Pramita, 2021); (Nurseto, 2012); (Junaidi, 2019). Media can provide meaningful learning experiences, activate and delight children (Andrijati, 2014) and the existence of learning media will motivate the learning process (Aribowo, 2017; Azhar, 2017). Using appropriate and interesting media can increase students' interest in learning (Aziza, Widodo and Agustito, 2019).

The results of research conducted by UNICEF (2020), many teachers have not used various digital learning platforms in the learning process. Teachers need to innovate in order to improve the quality of education such as using media. Media can be used as a link between material and natural findings by including content/images that are appropriate to the material so that students can more easily understand and remember the material (Mulyawati and Kowiyah, 2018). So, having learning media will really help the learning process. The importance of learning media will require teachers to be more creative in using learning media so that it has an impact on achieving learning goals. One learning media that can be used is comic media. Guntur, Sahronih and Ismuwardani (2023) said that comics are a composition of images and words that are intended to convey information to the reader. Comics always use image space in layout. In this way, the images form a narrative outlined by shapes and symbols. Comics are very familiar to elementary school age children and adults (Kurino, Herman and Turmudi, 2023).

The results of initial observations carried out in class IV of SD Negeri 02 Amban which were carried out in March 2023 showed that students' mathematical problem solving abilities were relatively low, especially in fractions. As a result of interviews with teachers, information was found that students' interest in learning in mathematics was relatively low, this could be seen from the lack of student activity during learning. Apart from that, the use of innovative media is very limited, as can be seen from the main learning sources for students, namely books

prepared by the government and power points prepared by teachers. Based on this background, research on the development of comic media to improve elementary school students' problem solving abilities and interest in learning mathematics subjects.

METHODS

Types and Design

This research is a type of development research or Research and Development (R & D). The development in this research is the development of Class IV Mathematics Comic Media with Fraction Material that is valid, practical and effective. The procedure used is to simplify the Borg & Gall development model (Sugiyono, 2015) which consists of 10 steps, in this research it will be limited to the seventh step, namely:

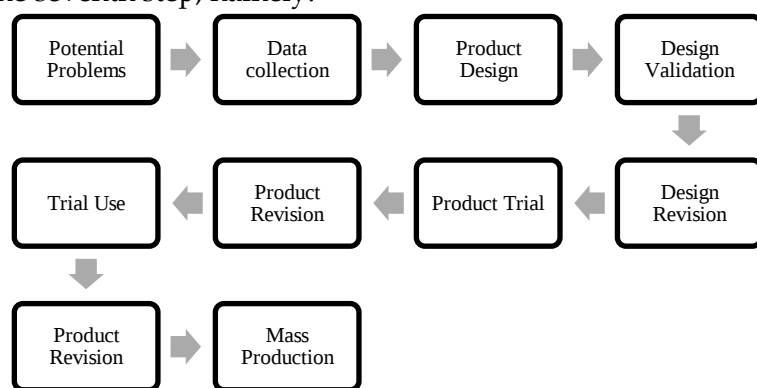


Figure 1. Research Flow Diagram (Procedure).

The subjects of study

The subjects of this study were students of SD Negeri 02 Amban. To determine the effectiveness of the product developed, the product needs to be tested for practicality in class IV students of the 2023/2024 Academic Year. The classes that will be used for product trials in this study are divided into two, namely class IV A students as the experimental class and class IV B students as the control class.

Data Collection Techniques

Data collection techniques used in this study include:

a. Questionnaire

Questionnaires are data collection techniques by asking respondents questions in writing. In this study, there were two questionnaires used, namely a student response questionnaire to learning aimed at determining the practicality of the product to be developed and a student learning interest questionnaire. The student learning interest questionnaire consists of 12 statements from four main indicators of learning interest, namely feelings of pleasure, student interest, student attention and student involvement. The questionnaire was given to students before and after being given treatment in the form of comic-assisted mathematics learning.

b. Validator assessment sheet

The validator assessment sheet in this study was used to obtain data on product validity. Validation was carried out after the product design. This process was carried out several times until a valid product was obtained.

c. Problem Solving Ability Test

The Problem Solving Ability Test is used as a reference to obtain the effectiveness of the device. The test was given to the experimental class and the control class.

Data analysis

The data analysis techniques used in this research consist of three, namely data analysis of validity, practicality and effectiveness of the Mathematics Comic Media Class IV Fraction Material that will be developed.

a. Validity data analysis

Validity of the Class IV Mathematics Comic Media Fraction Material which will be developed in this research using internal testing, namely expert review of the Class IV Mathematics Comic Media Fraction Material. Testing can be carried out several times until a valid design for Mathematics Comic Media Class IV Fraction Material is found. Expert opinion testing (expert review) was carried out by asking for the opinions of 3 experts and practitioners. The level of validity of the product being developed is measured using the following analysis techniques:

$$\text{Average Validation Score} = \frac{\text{Average Number of Validators Aspect}}{\text{Number of assessment aspects}}$$

The validity categories of Class IV Mathematics Comic Media. The Fraction Material that has been developed is made into four categories as in Table 1 below.

Table 1 Guidelines for Assessing the Validity of Class IV Mathematics Comic Media Fraction Material

Interval Average Score	Category
$1,0 \leq \text{Average} \leq 1,75$	Not Enough
$1,75 < \text{Average} \leq 2,50$	Enough
$2,50 < \text{Average} \leq 3,25$	Good
$3,25 < \text{Average} \leq 4,00$	Very Good

Class IV Mathematics Comic Media Fraction Material is said to be valid if the average score of all validators' assessments of Class IV Mathematics Comic Media Fraction Material is in the good or very good category.

a. Practicality data analysis

Practicality data was obtained from student response questionnaires. Isharyadi and Ario (2019) stated that the analysis of the practicality test for Mathematics Comic Media Class IV Fraction Material was carried out by providing a questionnaire to students, by determining the percentage of all items based on the following criteria:

$$\text{Percentage} = \frac{\sum \text{Total score obtained}}{\sum \text{Maximum Total Score}} \times 100 \%$$

Categories of practicality for Class IV Mathematics Comic Media. Fraction material that has been developed is made into five categories as in Table 2 below.

Table 2 Categories of Practicality of Class IV Mathematics Comic Media Fraction Material

Rating (%)	Category
80 <N ≤100	Very Practical
60 <N ≤80	Practical
40 <N ≤80	Practical Enough
20 <N ≤40	Less Practical
0 <N ≤20	Impractical

b. Effectiveness data analysis

Analysis of effectiveness data uses the average difference test in problem solving abilities. The test of the difference in average learning achievement between the experimental class and the control class begins with a test of the assumption of requirements consisting of a normality test and a homogeneity test which is then continued with an average difference test. Normality testing in this study used the Shapiro Wilk Test which aims to determine whether the population is normally distributed. Homogeneity testing in this study used Levene's Test For Equality of Variances which aims to determine whether the two groups, namely the control class and the experimental class, are homogeneous. After the prerequisite tests are fulfilled, data analysis continues with a test of the average difference between the problem solving abilities of the experimental class and the control class. with Independent sample t-test with a significance level of 5%.

RESULTS AND DISCUSSION

a. Potential Problems

Problems were obtained through observations and interviews related to the analysis of needs for Class IV Mathematics Comic Media Fraction Material at SDN 02 Amban Manokwari, Manokwari Regency.

b. Data collection

The data collection process at this stage is the stage of collecting data related to Class IV Mathematics Comic Media material, Fraction Material. At this stage the researcher collects references from various sources that are relevant to the materials in the comic media being developed.

c. Product design

At this stage the researcher will use Class IV Mathematics Comic Media with Fraction Material in accordance with the RPP that has been developed. After that, the comic media was designed with the help of the Canva application.

d. Product validation

Product validation includes aspects of content/material validity, which is carried out by three experts consisting of experts in the field of education with a minimum education qualification of S3 or Doctorate.

The results of the validation of learning tools and research instruments are presented in the table below:

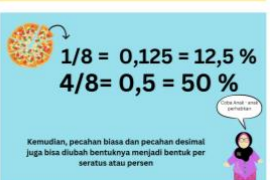
Table 3 Results of Validation of Mathematical Comic Media and Research Instruments

No	Learning Tools/Research Instruments	Validator 1	Validator 2	Validator 3	Average	Category
1	Lesson Plan	3.79	3.71	3.50	3.67	Very Good
2	Student worksheet	4.00	3.67	3.67	3.78	Very Good
3	Comic Media	3.88	3.75	3.50	3.71	Very Good
4	Problem Solving Ability Test	3.83	3.67	3.67	3.72	Very Good
5	Study Interest Questionnaire	3.50	3.75	3.50	3.58	Very Good

e. Design revision

Product revision is an activity to revise deficiencies and perfect the product based on the evaluation results of experts/validators. Design revisions to product designs for mathematical comics with valid fraction material. The revision of the mathematics comic is as follows:

Table 4 Results of Validation of Mathematical Comic Media and Research Instruments

Validator	Comments/ Suggestions	Before revision	After Revision
Validator 1	- Improve the cover to make it more attractive - The layout for embedding conversational sentences should not be too small	 The cover is too simple and not attractive	 The cover was designed from Canva by considering bright colors according to validator suggestions. The text size has been adjusted.
Validator 2	Some numbers are imprecise especially fractions	Mama ira membantu menjelaskan materi pecahan untuk anak anak ...  Writing fractions using $\frac{1}{8}$ should use the $\frac{1}{8}$ formula to avoid misconceptions	Mama ira membantu menjelaskan materi pecahan untuk anak anak ...  It has been adjusted so that it does not cause misconceptions

Validator 3	Some punctuation marks are still inaccurate and contain spelling errors		 Sudah disesuaikan sesuai dengan permintaan validator
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Product Trial

Product usability trials are trials carried out on limited groups to determine the practicality and effectiveness of the product to be developed. At this stage the researcher will test the test on class IV students at SD Negeri 02 Amban Odd Semester for the 2023/2024 academic year. The product trial will be carried out in October – November 2023. At this stage researchers will test it on class IV students with the following details:

Table 5 Product Trial Samples

No	Students	Class	The number of students
1	IV A	Control	32 Students
2	IV C	Experiment	32 Students

Usability trials were carried out during 4 meetings for providing material and 1 meeting for testing.

a. Practicality Data Analysis

Practicality data was obtained from student response questionnaires. Based on the practicality data analysis, the results of the practicality test obtained a positive student response of 88.6%, which is in the very practical category.

b. Testing Differences in Students' Higher Order Thinking Abilities

Normality test

Analysis of effectiveness data uses the average difference test in problem solving abilities. The test of the difference in average learning achievement between the experimental class and the control class begins with a test of the assumption of requirements consisting of a normality test and a homogeneity test which is then continued with an average difference test. Normality testing in this study used the Shapiro Wilk Test which aims to determine whether the population is normally distributed. The Shapiro Wilk Test was chosen because the sample size used was less than 100 students.

The hypothesis tested is as follows:

H_0 : Data on students' problem solving ability scores is normally distributed

H_1 : Data on students' problem solving ability scores is normally distributed

The normality test results of students' problem solving ability scores can be seen in table 6 below:

Tabel 6 Normality Test Results for Control Class and Experimental Class

	Shapiro Wilk Test		
	Statistic	df	Sig.
Nilai	.964	64	.061

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

a. Lilliefors Significance Correction

Based on the results obtained in table 6, the normality test on students' problem solving ability scores using the Shapiro Wilk Test obtained a significance value of 0.061 where $0.061 > 0.05$ so that H_0 was accepted. This means that the data on students' problem solving ability scores is normally distributed.

Homogeneity Test

The second prerequisite test is the homogeneity test, in this study using Levene's Test For Equality of Variances which aims to determine whether the two groups, namely the experimental class and the control class, are homogeneous. The hypothesis tested is as follows:

H_0 : The variance of experimental class and control class students is homogeneous

H_1 : The variance of experimental class and control class students is not homogeneous

The results of the homogeneity test for differences in students' problem solving abilities can be seen in table 7

Table 7 Results of Homogeneity Test of Problem Solving Ability of Control Class and Experiment Class Students

		Levene's Test for Equality of Variances	
		F	Sig.
Nilai	Equal variances assumed	.636	.428
	Equal variances not assumed		

Based on the results obtained in table 7, the homogeneity test on students' problem solving ability scores using Levene's Test For Equality of Variances obtained a significance value of 0.387 where $0.428 > 0.05$ so that H_0 was accepted. This means that the variance of students in the experimental class and control class is homogeneous.

a. Mean Difference Test

After the prerequisite tests are fulfilled, it is continued with a test of the average difference in problem solving abilities of control class and experimental class students. The average difference test was carried out using the independent sample t-test with a significance level of 5%. The hypothesis to be tested is:

H_0 : $\mu_1 \leq \mu_2$ (The problem solving ability of experimental class students is not better or the same as the problem solving ability of control class students)

H_1 : $\mu_1 > \mu_2$ (Students' problem solving abilities are better than the problem solving abilities of Control class students)

The test results of the differences in the average test results of students' problem solving abilities in the control class and experimental class can be seen in table 8.

Table 8 Test Results of the Average Difference in Problem Solving Ability of Control Class and Experiment Class Students

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Nilai	Equal variances assumed	2.792	62	.007	12.188	4.365	3.463	20.912
	Equal variances not assumed	2.792	60.576	.007	12.188	4.365	3.459	20.916

Based on the results obtained in table 8, the test of the difference in the average test results of students' problem solving abilities in the Control Class and Experimental Class, obtained a significance value of 0.007, where $0.007 < 0.05$, so H_0 is rejected. This means that students' problem solving abilities are better than the problem solving abilities of class students. Control.

The average problem solving ability of control class students is 60.31, while the average problem solving ability of experimental class students is 72.50. With details as shown in table 9 below.

Table 9 Average Problem Solving Ability of Control Class and Experiment Class Students

	Class	N	Mean	Std. Deviation	Std. Error Mean
Scores	Experiment	32	72.50	16.064	2.840
	Control	32	60.31	18.749	3.314

b. Test the Effect of Interest in Learning on Students' Problem Solving Ability

The influence test in this study used a simple regression test. Simple regression test to determine the influence of Learning Interest (X) on Students' Problem Solving Ability (Y). Before the influence test is carried out, a prerequisite assumption test is carried out in the form of a normality test of the dependent variable. In the previous sub-chapter, a normality test was carried out on the problem solving abilities of experimental class students. The results show that the dependent variable posttest learning achievement (Y) in the experimental class has met the required assumption tests so that the analysis continues with the influence test. The influence test used is simple regression analysis with the help of SPSS Statistics 23.0. The hypothesis is formulated as follows:

H_0 : $\beta = 0$ (there is no linear influence of variable X on variable Y)

H_1 : $\beta \neq 0$ (there is a linear influence of variable X on variable Y)

The error rate used is $\alpha = 0.05$. The testing criteria is that H_0 is accepted if the significance is > 0.05 , meaning there is no linear influence of the Learning Interest variable on Students' Problem Solving Ability. The test results of the influence of Learning Interest on Students' Problem Solving Ability can be seen in table 10.

Tabel 10 Anova^a Tabel

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6436.195	1	6436.195	123.472	.000 ^b
	Residual	1563.805	30	52.127		
	Total	8000.000	31			

a. Dependent Variable: Scores_Experiment

b. Predictors: (Constant), Learning_Interest

Based on the results obtained in Table 10, testing Interest in Learning on Students' Problem Solving Ability using a simple regression test obtained a significance value = 0.000 where $0.000 < 0.05$ so H_0 was rejected. This means that there is an influence of Learning Interest (X) on Students' Problem Solving Ability (Y). The magnitude of the influence of Interest in Learning on Students' Problem Solving Ability can be seen in table 11

Tabel 11 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.897 ^a	.805	.798	7.220

a. Predictors: (Constant), Learning_Interest

Based on Table 11, it is obtained that $R \text{ square} = 0.805 = 80.5\%$, this means that students' problem solving abilities are influenced by interest in learning by 80.5%, and 19.5% are influenced by other factors. Next, to find out the regression equation, see table 12.

Tabel 12 Coefficients^a

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
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		B	Std. Error	Beta		
1	(Constant)	-24.308	8.805		-2.761	.010
	Kemadiri n_Belajar	2.492	.224	.897	11.112	.000

a. Dependent Variable: Scores_Exp

Table 12 describe the values $a = -24.308$ and $b = 2.492$ are obtained so that the regression equation is $\hat{Y} = -24,308 + 2,492 x$. The regression equation is used as a basis for predicting students' problem solving abilities (Y) if learning interest (X) is known. These results are in accordance with the opinions of Astuti, Hidayat and Rusdiyani (2021), Pangriptaningrum *et al.*, (2024), Puspananda (2022) Subroto, Qohar and Dwiyana (2020), Shomad and Rahayu (2022), Mujahadah, Alman and Triono (2021), Harmini, Asikin and Suyitno (2020); Mulyati, Kusumadewi and Ulia (2021) revealed that comic media effectively improve students' problem solving abilities. The use of comics as a learning medium offers an interesting and effective approach for students because of its straightforward nature, easy to understand, and able to bring learning materials to life with visual creativity (Mikamahuly and Fadieny, 2023).

CONCLUSION

The research instruments consisting of learning implementation plans, student worksheets, comic media, problem solving ability tests, and learning interest questionnaires that have been developed are in the very good category based on the assessments of the three validators. Based on the validation results, it can be concluded that the two research instruments that will be used are valid so they can be used in limited product trials which will be scheduled for October 2023 in class IV at SDN 02 Amban.

After conducting limited trials, it can be concluded that comic media is effective in improving students' problem solving abilities in terms of learning interest with the following criteria: The results of the practicality test obtained a positive student response of 88.6%, which was in the very practical category, The students' problem solving abilities were better than the problem solving abilities of the Control class students. The average problem solving ability of control class students is 60.31, while the average problem solving ability of experimental class students is 72.50 and There is an influence of interest in learning on students' problem solving abilities.

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