



DEVELOPING DIGITAL - BASED COMIC MEDIA IN TEACHING MATHEMATICS FOR ELEMENTARY SCHOOL STUDENTS

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Abstract

This research aims to develop digital-based comic media on addition and subtraction materials of mathematics for elementary school students at grade II. This research was motivated by a lack of knowledge of students on addition and subtraction materials. The novelty of this media is in the form of files without using sheets of paper. This study used ADDIE model (Analysis, Design, Develop, Implement, and Evaluate). Based on the five stages of development of comic media resulted from the feasibility of 90% while the practicality of teachers obtained a percentage of 90% and practicality of students obtained a percentage of 93%. The use of products gets a percentage of 86% with the category "excellent". This study has an implication that the use of learning media makes students more actively involved in the learning process especially those in elementary schools. Therefore, teachers are supposed to maintain their creativity in teaching.

Keywords: Addition, Digital Comics, Elementary School, Mathematics, Subtraction,

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INTRODUCTION

Mathematics is one of the most crucial subjects taught for elementary school students (Adilla et al., 2019). This is in accordance with Rizki & Pd (2019) reporting that "mathematics is used anytime, anywhere by people. In addition, Farid & Yansyah (2019) report that mathematics is a science whose objects are in the form of facts, operations and concepts. (Lestari & Surya, 2017) revealed that it is a basic science that accompanies the process of advancing and human civilization. Meanwhile, (Hasibuan, 2018:21) states that mathematics which has its main characteristics is deductive reasoning and inductive reasoning. According to (Rizki & Pd, 2019), the function of mathematics in learning as a medium or tool for students to achieve learning competence, as a means of thinking patterns or knowledge. According to (Priatna & Yuliardi, 2019) the addition performance is denoted by the usual "+" is called plus or plus, and the "-" sign is called minus.

Mathematics lessons for elementary school students still show weaknesses. In mathematics learning in elementary schools, there is still a lack of interaction between teachers and students (Fironika, 2014). Mathematics lessons are abstract so that it is difficult for elementary school students to understand. Elementary school students need real objects or examples that can be seen and held directly. As stated by Piaget that "children aged 7 to 11 years can think concretely but have not been able to solve abstract problem solving" (Suparno, 2010). Santrok and Yusen in (Sumantri & Syaodih, 2010) divide them into 5, namely, (1) the prenatal phase or in the womb, at this stage the time between conception and birth. (2) Baby phase, lasts from birth to 18 or 24 months, new psychological activities begin socialization. (3) The early childhood phase, the development that takes place from birth to 5 or 6 years is sometimes called the pre-school period. They learn to do many things themselves and develop related to school readiness and spend a few hours playing, (4) Middle and late childhood phases, a development that lasts from approximately the age of 6 to 11 years. Have mastered the basic skills of reading, writing and arithmetic. (5) Adolescent phase, the transition period from childhood to early adulthood. Starting at around 12 years of age and ending at 18 to 22 years of age. In this phase, efforts are made to be independent and seek self-identity and be able to think logically, abstractly and idealistically. "Experiences as attacked are obtained from direct experience (concrete), then through artificial objects, to abstract symbols" (Arsyad, 2013:13). But so far, students' abilities in mathematics need more attention. The application of wrong mathematical abilities can affect students' intellect to go higher (Anita, 2014),

In this era of globalization, science and technology are developing very fast, especially technology has an effect on education (Tirtarahardja, U., 2012). Rapidly developing technology makes it easier for teachers to provide facilities such as tools or media for learning (Afandi, 2013; Wahyuningsih, 2018, 2019; Wahyuningsih & Dewi, 2019). Various learning media make students not get bored quickly and learning becomes more interesting. Learning media is a tool

in the learning process to stimulate students' ability to encourage the learning process (Tafonao, 2018:103). media is anything that functions to convey information or messages from the communicator (teacher) to the communicant (students) and by utilizing the senses it will benefit students (Farid & Yansyah, 2019).

However, the reality in the field is that there are still many teachers who have not maximized learning media. In teacher learning using worksheets, students tend to feel bored and quickly get bored in the learning process. The advancement of technology has an effect on the preparation of learning media. The media is an element of communication from communicators to communicants (Daryanto, 2016:3). The classification of learning media according to (Nurdyansyah, 2019:50) is human-based media (teachers, instructors, tutors, role playing, group activities), print-based media (books, guides, exercise books, work aids), media-based visuals (books, work aids, charts, graphics, maps, pictures), audiovisual-based media (video, film, tv), computer-based media (computer-assisted teaching, interactive video). The advancement of technology is used by teachers as an alternative so that the media is more varied. One of them is comics. (Daryanto, 2016:145) defines a cartoon that expresses characters and a story related to images and is designed to provide entertainment to readers. The development of comics is developing well, comics are in demand of all ages. Comics themselves have various forms, one of which is a digital-based comic book. According to (Suana, 2017:89) revealed that it is a book that contains writings and pictures. Meanwhile, according to (Suana, 2017:89) electronic or digital books contain graphic, text, and image displays. So in conclusion a digital or electronic book is a book in which there is text or images in it. (Sudjana & Rivai, 2017:69) the main role in comics is to arouse students' interest in reading. According to (Soedarso, 2015:496) comics consist of 2 categories, namely comic strips or serial comics and comic books or known as comic books.

The problems in previous research show similar problems to this study. For example, research (Ulia, 2018:3) with the existence of learning media can make students enthusiastic in the learning process so that the material presented by the teacher can be attacked properly by students. (Nurrita, 2018:171) also found that if students are taught only in theory it will cause boredom, with the existence of learning media it can increase student motivation and interest in learning.

Based on the results of an interview on Monday, 19 October 2020 at Tambakromo 02 Public Elementary School with grade 2 teacher, Zumala. During a pandemic like this student are only given worksheets because government handbooks can usually be distributed, during a pandemic like this it is not allowed. If there are students who do not understand, they can ask him or look for references on the internet. And for learning mathematics, students are usually only given examples via photo paper or by being told the material in the worksheets on such pages. Most grade 2 students already understand addition and subtraction material, but in units

or tens. Addition and subtraction materials use hundreds of numbers, grade 2 students are still confused about the material.

Some students do not master the problems that have a problem solving. This is because students must first understand and study the questions about these problems. Even though in the story questions, there are problem solving which can develop and foster students' intelligence. One of them is the plural intelligence of students. With students knowing their plural intelligence, these students can think rationally in solving problems and can determine solutions according to the problem. And so that students can find out their plural intelligence, teachers in providing learning need a tool or intermediary. These tools or intermediaries are usually called learning media.

With the lack of use of media in learning, it becomes a reflection material for utilizing digital-based comic media so that students do not experience boredom in learning. According to Kanti et al (2018:135) "digital comics have several advantages, namely, increasing interest in learning, understanding abstract learning, the material is packaged in the form of pictorial stories and without using an internet connection to read it". With the development of digital-based comic learning media, it is hoped that it can make it easier for students to understand addition and subtraction material.

Research on the development of teaching materials containing local wisdom is relevant to the research conducted by (Soedarso, 2015) concluding that the suitability of the needs of teachers and students. Comics are focused on school class lessons and are aimed at high school children. Kanti et al., (2018) report the development of digital comic media on mathematics learning data processing material in class V MI Darussalam Curahmalang Jombang. The difference with this development is that this research focuses on the mathematics of addition and subtraction material and is aimed at elementary school students.

METHODS

This research and development were carried out at Tambakromo 02 State Elementary School using the R&D (Research and Development) method. Methods that are deliberate, aim to formulate, develop, test, certain methods, methods, products, which are superior and meaningful (Putra, 2015). The research method used the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model that was developed by Dick and Carry in 1996 (Branch, 2010). The reason of using ADDIE model is to have an evaluation in each level so that the error and mistake of the product can be minimalized.

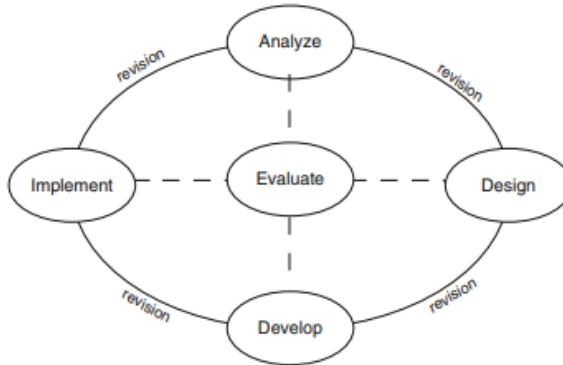


Figure 1. The development stages of ADDIE model

Data collection techniques in this study used interviews, questionnaires and tests. The questionnaire used for the feasibility validation test filled by four validators, namely two academic validators and one practitioner validator, while the practicality test is filled out by the class teacher and all students in grade II of Tambakromo 02 Public Elementary School. Meanwhile, to calculate the feasibility level of the validation sheet, the researcher uses the formula by Arikunto (Rohmah, 2016:60). Meanwhile, to test a product on the material of addition and subtraction, using the formula by (Putranto & Dhoruri, 2013). After calculating all student test scores using the formula above then calculating classical completeness.

In analyzing the data, the writers had several stages:

1. Expert Validation Data Analysis

To determine the feasibility level of digital-based comic media, expert validation should fill out a questionnaire. It uses a scoring guideline, namely the Likert scale with five alternative answers. Meanwhile, to calculate the feasibility level of the validation sheet, the writers used the formula by Arikunto (2016) explaining that P is the percentage of feasibility, $\sum x$ is a score and $\sum x_i$ is the total score.

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

The result of the level of feasibility or validity can be described as follows:

Scores	Category	Scoring (%)
5	Very valid	$80 < N \leq 100$
4	valid	$60 < N \leq 80$
3	Less valid	$40 < N \leq 60$
2	Not valid	$20 < N \leq 40$
1	Not very valid	$0 < N \leq 20$

Source : (Kholipah & Pritandhari, 2020:45)

2. Practicality Test Data Analysis

To find out the practicality of digital-based comic media, teachers and students were asked to fill out a questionnaire. The questionnaire sheet uses a Likert scale with five alternative answers. To calculate the value of practicality, researchers use the formula (Sugiyono, 2013):

$$\text{percentage} = (\text{total score obtained}) / (\text{total maximum score}) \times 100\%$$

The results of the level of practicality can be known with the following conditions:

Score	Category	Scoring (%)
5	Very practical	$80 < N \leq 100$
4	Practical	$60 < N \leq 80$
3	Less practical	$40 < N \leq 60$
2	Not practical	$20 < N \leq 40$
1	Not very practical	$0 < N \leq 20$

Source: (Kholipah & Pritandhari, 2020)

3. Usage Test Data Analysis

The trial assessment of the use of digital-based comic media is based on a learning outcome test conducted at the end of the lesson to determine the effectiveness of digital-based comic media. The steps are as follows (Putranto & Dhoruri, 2013):

- Calculating the test scores of each student's learning outcomes.

Determine the results achieved by each student with the following formula:

$$x = \frac{\sum_{i=1}^k x_i}{\sum_{i=1}^k x_{imaks}} \times 100$$

Note:

X: student's score

$\sum_{i=1}^k x_i$: total score of learning outcomes test

$\sum_{i=1}^k x_{imaks}$: the maximum score for learning outcomes

- Calculating the number of students who graduated based on the school's KKM, which is 75.
- Calculating classical completeness by using the following formula:

$$p = \frac{L}{n} \times 100\%$$

note:

p: the percentage of students passing classically

L: the number of students who passed the KKM

n: the number of students

d. Converting the calculation of the previous step to show the students' academic ability categories classically as shown in the following table:

Score Range	Classification
$p > 80$	Very good
$60 < p \leq 80$	Good
$40 < p \leq 60$	Enough good
$20 < p \leq 40$	Less good
$p \leq 20$	Not very good

Source: (Widoyoko, 2013)

RESULTS AND DISCUSSION

Developing digital-based comic learning media Using ADDIE model on Mathematics to Improve Students' ability in Addition and Subtraction Materials

Based on interviews at Tambakromo 02 State Elementary School, it was found that there was a problem with limited learning media and knowledge of multiple intelligences, so research developed a digital-based comic media product on addition and subtraction material. The process of developing digital-based comic learning media on addition and subtraction material in class II uses the ADDIE model which consists of five stages, namely analysis, design, develop, implement, evaluate.

a. The first stage is analysis

This stage is to formulate the problems faced by teachers and students. Through the interviews that have been conducted, it can be concluded that the teacher uses less media in the learning process. The problem faced by students is that students have difficulty solving the problems contained in the questions. The problems that have been analyzed are then formulated and get solutions and problem solving. The solution that researchers consider appropriate is the development of digital-based media.

b. Design Stage

Based on the results of the analysis phase, it is used as the basis for designing the media. At this stage, product design is carried out in the form of media named "Digital-based comics" addition and subtraction material in learning themes 1 KD 3.3 and 4.3 to determine the ability of grade II students. The following is the examples of design stage:



Figure 2. cover



Figure 3. Page of purpose of learning

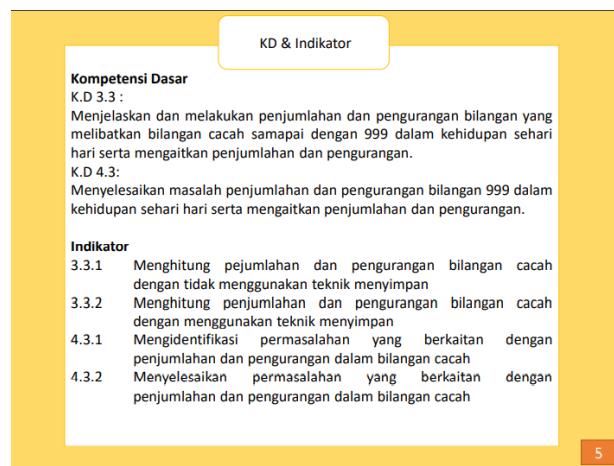


Figure 4. page of basic competence and Indicators

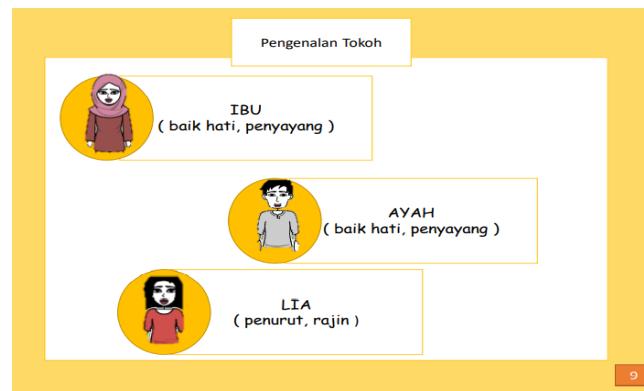


Figure 5. Page of introducing members



Figure 6. page of story content

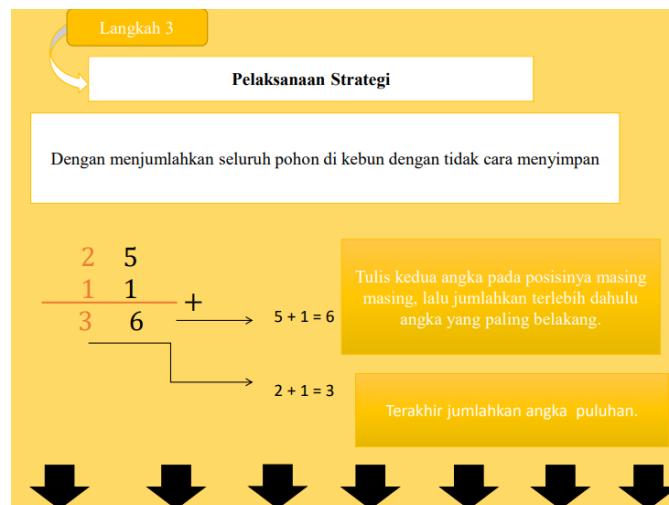


Figure 7. page of discussion

c. Media development Stage

It begins with designing and compiling stories and materials that are packaged in the form of digital-based comic media. The first design is done by making a character in a comic story. The concept of learning media used is digital based so that students are able to make good use of the device. The media development stage is carried out by using various references so that the learning media meets the material aspects and good presentation, and is easy for students to understand. After producing, it was validated by 3 validators, namely 2 lecturers and 1 teacher. "The purpose of validation is knowing and assessing the feasibility level of a product being developed" (hendryadi, 2017). Media validation is seen from the material and presentation aspects, then it is revised according to the validator's suggestions. The results of the validation of the first validator, Ulia, obtained a score of 81 with a percentage of 81%. While the results of the second validation, Setiyono, obtained a score of 95 with a percentage of 95%. And the results of the third validation, namely Zumala, obtained a score of 93 with a percentage of 93%.

Meanwhile, digital-based comic media was also tested for the level of practicality carried out by a class II teacher at Tambakromo 02 Elementary School, namely Zumala, by filling out a questionnaire that contained 10 statement. The result of the teacher response questionnaire is 45 which is then in the form of percent, namely 90% with the category "very practical".

In addition, there is revision of product suggested by the validators. Therefore, the improvements were made to the draft learning media. These improvement of learning media made by the writers include:

1. Revising types of fonts

Before being revised, there were still different types of fonts. After being revised and all fonts were equalized.

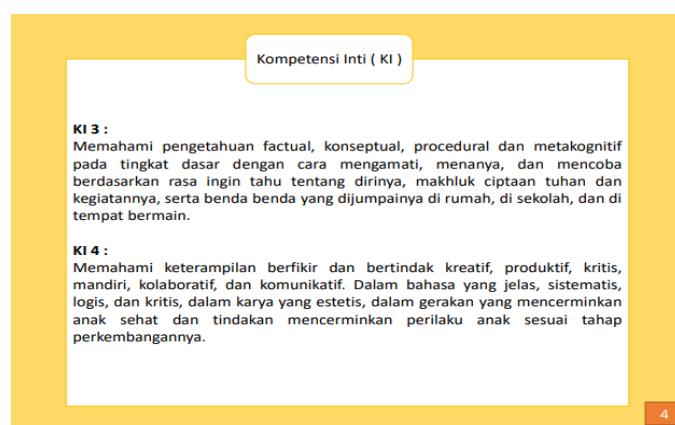


Figure 8. Font Types Before Revision

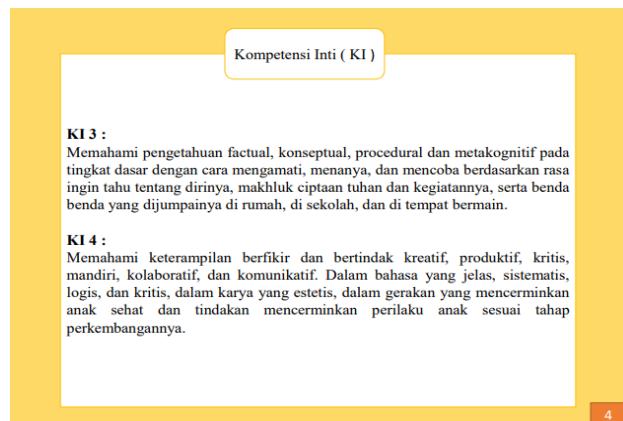


Figure 9. Font Types After Revision

2. Adjusting writing with standard rules

Before the revision, there were spellings that did not meet the standard rule of writing, after being revised the letters that did not initially use capital letters became capital letters.



Figure 9. Writing Before Revision



Figure 10. Writing After Revision

3. Adding Material Summary

Before being revised, there was no summary of the material. After being revised, a summary of the material was added.

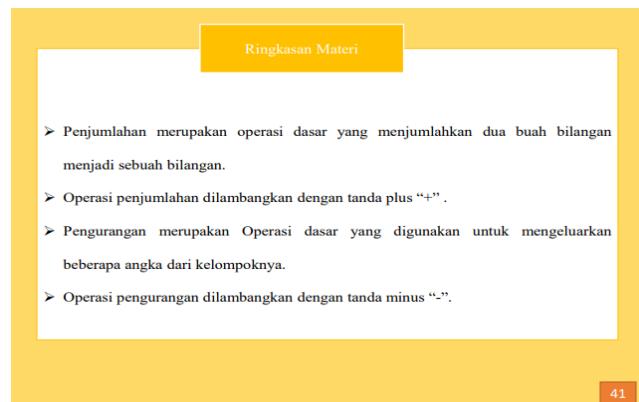


Figure 11. Material Summary

d. Implementation Stage

The use of the product at this stage the product is used at SDN Tambakromo 02 which is located in Tambakromo Village, Kec. Tambakromo, Kab. Starch. The use of the product is carried out in class II SDN Tambakromo 02, totaling 15 students on February 10, 2021. After implementing a media, students were asked to work on the final result questions to determine the plural intelligence of students after using comic media.

e. Evaluation stage

In this stage, the practical level assessment was carried out by all 15 students of grade II of Tambakromo 02 State Elementary School. The results obtained from the student response questionnaire were 1,310 with a percentage of 86%. Based on the questionnaire responses, students get the "very feasible" category, which means that the learning media fosters students' enthusiasm for mathematics in addition and subtraction material.

After going through the stages in the development of comic media, he produced comics that can be read online and offline. Teaching aids in the form of learning media make it very easy for students in terms of teaching and learning (Supriyono, 2018). This media is developed through the 5 stages described above. Research using comic media based on Android has also been conducted by Nurhayati (2019) regarding the development of mass media digital comics showing the feasibility of media literacy is 3.73 & 74.6% with the appropriate category, information and technology experts 3.81 & 76.2% abli material amounted to 3.89 & 77.8% with the feasible category, and field trials of 3.94 & 78.7% authentic with the feasible category, digital-based comic media on addition and subtraction material has the advantage of being based media. This Android is offline and does not require internet access to be used. In the feasibility test, research was carried out by 3 validators with an average score of 90 percent 90% in the "very feasible" category. The results of the three validators can be seen in the following graph:

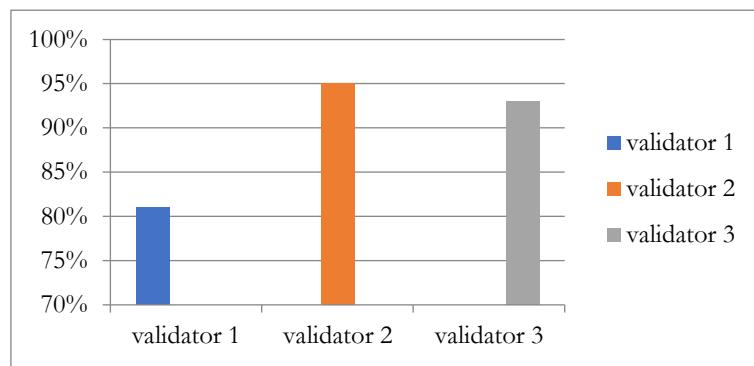


Figure 12. Graph of the feasibility of learning media

At the media application stage, a final result test was carried out to determine students' ability in addition and subtraction material. The results of the trial can be seen in the following graph:

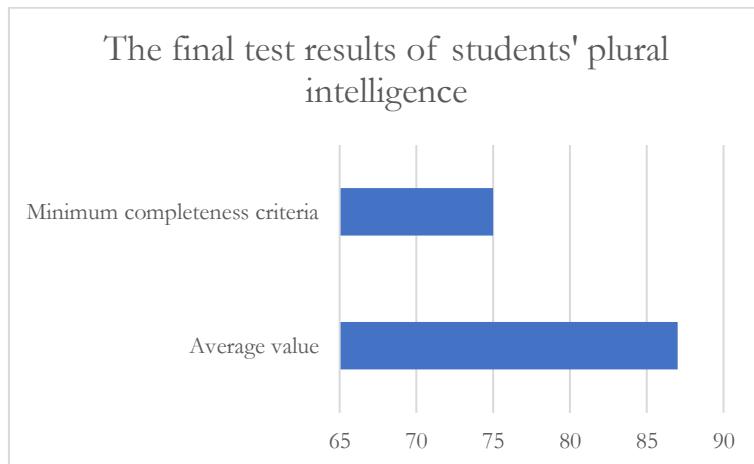


Figure 13. Graph of the use of learning media

Meanwhile, to test the practicality of a media, the research was carried out by class teachers and all grade II students of Tambakromo 02 Elementary School. The teacher response questionnaire obtained a percentage of 90% while the student response questionnaire obtained a percentage of 93%. In obtaining questionnaire scores the teacher and student responses get the "very practical" category used in addition and subtraction material. The results of teacher and student responses can be seen in the following graph:

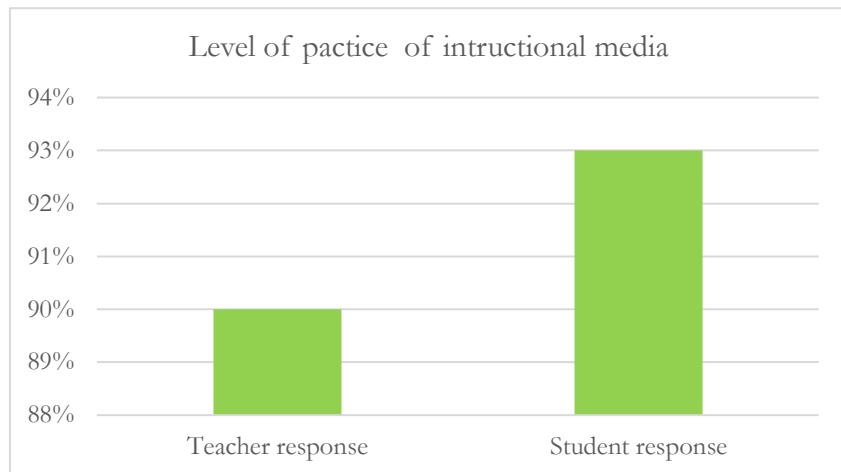


Figure 14. Graph of the practicality of learning media

Based on the students 'test scores, it is known that the students' scores on each indicator of multiple intelligences include 89% problem solving, 95% strategic planning, 77% strategy implementation and 83% checking. Student scores are influenced by the use of learning media, namely digital-based comic media according to student needs. Learning using comic media can provide better knowledge on mathematics for elementary school students. This finding is accordance with other previous studies reporting that comic media can be effectively used in teaching various subjects including English, Science, and mathematics (Rokhayani & Utari, 2014; Suryatin & Sugiman, 2019; Winarto et al., 2018). Therefore, it can be highlighted that the use of learning media makes students more actively involved in the learning process

CONCLUSION

The development of digital-based comic media uses the ADDIE model with 5 stages, namely analysis (analysis stage), design (design stage), develop (development stage), implement (application stage), evaluate (assessment stage). The learning media product is declared "very feasible" as evidenced by the first validator with a score of 81 by obtaining a percentage of 81%, the second validator with a score of 95 by obtaining a percentage of 95%, the third validator with a score of 93 by obtaining 93%. Digital-based comic media is a very practical category. This can be proven by the results of teacher responses and student responses. The response of the teacher who got a score of 45 by obtaining a percentage of 90%, and the response of students who obtained an average score of 47 by obtaining a percentage of 93% so that the learning media was declared "very practical".

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