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Making Comic Books Applying Science to Improve Students' Capabilities in Representation at SMP

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ABSTRACT

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This research aims to: The objectives of this study are to: 1) determine the validity of comic media; 2) determine its practicality; 3) determine its effectiveness; and 4) determine how to help students become more adept at representing themselves through comic media. ADDIE, which represents the evolution of analysis, design, execution, and assessment, model that is employed. According to his research's findings, 1) Comic media was deemed legitimate with an average score of 96.51%; these findings demonstrate the legitimacy of the comics produced. 2) Students' results on the practicality questionnaire yielded a score of 4.777 with a percentage of 95%, and teachers' results showed that comics are also very practical, scoring 4.866 with a percentage of 97.30%. 3) The created comics demonstrate effectiveness, scoring 59.306 on the pretest and 93.61 on the posttest for representational capacity. 4) At the summit improvement class, having an n-gain score for representation ability of 0.84.

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A. INTRODUCTION

The curriculum acts as a roadmap for achieving academic goals in the classroom. Indonesia currently uses the 2013 curriculum as a reference for education. Students must take mathematics at every educational level, including elementary, junior, and senior high school. It is clear that mathematics is important to human existence, which is why it is taught in all educational levels. In essence, the goal of studying mathematics is to help students learn it because the subject contains a lot of questions that can sharpen their critical thinking abilities.

Thus, literacy is a prerequisite for learning. One strategy for putting educational programs into practice is the literacy movement. The ability to accurately read, write, hear, and take notes is referred to as literacy, and it is capable of aid in information finding and effective communication, according to Sari, dkk (2018, pp. 94–103). Using media, like comics, is one idea that can support the literacy movement in education. Comics can be incorporated into math lessons to help students understand math concepts and to pique their interest in reading. According to Rosadi and Karimah (2022, pp. 87-96) support and interest in the students' work are two crucial elements of the classroom learning process. Because of this, teachers need to use instructional strategies like using comic books that can pique students' interest and increase their motivation to learn.

Indonesia is still lagging behind other countries regarding the learning outcomes for arithmetic, which is indicative of the poor the standard of instruction in our nation, based on information from the Ministry of Culture and Education (PISA), (2018). The average score for Indonesian students was 371, in reading out of 487 on the Programme for Assessment of International Students administered according to the Organization for Economic Cooperation and Development, although the mean score for pupils in the OECD was 487. Furthermore, the average score for Indonesian students was only 379, compared to the OECD average of 487. The typical science grade for Indonesian students was 389, while the OECD average was 489. The average science score for Indonesian students was 389, while the OECD average was 489. The academic performance of pupils from Indonesia

indicates that they are still falling behind in reading, math, and science. The findings indicate that there is a need to enhance the skills of Indonesian children, particularly in the area of mathematics.

Six guidelines for mathematics competence. Their founding was done in 2000 by the National Association of Mathematical Teachers. These requirements cover comprehension, ability to solve problems, convey ideas, establish connections, reason, and express. Pianda et al. (2018) state that mastering formula skills and comprehending concepts are two aspects of studying mathematics in the classroom. Not just the outcomes, but also the approaches taken to address these issues while taking the students' capacity for contemplation into account. In order to enhance students' representational abilities, appropriate learning is required, and one such method The utilization of comic books in the classroom. This is necessary to help students comprehend and learn math lessons more readily.

Two components of understanding, according to Suningsih et al. (2021, pp. 225-234), are knowledge and the capacity to consider a subject from several perspectives. Students demonstrate their thinking about a problem in a way that aids in their solution through representation. For students to comprehend lessons, particularly math lessons, they must possess those skills. In a journal article titled " Creation of Digital Comics to Enhance Students' Conceptual Knowledge of Mathematics" Afifah and Dewi (2022, pp. 24-34) discovered that e-comics are regarded as an efficient teaching tool for improving students' understanding of mathematical concepts. This is due to the fact that student learning completeness has been attained based on the percentage effectiveness criteria results. The results showed that incorporating comic books into The classroom is able to improve pupils' understanding of mathematical concepts and their capacity for representation.

Comics, according to Wulandari (2021), are images arranged logically and used to either communicate ideas or elicit spontaneous reactions from students. Based on the information presented above, together with the problem's history, an observation, as well as some corroborating study, researchers provide education through comic books.

B. RESEARCH METHODS

The five stages of design for development research include analysis, creation, application, testing, and assessment. Gafur, A. (2012) states that the ADDIE model is used in this process. As a result, a variety of products, including media, instructional materials, learning strategies, and models, can be made using this model. Figure 1 illustrates the research object, which was comic media containing Science instruction in social arithmetic for seventh-grade pupils at SMP Muhammadiyah 03 in Medan. Batubara (2020)

Figure 1. ADDIE Model of Development.

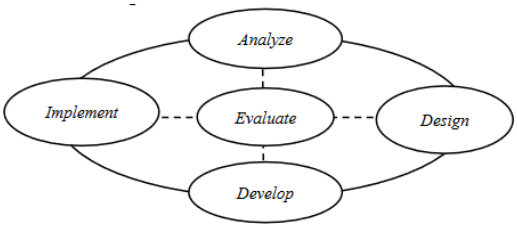

Table 1 below displays a single group pretest-posttest design.

Table 1 Putting the One Group Pretest-Posttest Design into Practice

Pretes t	**Treatmen t**	***Posttes t***
O1	**X1**	**O2**

Various formulas are employed to assess the validity, practicality, and efficacy. The following formula is used to determine if comedic educational resources are legitimate. Akbar, S (2013):

$$\text{Validity Score: } \frac{TSe}{FSh} \text{ x } 100\% \quad (1)$$

The standards for educational media's validity level are listed in Table 2..

Table 2 Acquiring Knowledge about Media Validity Level Categories

No.	**Standards of Validation**	**Level of Trustworthiness**
1	85,01 % - 100, 00 %	Excellent, or doesn't need to be edited
2	70,01 % - 85,00 %	Useful or reusable with adjustments

No.	Standards of Validation	Level of Trustworthiness
3	50,01 % - 70,00 %	Reduced reliability; usage is discouraged as major adjustments are needed..
4	01,00 - 50,00 %	Untrue or inappropriate

The following method is used to assess practicality based on seeing how learning is put into practice. Fitriyah, and As'ari (2013).

$$\text{Ratio of Choice} = \frac{Spurchase\ order\ in\ questionnaire}{maximum\ score} \text{ x } 100\ \% \quad (2)$$

Table 3 lists the prerequisites for practical learning resources.

Table 3 Execution Level Learning Category

No.	Percentage (%)	Practicality Criteria
1	80 - 100	Incredibly useful, unediting
2	66 - 79	Reasonable, sans editing
3	56 - 65	Enough of a practicality, sans editing
4	40 - 55	Less useful; more work is needed
5	40 - 39	Not feasible; modification is needed

It uses the Minimum Completeness Criteria (KKM) ≥ 70 as a guide when determining the basic requirements for idea understanding and representation abilities. The following details regarding the interval of mastery criterion are shown in Table 4.

Table 4 Level of Student Mastery

No.	Value Interval	An explanation of successful learning
1	BK < 55	Reduced
2	55 ≤ BK < 70	Just to recap
3	70 ≤ BK < 85	Alright
4	85 ≤ BK≤ 100	Excellent

The following formula can be used to determine the percentage of learning for each learner:

$$KB = \frac{T}{T_t} \times 100\% \quad (3)$$

The following shows how students' abilities to represent mathematical concepts have improved as a result of using the normalized gain index data:

$$N - Gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \quad (4)$$

Table 5 below displays the normalized gain index criteria.

Table 5 ***N-Gain*** Score Groups

N-Gain **Score**	***N-Gain*** **Criteria**
$0{,}00 < N - Gain \leq 0{,}30$	Minimal
$0{,}30 < N - Gain \leq 0{,}70$	In between
$N - Gain > 0{,}70$	Elevated

C. RESULT AND DISCUSSION

1. Validity of Comic Learning Media

96.51% is the average score. The three validators' results generally indicated that the comic may be used without change, as shown in the accompanying table:

Table 6 Verification of Comics Outcomes

No.	Validator	Score	Description
1	Dr. Arnita, M.Si.	100%	Incredibly true
2	Dr. KMS. Amin Fauzi, M.Pd.	89,52%	Incredibly true
3	Dr. Waminton Rajagukguk, M.Pd	100%	Incredibly true
	On average	96,51%	Incredibly true

2. Practically of Comic Learning Media

This study makes use of a student response questionnaire and a learning implementation observation questionnaire to evaluate the usefulness of the educational materials produced. This is done to make sure that

the learning objectives are met to the highest standard and that the produced learning materials are regarded as useful. The findings of the monitoring of the application of learning contain the shown in Table 7.

Table 7 Outcomes of the Implementation Survey and Student Input

	Type of Questionnaire	
	Learning Implementation	**Student Reaction**
Score	4,866	4,777
Percentage	97,30%	95%
Criteria	Extremely useful	Extremely useful

As indicated by the data in Table 7, finalizing the practical assessment for pupils' survey at a completion rate of 95% and a 4.777 average score, and completing the questionnaire for educators (teachers), which is classified as "extremely practical", yielded an average rating of 4.866 and a portion of 97.30%. These two presentations' outcomes yielded the "Very Practical" practicality standard.

3. The Effectiveness Of Educational Comics

Table 8 presents the following information about the degree of student proficiency in mathematical data representation..

Table 8 Pretest Result of Ability to Represent Mathematically

Ability in Math	**Average Score**
Ability to Represent	59,306

The representation ability pre-test results averaged 59 when taking into account the above table. Students' level of proficiency is still within the "sufficient" range, according to this result.

Table 9 Result of The Posttest on Mathematical Representation

Ability in Mathematics	**Average Points**
Capability to Represent	93,611

According to the above table, the mean score for representation ability after the test is 93.611. The data suggests that students' competence levels fall into the "very good" range.

4. Improved Representation Ability

The results of the following are the normalized gain scores shown in the table, based on the Ideal Maximum Score (SMI) = 100 N-gain computation:

Table 10 N-gain Score Result

Ability	Score	Criteria
Computational Illustration	0,84	Significant Improvement

Considering the information in the table above, it is evident that the n-gain score for the representation ability is 0.84, indicating that it is in the significant improvement category. Based on the available data, comic books can be an effective teaching tool for math.

The end product this study is a mathematical cartoon book that applies a systematic method for approaching class VII social math content. This study's goal was to ascertain whether the comics were a legitimate, useful, and efficient way to improve Mohammediyah 03 Junior High School in Medan students' representational skills in grade VII.

The process for developing comic media is called the ADDIE framework and it is broken down divided into stages for development, analysis, design, execution, and assessment. The subjects of the research were pupils in seventh class Ibrahim SMP Muhammadiyah 03 Medan. The purpose of the study was to determine whether utilizing comic books in the classroom improves students' ability to represent mathematical concepts. Experts must first validate comic books before they can be used in the classroom.

The purpose of the procedure for validating comics is to assess the caliber of comics by considering factors such as language, presentation, and content viability. The numerical information displaying the comic validation outcomes shows that the comics produced are really legitimate, with a score of 96.51%. The results of this inquiry align with a study conducted by Umroh et al. (2017), entitled " Creation of Class VII MTs Subject Matter of Mathematics Learning Modules Based on Unity of Sciences," which indicates that the modules have adequate validity and are useful as they are simple to implement in classroom settings.

Students who complete the questionnaire for practicality yields a 95% percentage and an average rating of 4.777, while educators obtain a mean score of 4.866 and a practical remark in addition to a 97.30%

proportion. The data was gathered to evaluate teachers' and students' practicality through the completion of the survey sheet.

To determine efficacy, the results of the pre- and post-tests were evaluated. In terms of students' mathematical representation ability, the pretest scores of 59.306 and 93. On average, 611 showed a decrease from the post-test scores. The comic media is classified as "very good" based on these data. Thus, finally that comic books are a useful teaching tool.

Next, using an increase on representation skills normalized to 0.84, the results of the Normalized Gain test show how much students' capacity for representation has improved. As such, it falls into the high improvement category. Thus, it can be concluded that scientifically based comic learning has improved. Comic books can therefore be used to teach.

According to research " Development of Comic-Shape Math Teaching Materials to Enhance Students' Mathematical Proficiency in Grade VII Junior High School" by Fikriani and Nurva (2020), the comics were found to be very valid (90%) and practical (83.5%) as well as effective (73.3%) at improving students' mathematical abilities. The aforementioned data demonstrate how comics can motivate students and aid in their mathematical learning. Furthermore, social mathematic content is linked to comics so that students can learn and develop their representational abilities.

D. CONCLUSION AND SUGGESTIONS

The final outcome of this progress inquiry is scientifically based comic books as a math resource education that enhances representation abilities and comprehension of mathematics ideas in social arithmetic class VII content. Putting the analysis, development, design, execution, and assessment into practice techniques helps achieve this. The following outcomes are expected: (1) Validity, or the ability of comics to be used in accordance with the opinions of all validators, is the result of expert evaluation. 96.51% on average is the score. Thus, comics created using a scientific method to help students become better at representing and comprehending mathematics fall into the category of extremely valid comics. (2) Practicality, or the outcomes of evaluating comics created using a scientific methodology to enhance pupils' comprehension and representation of mathematics. Based on the implementation questionnaire that the teacher completed, the presentation received a 97.30% rating with an excellent assertion, and the average score was 4.866. Despite the fact that the results of the student response survey showed a 95% presentation in a category that is highly useful and a score of 4.777. (3) Pre- and post-test results regarding the effectiveness of the pupils' mathematical representation capacity, which are 59,306 and 93,611. It falls into the excellent category and uses comic media for learning effectively, according to the posttest results. (4) The mathematical representation ability n-gain score with the n-gain testing was 0.84, falling into the high improvement category. This demonstrates how the capacity for idea representation increases when learning a scientific method through comic book media.

Regarding recommendations, they are as follows: comic learning media that takes a scientific approach to social arithmetic content can be one of the options for junior high school students in the VII grade; comic learning media that takes a scientific approach to social arithmetic content can be improved in terms of content and appearance; and it is required to create additional materials for math comics in addition to social arithmetic content.

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