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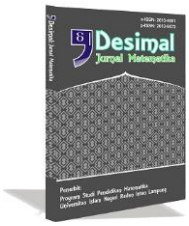

Comic media development to improve students' understanding of comparative concepts

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ABSTRACT

Understanding mathematical material begins with reading, but there are still many students who need reading interest so that it will affect their ability to deal with problems. It is also important to learn mathematics using mathematics learning media. This will motivate students to read the material provided so that students can easily understand it. The purpose of this study is to explain the process and results of developing comics media for comparative material. The development of comic media on this comparison material is to improve students' understanding of the concept of comparison. The quality of this media development is seen from the aspects of validity, effectiveness, and practicality. This research is development research using five stages, namely: Analysis, Design, Development, Implementation, and Evaluation. This research produces a mathematical comic comparison material. The results are: (1) based on the comic media quality assessment for experts, the average score is 4.28 and is included in the very valid classification, (2) based on the results of student learning tests, the media created is declared effective by solving test questions 95% with an average class score of 84.5 and included in the very effective classification, (3) based on the student response questionnaire, the comics media made were declared practical with a total average percentage of 97.2% which were included in the very practical classification. Thus the developed comics media can be used for learning mathematics comparative material.

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INTRODUCTION

The results of the Programme for International Student Assessment (PISA) related to the reading literacy level of students in Indonesia in 2021 stated that the literacy level of students in Indonesia was still relatively low. The standard level of student literacy in Indonesia is still at level 2 PISA, so students are still thinking at a low level and not able to think at a higher level. Students at this level are only able to understand what is written in the text. The last 2018 education system evaluation survey showed that 70 percent of Indonesian children were below the minimum competency level in reading,

namely 71 percent in mathematics and 60 percent in science (Fahlevi, 2021).

This shows that students' reading, math, and science skills in Indonesia are in the lowest rank. Even though reading is a receptive activity and an active form of absorption so that it can understand the contents of the reading (Yunus, 2012). Reading activities are very important in human life, especially for students. But for most people reading is not an easy thing. Reading is not an activity of looking at symbols alone, but rather an activity of understanding the meanings that are related to one another so that it creates an understanding of a reading content (Djuanda, 2007).

In learning mathematics, if students are not careful in reading due to a lack of interest in reading, it will result in a less than the optimal understanding of mathematics. Therefore, the teacher as a teacher must be able to take advantage of innovative learning methods and media, in order to motivate students to be more enthusiastic in learning activities so that it affects student learning outcomes.

Hamalik (1986) stated that the use of media in learning activities can raise students' enthusiasm for learning, as well as increase motivation and stimulation of learning activities, and even bring psychological effects on students so that it affects student learning outcomes. Various teaching methods and materials can increase students' learning motivation. In addition, learning media can also help students improve understanding because the material is presented in an interesting way. For example, teachers use teaching aids or pictures for teaching media, so students are more interested and enthusiastic about learning.

One of the efforts to increase student's interest in learning mathematics is to cultivate students' learning to read to understand existing concepts. In this case, the teacher plays an important role in this effort, because books alone cannot make students excited to read, but there needs to be a new design so that students are more interested in reading. One of the popular media among students is comics because comics are interesting media to read.

The comic is a book that contains simple stories equipped with funny pictures so that the contents are easy to understand and make comics loved by both children and adults (Daryanto, 2010).

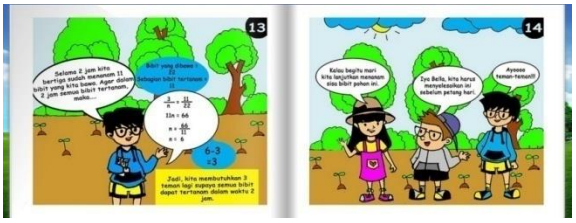

Figure 1. Comic Display

According to Trimo (1997), comics media used for learning have several advantages, such as expanding vocabulary, making abstract things easier to understand, stimulating reading interest, and increasing understanding of teaching materials. The comics developed by the researcher almost contain all the components in the textbook, where there are summaries, glossaries, and answer keys to practice questions that are packaged in an attractive way so that students are more interested in learning the material in comics.

This research aims to describe the process and results of the development of comparative material comics media. The development of this comic media is expected to help students understand the concept of comparative material, especially for class VIII junior high school students. Comparative material was chosen because we often encounter comparative material in everyday life problems, so it will be easier if it is made into a story in a comic. By learning comparative material through comics, students' memory will be stronger because they are influenced by emotional involvement when reading comics which

are expected to be the right alternative media for learning (Ledoux, 2002).

The development of comic media in learning has been done by previous researchers, including research by Septy et al. (2015) entitled "Development of Comic Learning Media on Opportunity Material in Class VIII". The difference in the previous research is that it uses opportunity material, while the current study uses comparative material. In addition, another research by Adeliyanti et al. (2018) entitled "Development of Technology-Based Mathematics E-Comic as a Learning Supplement in Quadratic Function Applications", while the difference in previous research is using online comics in google classroom and can only be accessed using an email account, e-comic explains the material for quadratic functions, while in the current study the researcher creates comic books and online comic books that can be accessed by anyone at the address: https://anyflip.com/bsink/wcyl/ comics explains comparative material. Researchers made online comics because, at the time of research at school, activities were limited due to the covid-19 outbreak, so with the help of online comics it would be easier for students to study at home.

From the explanation above, there are differences and innovations made by researchers at the stage of developing comics media. Based on previous relevant research, it was stated that the learning media developed received a positive response from students, they felt happy and interested in the media so that lessons were well received and could improve student learning outcomes.

METHOD

The research method used is development research with the ADDIE development model, which has five stages: (1) Analysis; (2) Design; (3) Development; (4) Implementation; (5) Evaluation. Researchers have a goal to create learning media in the form of comics on comparative material for junior high school students. The development of the ADDIE model is used because the stages are in accordance with the development of comparative material using comics media, as well as the stages of design, implementation, and evaluation that are very likely to produce practical and effective media. Figure 2 is the stages of the ADDIE development model.

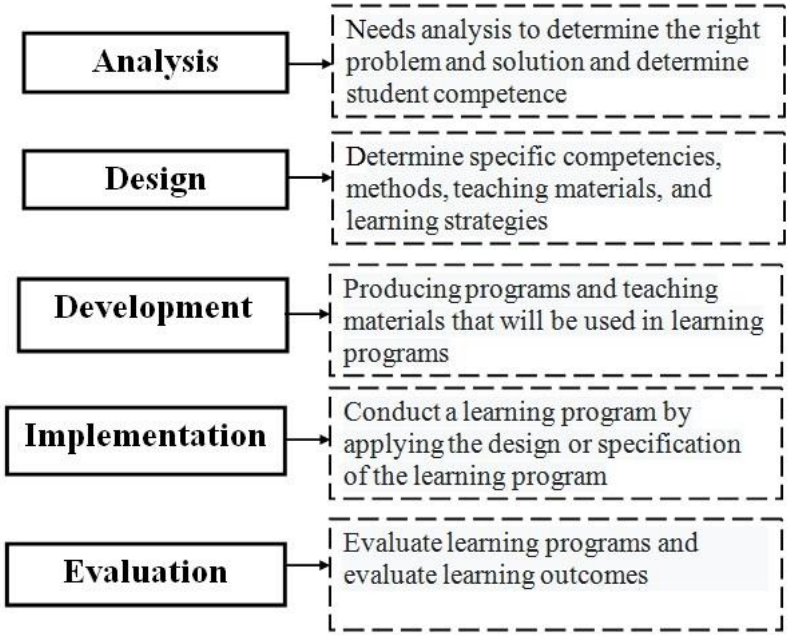

Figure 2. ADDIE Development Model

The analysis phase aims to explain the details of the program. In the initial step, the researchers conducted a curriculum analysis by conducting a literature review which included an analysis of core competencies, basic competencies, materials, competency indicators, and using the 2013 curriculum as a reference. At the design stage, the researchers outline the contents of the comic comparison material, prepare references, sketches, and materials. Next, determine the specifications for the comic, make a comic media assessment sheet consisting of an assessment sheet by material experts, media experts, and language experts, as well as compose test questions and student response questionnaires.

Furthermore, the researchers tested the comics media that had been validated in the comparative material mathematics learning activities in schools. This is the second step or implementation which is an achievement after the process of designing and developing Comics. The last step of developing comics media is the evaluation process, at this step the researcher conducts a final revision after the comics media has been piloted to produce comics media that are suitable for learning comparative material. The development flowchart in developing comparative material comics media for class VIII junior high school students is seen on Figure 3.

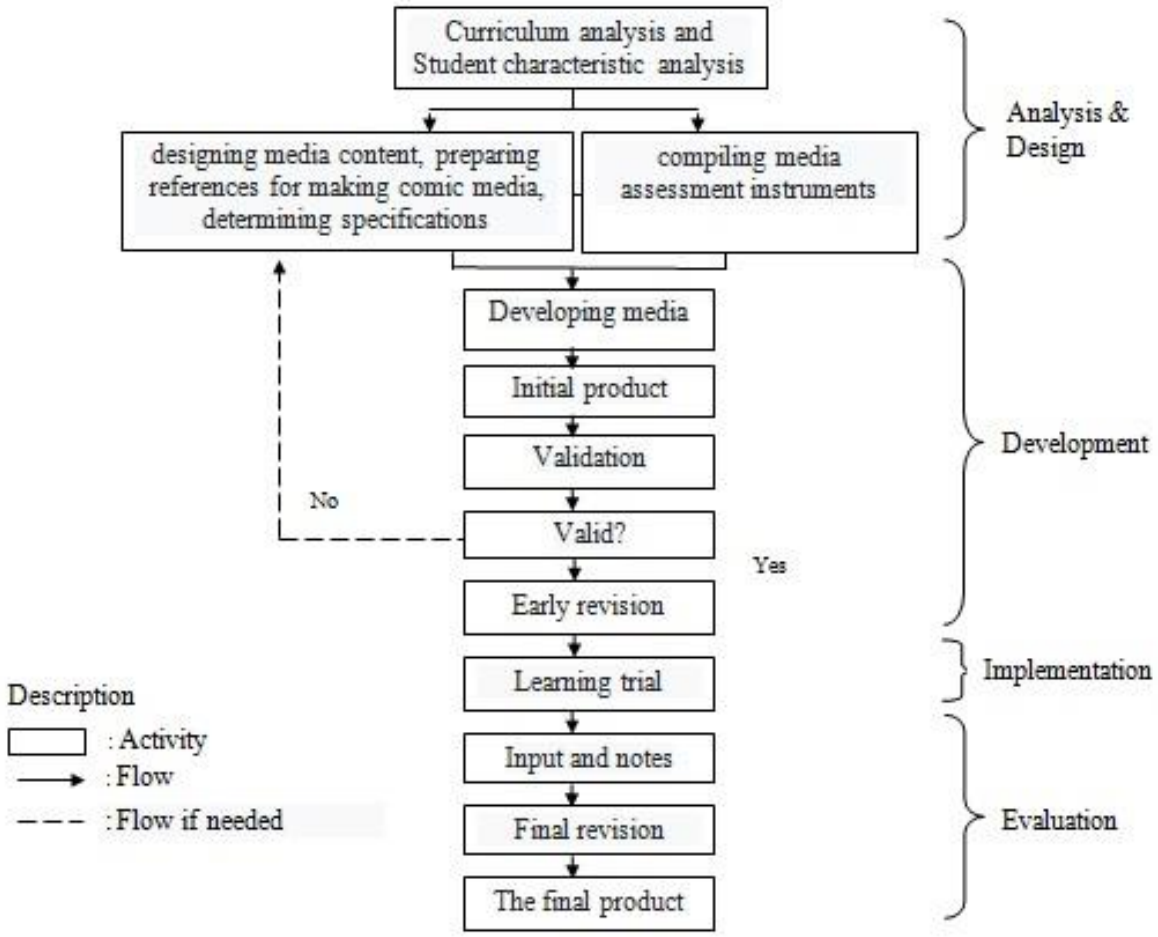

Figure 3. Comic Media Development Flowchart

The research was conducted at SMPN 1 Candi, Sidoarjo, Indonesia with the research subjects being grade VIII I students. In this study, several data

collection techniques were used to support researchers to obtain data on the results of developing comparative comics media from the aspect of validity, effectiveness, and practicality. Media validity data were obtained through expert assessments of comics media, media practicality data obtained through student response questionnaires, and media effectiveness data obtained through student learning outcomes data conducted at the end of the lesson.

RESULTS AND DISCUSSION

The initial stage of development is the analysis stage. In the analysis phase, the researchers conducted curriculum analysis and student analysis. Curriculum analysis is carried out by examining the Basic Competencies and Learning Indicators on comparative materials applied in the schools where the trials are conducted and using the 2013 Curriculum as a reference. Based on this curriculum analysis, researchers developed comics media that were in accordance with Basic Competence 3.8, namely knowing the difference between comparisons of worth and value with the help of data tables, graphs, and equations, and Basic Competency 4.8, which was solving problems related to comparisons of worth and reversed values. The researchers also made a lesson plan when conducting trials. In addition, researchers analyzed the characteristics of students in terms of cognitive development, where students over the age of 12 years (class VIII SMP students) were in the formal operations phase, where students could do theoretical thinking. From the results of studying the competencies and characteristics of students, it was found that the appropriate material was comparison material to be developed in comics as a learning medium for class VIII SMP.

After the analysis stage, the next is the design stage. At the design stage, the researchers assemble the framework in the comic media, plans reference books, pictures, materials, and descriptions, decides on the details of the comic media to make it easier for researchers to make comic media, and arranges the comic media assessment instrument to be used as material in developing and improving comics.

In the design stage, there are several steps that must be taken, the first is to develop a comic media framework. The comics media framework contains the delivery of comparative material adapted to the results of curriculum analysis. The following Table 1 shows the presentation of comparative material on comic media.

Table 1. Presentment of Comic Media Material

Learning Activities (KB)	Material
KB 1	Comparison
KB 2	Scale
KB 3	Direct Proportion
KB 4	Inverse Proportion

Then the second step is to plan reference books, pictures, materials, and description questions. The book is used by the researchers as a reference, namely 1) Nuh (2014). MATEMATIKA SMP/MTs Kelas VIII Semester 2. Curriculum and Books Center, Balitbang, Kemdikbud. 2) Team (2011). *SMART MATH* (Untuk kelas VII, VIII, IX SMP). CV. Putra Pratama. As for pictures and materials, the researchers designed and explained the characters of each character, described the setting in the comics and made conversation scripts between characters using comparative material as a topic of discussion.

After all the references are collected, the third step is to determine the specifications of the comic. There are three parts in the developed comic media, namely 1) the first part or cover consists of the comic cover and the introduction; 2) the second part is the content consisting of character introduction, material

description, examples, summary, and practice questions; 3) the third or final part consisting of answer keys, glossary, a summary of comics, and compiling instruments for evaluating comics media.

After passing the design stage, the researchers continued the third stage, namely the development stage. At this stage, the researchers carried out three processes, namely, the process of developing comics media, the process of assessing the quality of comics media, and the process of improving comics media.

In the process of developing comics media, researchers arranged comic sections to make it easier for students to understand comparative material. The sections in the comic include the beginning, the content, and the ending.

The initial section contains a Comic Cover and a foreword page. researchers make comics media using a combined technique, first, the researchers draw the characters along with the comic background manually then proceed with the coloring process using photoshop. As for the front cover, there is a picture of the character and background in the comic story and there is a comic title, namely "Mission Planting Three Friends", while on the back cover of the comic there is a summary of the story to attract students' interest in learning with comic media. Figure 4 is the comic cover display.

Figure 4. Comic Cover Display

While on the foreword page, the author briefly describes the contents of the comic media, appreciation, and gratitude, as well as the author's expectations about the comic media, as well as the name of the author. It can be seen in Figure 5.


KATA PENGANTAR

Assalamualaikum.Wr.Wb.

Segala puji bagi allah yang senantiasa memberikan rahmat serta hidayahnya sehingga penulis bisa menyelesaikan karya pertamanya yang berhubungan dengan dunia pendidikan yaitu komik edukasi dengan judul "Misi Penanaman Tiga Sahabat".

Buku komik ini berisi materi pada pembelajaran matematika yaitu materi perbandingan. Buku ini dilengkapi dengan gambar tokoh komik yang memudahkan siswa untuk memahami materi perbandingan.

Perbandingan adalah salah satu ilmu matematika yang sering kita jumpai dalam kehidupan sehari-hari. Buku ini mengambil sumber dari buku matematika siswa kelas VII SMP yang kemudian dirancang menjadi tampilan cerita yang menarik dalam komik.

Saya berharap buku komik ini dapat bermanfaat bagi siswa yang kesulitan dalam materi perbandingan serta bisa menjadikan siswa lebih bersemangat dalam belajar dan memahami konsep perbandingan dalam kehidupan sehari-hari.

Sidoarjo, 12 September 2021

Dian Sartika
Penyusun

Figure 5. Preface Page

The content section contains a character introduction page, material descriptions, sample questions, summary, and practice questions.

The character introduction page contains pictures and the characters in the comic story. Figure 6 is a form of the introduction page in the comic media.

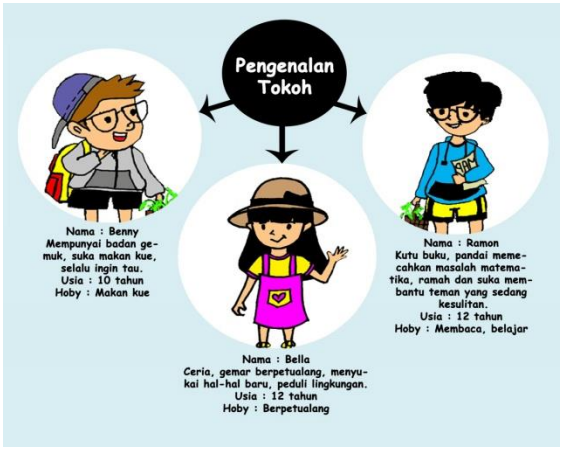

Figure 6. Comic Character Introduction Page

On the material description page and examples of material questions, the description of the material in the comic is arranged according to the indicators of achievement of abilities that must be achieved. The depiction of the material is made using stories in comics. Submission of material begins with the problems experienced by the characters in the story, making it easier for students to understand comparative material. The

concept of comparison is described in detail so as not to cause multiple understandings in students. The description of the material is also accompanied by examples of questions with how to solve them. Figure 7 is an example of a description of the material developed in the comic media.

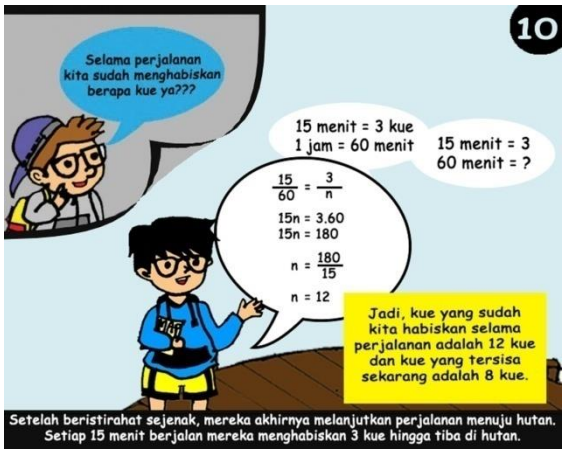

Figure 7. Description of Material in Comic Media

The material summary page is presented so that students can review and better understand the concepts in comparative material. The summary is written briefly and clearly so that students can understand it easily. Figure 8 is a summary description of the comic media.

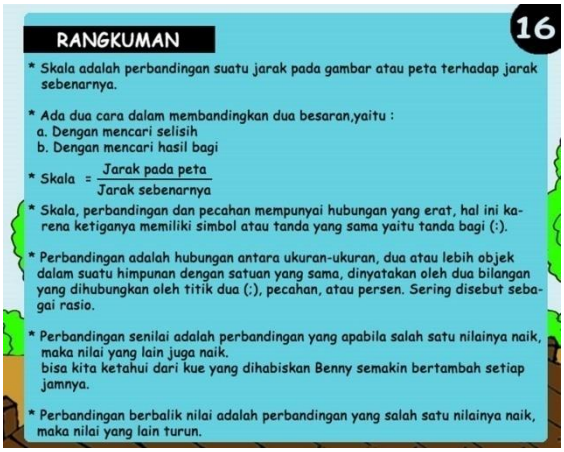

Figure 8. Summary Display

On this page, researchers make practice questions with the aim of training and improving students' skills in solving questions related to comparative material. Practice questions are presented in various ways according to the level of difficulty. Figure 9 is one display of the practice questions in comics.

Figure 9. Practice Questions Display

While the last part of the comic contains the answer key page and glossary.

The answer key page contains answers from practice questions on comics, used as a guide and comparison by students to correct their work, while the Glossary Page contains important terms in the Comic media comparison material with clarification on the importance of terms that make it easier for students to understand the material. In comparison material, there are four terms presented in the glossary, namely Comparison, Scale, Direct Proportion, and Inverse Proportion.

The second process in the development stage is the process of evaluating the quality of comics media. In this process, the comics media that were developed were further validated by media experts, material experts, and linguists. The validators in the evaluation of the comics media are a lecturer in the mathematics education study program at STKIP PGRI Sidoarjo and a mathematics teacher at a state junior high school in Sidoarjo who is a media expert, a lecturer in the mathematics education study program at STKIP PGRI Sidoarjo and a mathematics teacher at SMP IT in Sidoarjo who become material expert and one of the Indonesian language teachers at SMP IT in Sidoarjo who became a linguist. The

validator gives an assessment of the comic media using the comic media assessment sheet. Table 2 is a recapitulation of assessments by media experts, material experts, and linguists.

Table 2. Comic Media Rating Recapitulation by Experts

Expert	Average Score	Total Average	Category
Media Expert	4.38	4.28	Very Valid
Material Expert	4.31		
Linguist	4.15		

Based on Table 2, the average score of comic media assessment is 4.28 which is included in the very valid classification. This can be seen through the table of criteria for the validity of learning media according to Khabibah (2006), namely:

Table 3. Criteria for Validity of Developed Module

Score	Criteria
$4 \leq RTV \leq 5$	Very Valid
$3 \leq RTV \leq 4$	Valid
$2 \leq RTV \leq 3$	Less Valid
$1 \leq RTV \leq 2$	Invalid

So, it can be concluded, according to media experts, material experts, and linguists that the comics media made are **very valid**, namely in accordance with educational comic book standards and have a good degree of validity.

The third process in the development stage is the process of improving comic media. The improvement of the comic media is carried out after filling out the assessment sheet for the comic media by the experts. The comments and suggestions for improvement from experts regarding the comic media are used as material in improving the quality of the comic media. The suggestions from the validator relate to the writing of the "division" sign, ambiguous language in the summary, and the use of capital letters in the names of characters. Details of the improvement of the comic media can be seen in Figure 10.

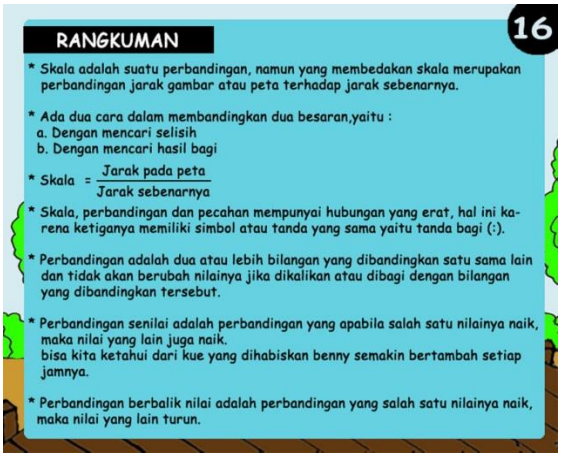

Figure 10. Summary Before Revision

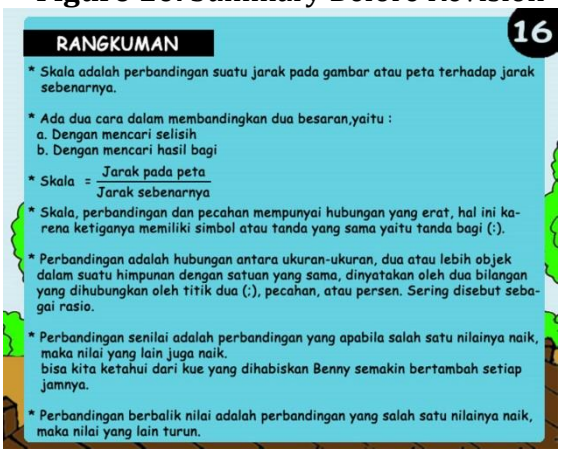

Figure 11. Summary After Revision

Figure 12. Problem Solving Before Revision

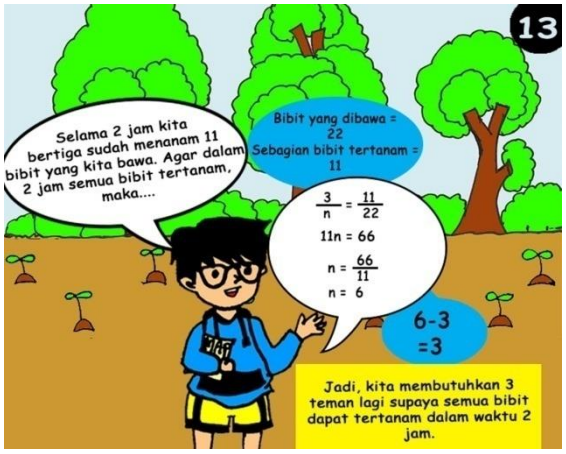

Figure 13. Problem Solving After Revision

Figure 14. Writing Divisors Before Revision

Figure 15. Writing Divisors After Revision

The fourth stage of this development is the Implementation Stage. At this stage, the improved comic media was then tested in the teaching and learning process in schools. The trial phase was carried out on 22 students in class VIII at one of the public junior high schools in Sidoarjo from September 21, 2021, to October 04, 2021. Students seemed enthusiastic about taking part in learning using comics media.

Figure 16. Students Use Comic Media for Learning

After learning with comic media, students are then given a Learning Outcome Test to see the final skills of students after learning with comics media. The completeness of the learning outcomes test is 95% with a class average score of 84.5 and is included in the very good category, this can be seen through the table of completeness criteria for the learning outcomes test according to Widoyoko (2009).

Table 4. Criteria for Completeness of Learning Outcomes Test

Percentage (%)	Criteria	Effectiveness Analogy
$p > 80$	Very good	Very Effective
$60 < p \leq 80$	Good	Effective
$40 < p \leq 60$	Good Enough	Effective Enough
$20 < p \leq 40$	Less Good	Less Effective
$p \leq 20$	Bad	Ineffective

From these results, it can be concluded that the developed comic media is **very effective**, meaning that the developed comic media provides good results for students.

Figure 17. Example of Student Work

Furthermore, the results of the student response questionnaire to the comics media got satisfactory results with an average percentage of 97.2% and included in the very good criteria, this can be seen through the table of student response questionnaire criteria according to Riduwan (2010).

Table 5. Student Response Questionnaire Criteria

Score	Criteria	Practical Analogy
$0 \leq PRS < 20$	Bad	Not Practical
$20 \leq PRS < 40$	Less Good	Less Practical
$40 \leq PRS < 60$	Good Enough	Practical Enough
$60 \leq PRS < 80$	Good	Practical
$80 \leq PRS < 100$	Very Good	Very Practical

From these results, it can be concluded that the comic media developed is **very practical** and easy to use in learning activities at school.

After implementing Comic media, the researcher then carried out the final stage, namely the Evaluation Stage. The evaluation stage is the revision stage of the developed media if there are suggestions for improving the media after implementation. However, in this research, there were no revisions from teachers or students. Thus, the comic media that is made has good quality because it fulfills three aspects, namely **very valid**, **very effective**, and **very practical**. According to the theory of Nieveen (1999) that a product of learning material development must meet the criteria of validity, practicality, and effectiveness so that teaching materials can be used properly and assist students in achieving competence.

The research of Adeliyanti et al. (2018), resulted in 81.25% class completeness and the user response questionnaire obtained showed the percentage of the questionnaire was 94%, while in the current study it produced 95% class completeness and student response questionnaires with an average of 97.2%. The difference in previous research is that using online comics in google classroom can only be accessed using an email account using a class password, students who want to access must have the google classroom application, while in the current research, researchers develop comic books and comic books online that can be accessed by anyone. just by using the following link: https://anyflip.com/bsink/wcyl/

The results of this research indicate that students during learning using comic media find it easy to access online. This makes it easier for students to learn comparative material during the Covid-19 pandemic because students learn a lot online. In addition, students feel happy learning with this media, do not feel bored and are motivated to learn comparative mathematics using comics media. The difference between the comics developed by the researchers compared to previous comics is that they are designed in an attractive and colorful way, equipped with summaries, glossaries, and answer keys for practice questions that are packaged in an attractive way and make it easier for students to understand the concept of comparative material.

CONCLUSIONS AND SUGGESTIONS

Comparative material comics for junior high school students that have been developed and tested on 22 students get good results. As for the score obtained by media experts, material experts, and linguists with an average score of 4.28, the assessment of student learning test results with a class average score of 84.5 and the completeness of the learning outcomes test is 95%, and the assessment of student response questionnaires with a total

percentage 97.2%. These results show that comics media are suitable for learning in schools because they fulfill three aspects, namely very valid, very effective, and very practical.

In this research, there are several obstacles and suggestions for further research. The obstacle experienced by researchers is that the implementation of the comic media trial in schools is not optimal due to a reduction in lesson hours during the Covid-19 pandemic, researchers hope for further researchers to be able to conduct trials with a longer duration of time in order to get maximum results. again. In addition, suggestions for future researchers are to not only assess knowledge but also assess attitudes and skills.

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