



Development of *E-Comic*-Based Mathematics Teaching Materials on the Topic of Multiplication and Division with Realistic Mathematics Education (RME) Approach

Nurbaiti Widyasari¹ dan Anisa Nurcahyani²

^{1,2}Universitas Muhammadiyah Jakarta

Corresponding Author: nurbaiti.widyasari@umj.ac.id¹

History Article

Received: October, 2021

Accepted: November, 2021

Published: December, 2021

Abstract

The purpose of this study was to develop E-Comic-based mathematics teaching materials on the topic of multiplication and division with the Realistic Mathematics Education (RME) approach. This research is a research and development using the Hannafin and Peck development model. This model consists of three phases, namely needs assessment, design, development, and implementation. The subjects in this study were students of class 3A SDN Pinang 2 Tangerang City. The results research obtained included 1) material expert validation got 95,38% with very valid criteria, 2) linguist validation got 87,5% with very valid criteria, 3) media expert validation got 97,5% with very valid criteria. Assessment of student responses 1) small group test got 95,41% with high criteria, 2) large group test got 99% with high criteria. Based on the results of the assessment, the E-Comic-based mathematics teaching materials developed are valid and can be used as additional teaching material for teaching the concept of multiplication and division.

Abstrak

Tujuan penelitian ini adalah mengembangkan bahan ajar matematika berbasis E-Comic pada topik perkalian dan pembagian dengan pendekatan Realistic Mathematics Education (RME). Penelitian ini merupakan penelitian pengembangan (Research and Development) dengan menggunakan model pengembangan Hannafin dan Peck. Model ini terdiri atas tiga tahap, yaitu penilaian kebutuhan, desain, pengembangan dan implementasi. Subjek pada penelitian ini adalah peserta didik kelas 3A SDN Pinang 2 Kota Tangerang. Hasil penelitian yang didapatkan antara lain 1) validasi ahli materi mendapatkan 95,38% dengan kriteria sangat valid, 2) validasi ahli bahasa mendapatkan 87,5% dengan kriteria sangat valid, 3) validasi ahli media mendapatkan 97,5% dengan kriteria sangat valid. Penilaian respon peserta didik 1) uji kelompok kecil mendapatkan 95,41% dengan kriteria tinggi, 2) uji coba kelompok besar, mendapatkan 99% dengan kriteria tinggi. Berdasarkan hasil penilaian tersebut maka bahan ajar matematika berbasis E-Comic yang dikembangkan valid dan dapat dijadikan sebagai bahan ajar tambahan untuk pengajaran konsep perkalian dan pembagian.

Keywords: Mathematics teaching materials, E-Comic, Multiplication, and Division, Realistic Mathematics Education

INTRODUCTION

Mathematics is the most important thing to learn from the elementary school level in the world of education because it teaches how to solve everyday problems. According to Department of National Education (Kurnianti et al., 2017), the purpose of learning mathematics is to build students' critical reasoning ability when faced with everyday life problems related to the field of mathematics.

Mathematics is very important for elementary school students to learn and master from the lower grade level. One of the important elements to learn is the numbers contained in arithmetic operations. First, master addition and subtraction, then next, need to master the concept of multiplication and division. The concept of multiplication can be instilled in students as repeated addition, while the concept of division is instilled as repeated subtraction.

The ability of students is still low in understanding and mastering the concepts. This was found in the results of research from (Yusmanita et al., 2018) in SD Negeri 46 Banda Aceh students that there were obstacles in understanding the concept of multiplication when analyzing the results of the tests carried out. It was also found in the results of research from (Fauziah et al., 2019) that the ability of the division concept of SDN Gebangsari 02 students was still low.

It can be said that some students still have difficulties in understanding mathematics subject matter even though they have been taught according to the teaching materials used. Providing subject matter requires additional teaching materials to support the success of the learning process. According to Lestari, designing and compiling teaching materials is one of the teacher's abilities to achieve the success of the learning process (Gazali, 2016).

Teaching materials are currently still glued to the theme book which must always be used so that there is no other support used by the teacher so that learning can be more effective. Therefore, other supporting teaching materials are needed by teachers for learning to take place (Maskur et al., 2020). The teaching material that is more varied to increase students' learning motivation and teacher's teaching motivation is comic-based. Comics have a role as a learning media according to Arrio (Lestari et al., 2016) namely the delivery of scientific information visualization interestingly and entertainingly. In this case, comics as a visual communication medium have an important role in conveying information or subject matter with the power of interesting and easy-to-understand illustrated stories.

Comics can be developed into E-Comic so that educational progress can adapt to technological developments that are developing continuously in various kinds of updates so that they can be used as E-Comic-based teaching materials for multiplication and division subject matters that can be accessed through devices. E-Comic-based teaching materials with multiplication and division subject matters designed for elementary school student learning need examples of the implementation of everyday life so that the concepts can be understood. The implementation can use the Realistic Mathematics Education (RME) approach because it can be applied when teaching mathematics as stated by Panhuizen and Wijers RME which is about how children learn mathematics and how to teach it (Wahyuni & Yolanda, 2017). By applying the RME approach, it is hoped that there will be an increase in understanding related to the concepts, especially multiplication and division.

The importance of applying the concepts of multiplication and division in

everyday life with teaching materials designed to be E-Comic or electronic comics makes students learning more meaningful through the mathematization of RME. RME relates to human activities and is associated with mathematization problems through horizontal and vertical mathematization processes. Horizontal mathematization according to De Lange (Nuraini, 2020) starts from the process of identifying problems of everyday life towards symbols or mathematical models by determining schemas and visualizations found by finding regularities, relationships, and structures. Furthermore, vertical mathematization according to (Lubis, 2016) starts from the process of reasoning everyday life problems and is then associated with mathematical concepts or mathematical formulas. This shows that when students are faced with solving problems in everyday life through horizontal mathematization, namely the formation of mathematical visualization concepts, it is enhanced through vertical mathematization by using symbols or mathematical language. Both of these processes will be applied to the media that will be developed by containing Ice Berg. Therefore, researchers will develop E-Comic-based mathematics teaching materials on the topic of multiplication and division using the RME approach.

METHODS

Research Type

The development model used is Hannafin and Peck. This model was chosen because it is oriented to product income (Ramadana et al., 2019). There are three phases in this development model, namely needs assessment, design, development, and implementation. These three phases need to be carried out in conjunction with evaluation and revision activities (Tegeh & Pudjawan, 2014). See details in Figure 1.

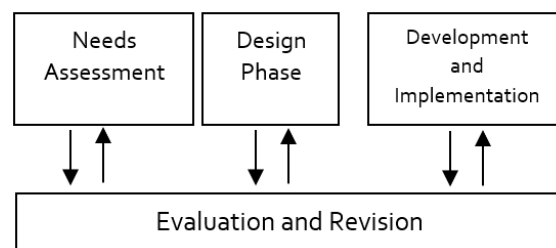


Figure 1. Hannafin dan Peck Model

The procedure in media development is as shown in Figure 1 with three phases to be followed: 1) Needs assessment through a series of problem analysis, learner analysis, goals analysis, and learning settings analysis (Tegeh & Pudjawan, 2014). 2) Design, the design phase is divided into several phases, namely the first phase that is making subject matter design concepts based on core competencies, basic competencies and according to student needs, the second phase is making comic designs, the third phase is evaluation and revision. 3) Development and Implementation, in the development phase there are several phases, namely first, making *E-Comic*-based teaching materials by making subject matters, practice questions, finishing designs, and converting the media into HTML5 *FlipBook* format. Second, test validation. Third, evaluation and revision. Implementation phase with a small group and large group trials.

Trial Subjects

The subjects of the trial that will be carried out are based on the formative evaluation cited by (Tegeh & Pudjawan, 2014) which is modified, namely a small group trial of six students and a large group trial of 15 students in class 3A at SDN Pinang 2, Tangerang City.

Research Instruments

The instruments used are the interview guide to analyze the needs assessment phase and the questionnaire used to

measure the validity and response of the subjects.

Data Analysis Techniques

Data processing is based on the results of validation by three experts in product quality assessment, data analysis in the questionnaire is carried out as follows: (a) Calculating the total score on each aspect; (b) The score is converted on a scale of five using the Widoyoko formula quoted by (Astuti, 2017) which is modified, score $> 4,2$ with very valid criteria, $> 3,4-4,2$ valid, $> 2,6-3,4$ sufficient, $> 1,8-2,6$ less valid, and $\leq 1,8$ invalid; and (c) Conduct a quantitative descriptive analysis based on Arikunto's reference quoted by (Saidah & Nugroho, 2015) which is modified as follows:

$$\text{Valid Percent} = \frac{\sum \text{Total Score Obtained}}{\text{Ideal Score}} \times 100\%$$

The results of the calculation of the validity assessment that have been obtained, the aspects assessed are 81% - 100% with very valid interpretations, 61% - 80% valid, and 41% - 60% sufficient, 21% - 40% less valid, and 0% - 20% not valid.

The phase of analyzing students' responses is in the form of the Guttman scale which is a measurement scale that can be done if researchers want to get a firm answer (Maolani & Cahyani, 2015). If the data scores have been collected, the final calculation is carried out or the mean value is converted into a percentage based on the reference formula according to Riduwan quoted by (Nadiroh & Susilowibowo, 2018) as follows:

$$\text{Valid Percent} = \frac{\sum \text{Total Score}}{\text{Maximum Score}} \times 100\%$$

The calculation results that have been obtained are interpreted in categories based on those quoted by (Satriani, 2020) if the aspects assessed are 67% - 100% with high interpretation, 34% - 66% moderate, and 0% - 33% low.

RESULTS AND DISCUSSIONS

Results

The research conducted has the following results

Needs assessment

At this phase, several analyzes were carried out through interviews with class 3A teachers at SDN Pinang 2. The results of the problem analysis showed that students did not understand the concept of multiplication $4 \times 5 = 5 + 5 + 5 + 5$ or other multiplication concepts such as $4 \times 5 = 5 + 5 + 2 \times 5$ and the concept of division such as $10 : 2 = 10 - 2 - 2 - 2 - 2 - 2$. The results of the learner analysis showed that the teacher teaches the subject matters only by sending learning videos to students via *WhatsApp* groups without being explained and only asks students to watch and listen to the video so that students do not understand the relation of multiplication and division subject matters in everyday life. In the results of goals analysis, the teacher said that the benefits of textbooks, especially comics, are more interesting because some pictures and storylines will help students learn so that learning objectives are achieved. In the results of the learning settings analysis, the teacher said that they only sent learning videos related to how to do multiplication and division problems.

Design

The first phase to do the design is to have a media concept design that will be developed. The concept developed is in the form of subject matters that still refer to basic competencies and indicators in the 2013 curriculum with modifications using the RME approach. The multiplication and division subject matters associated with RME are designed in an illustrated storyline that refers to the everyday lives of

characters in comics. The second phase is the design that will be developed on the *E-Comic* teaching materials media refers to the storyboard design with comic elements in the form of character sketches, layouts, and conversation balloons that will be used in *E-Comic* using *CorelDRAW X7*. The third phase, evaluation, and revision is based on experts' suggestions for improvement.

Development

At the development phase, there are several phases as follows, **1) making *E-Comic*-based teaching materials**, the researchers took the first phase, namely making multiplication and division subject matters based on basic competencies and indicators. The subject matters that will be included in the *E-Comic* teaching materials were developed in illustrated stories with character conversations explaining multiplication and division using the RME approach in everyday life with horizontal and vertical mathematization processes that are packaged in the form of *Ice Berg* as shown in Figure 2.

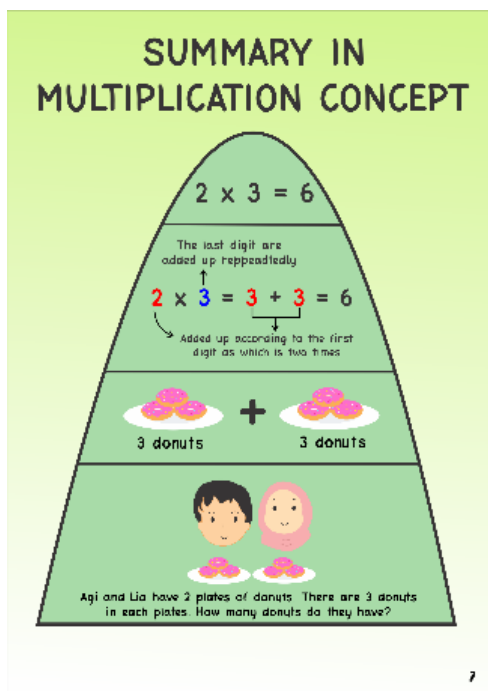


Figure 2. Multiplication Ice Berg

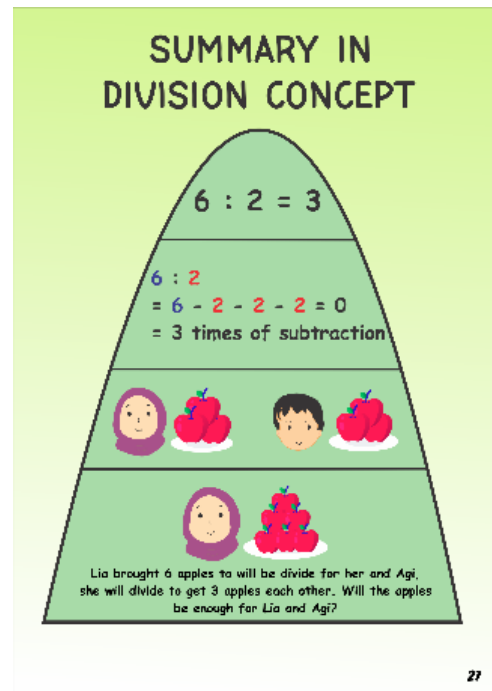


Figure 3. Division Ice Berg

The second phase is making practice questions as an exercise to do multiplication and division with the RME concept after reading the topic of multiplication and division in *E-Comic* teaching materials. The third phase is making the design concept of *E-Comic* teaching materials from picture sketches and coloring. The fourth phase is the media that has been completed in the coloring phase, then converted into *Flip-Book HTML5* format, a web link that can be accessed using the internet and devices, so that the comics created are called *E-Comic*. *E-Comic* display in *FlipBook HTML5* format as shown in Figure 3.



Figure 3. *E-Comic* display in *FlipBook HTML5* format

2) validation, subject matter expert validated the media in terms of subject matters was carried out by a mathematics education lecturer from the Faculty of Education UMJ with the results obtained show a mean score of 4,76 then if converted in percentage form it becomes 95,38% with very valid criteria. See details in Table 1.

Table 1. Assessment by Subject Matter Expert

Aspects	Scores
Suitability of the subject matters with core competencies and basic competencies	13
Subject matters accuracy	25
Question eligibility	20
Encourage curiosity	4
Total	62
Mean	4,76
Percentage	95,38 %
Criteria	Very valid

Linguist (language expert) for media validation in terms of linguistic rules was carried out by lecturer who is master of language education graduate with an assessment aspect that will be assessed in the form of language feasibility aspects. Based on the assessments obtained from linguists that have been calculated, the mean score is 4,38 then if it is converted in percentage form it becomes 87,5% with very valid criteria. See details in table 2.

Table 2. Assessment by Linguist

Aspects	Scores
Straightforward	13
Communicative	5
Interactive	5
Conformity with linguistic rules	8
Use of terms, symbols, and icons	4
Total	35
Mean	4,38
Percentage	87,5 %
Criteria	Very valid

Media expert for media validation in

terms of display and product use was carried out by lecturer who is a doctoral of educational technology graduate with aspects of the assessment that will be assessed in the form of aspects of graphic and operational feasibilities. Based on the assessment obtained from media experts, the calculated mean score is 4,88 then if converted in percentage form it becomes 97,5% with very valid criteria. Media expert provides a conclusion that is declared valid to be tested. See details in table 3.













Table 3. Assessment by Media Expert

Aspects	Scores
Visual display	33
Use of fonts	20
Media content criteria	15
Ease of use	10
Total	78
Mean	4,88
Percentage	97,5 %
Criteria	Very valid

3) evaluation and revision, products that have been validated or assessed got advice from three experts for product improvements that were developed that must be improved by researchers, namely first, suggestions for improvement from subject matter expert that need to be revised in the multiplication concept activity 2 showed that there is no consistency with the example of the previous concept and in the practice questions, showed errors in the redaction of the practice questions. See details in table 4.

Table 4. Product Revision from Subject Matter Expert



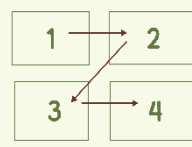
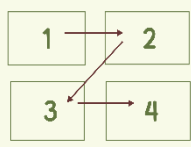
Before revision	After revision

Before revision	After revision
<p>Try the following questions!</p> <p>1.  If there are 2 plates, and each plate has 4 donuts. How many donuts in total?</p> <p>2.  If there are 3 plates, and each plate has 3 donuts. How many donuts in total?</p> <p>3.  There are 4 shelves with 5 books in every bookshelf. How many books in total?</p>	<p>Try the following questions!</p> <p>1.  If there are 2 plates, and each plate has 4 donuts. How many donuts in total?</p> <p>2.  If there are 3 plates, and each plate has 3 donuts. How many donuts in total?</p> <p>3.  There are 4 shelves with 5 books in every bookshelf. How many books in total?</p>
<p>Try the following questions!</p> <p>1.  If there are 3 kites that will be shared to 3 people. How many kites does each person have?</p> <p>2.  Lio has 4 ice cream. She wants to share 2 ice creams with agi. How many ice creams each do they have?</p> <p>3.  Lio has 8 oranges that she wants to share to her 4 friends. How many oranges each her friend have?</p>	<p>Try the following questions!</p> <p>1.  If there are 3 kites that will be shared to 3 people. How many kites does each person have?</p> <p>2.  Lio has 4 ice cream. She wants to share equally 2 ice creams with Agi. How many ice creams each do they have?</p> <p>3.  Lio has 8 oranges that she wants to share to her 4 friends. How many oranges each her friend have?</p>

Second, based on suggestions for improvement from linguists, it was more directed at improving the redaction of words and sentences, punctuation, the use of lowercase and uppercase letters that were less precise, pronouns in characters that must be paid more attention to, and errors in the use of the affix *di-* which was less precise. See details in table 5.



Table 5. Product Revision from Linguist

Before revision	After revision
<p>ACKNOWLEDGMENT</p> <p>This comic is compiled as additional teaching material for teachers in the learning process and can be used as a guide for students to learn anywhere & anytime.</p> <p>This comic is about getting to know the concepts of multiplication and division. These two mathematical arithmetic operations are found in every day life, for example at home and in the yard.</p> <p>This comic students will learn multiplication and division with lio and agi as story characters. Please follow their story, have a good study.</p>	<p>ACKNOWLEDGMENT</p> <p>This comic is compiled as additional teaching material for teachers in the learning process and can be used as a guide for students to learn anytime.</p> <p>This comic is about getting to know the concepts of multiplication and division. These two mathematical arithmetic operations are found in every day life, for example at home and in the yard.</p> <p>In this comic, students will learn multiplication and division with lio and agi as story characters. Please follow their story, happy reading.</p>

Before revision	After revision
<p>How to count donuts using repeated addition</p> <p> each plate has 3 donuts → 2 plates</p> <p>$2 \text{ plates} \times 3 \text{ donuts} = 3 \text{ donuts} + 3 \text{ donuts} = 6 \text{ donuts}$</p> <p>So form of multiplication is $2 \times 3 = 6$</p> <p>Oh I see</p> <p>The digit 2 in the front shows the number of plates. The digit 3 in the back shows the number of donuts. The digit 6 shows the answer.</p> <p>Well, that's right</p>	<p>How to count donuts using repeated addition</p> <p> There are 3 donuts in each plate → 2 plates</p> <p>$2 \text{ plates} \times 3 \text{ donuts} = 3 \text{ donuts} + 3 \text{ donuts} = 6 \text{ donuts}$</p> <p>So form of multiplication is $2 \times 3 = 6$</p> <p>Oh I see!</p> <p>The digit 2 in the front shows the number of plates. The digit 3 in the back shows the number of donuts. The digit 6 shows the answer.</p> <p>Well, that's right!</p>
<p>Agi</p> <p>I'm reading about multiplication</p> <p>I'm bringing donuts</p> <p>What are you reading?</p> <p>Hmm...</p> <p>Multiplication?</p> <p>I will explain to you</p>	<p>Agi</p> <p>I'm reading about multiplication</p> <p>I'm bringing donuts</p> <p>What are you reading?</p> <p>Hmm...</p> <p>Multiplication?</p> <p>I will explain to you??</p>
<p>INSTRUCTION</p> <p></p> <p>How to read this comic start from the top left, next to the right, bottom left and bottom right.</p>	<p>COMIC READING GUIDE</p> <p></p> <p>Start from the top left, next to the right, bottom left and bottom right.</p>

Third, the media expert suggested that the comic pictures in the subject matter section should be enlarged. See details in table 6.

Table 6. Product Revision from Media Expert

Before revision	After revision
<p>How to count donuts using repeated addition</p> <p> each plate has 3 donuts → 2 plates</p> <p>$2 \text{ plates} \times 3 \text{ donuts} = 3 \text{ donuts} + 3 \text{ donuts} = 6 \text{ donuts}$</p> <p>So form of multiplication is $2 \times 3 = 6$</p> <p>Oh I see</p> <p>The digit 2 in the front shows the number of plates. The digit 3 in the back shows the number of donuts. The digit 6 shows the answer.</p> <p>Well, that's right</p>	<p>How to count donuts using repeated addition</p> <p> There are 3 donuts in each plate → 2 plates</p> <p>$2 \text{ plates} \times 3 \text{ donuts} = 3 \text{ donuts} + 3 \text{ donuts} = 6 \text{ donuts}$</p> <p>So form of multiplication is $2 \times 3 = 6$</p> <p>Oh I see!</p> <p>The digit 2 in the front shows the number of plates. The digit 3 in the back shows the number of donuts. The digit 6 shows the answer.</p> <p>Well, that's right!</p>
<p>Agi</p> <p>I'm reading about multiplication</p> <p>I'm bringing donuts</p> <p>What are you reading?</p> <p>Hmm...</p> <p>Multiplication?</p> <p>I will explain to you</p>	<p>Agi</p> <p>I'm reading about multiplication</p> <p>I'm bringing donuts</p> <p>What are you reading?</p> <p>Hmm...</p> <p>Multiplication?</p> <p>I will explain to you??</p>

Implementation

This phase is the product implementation phase after being declared valid to be tested in the field. The results of the small group trial were 95,41% with high criteria. See details of the results of the questionnaire data in each aspect of the indicator in table 7.

Table 7. Small group data results

Indicators	Scores
Affective	95,83%
Cognitive	94,44%
Motivation	100%
Ease of students in relating to everyday life	83,33%

The results of the large group trial were 99% with high criteria. See details of the results of the questionnaire data in each aspect of the indicator in table 8.

Table 8. Large group data results

Indicators	Scores
Affective	98,33%
Cognitive	100%
Motivation	100%
Ease of students in relating to everyday life	100%

Discussions

The research objective is to develop *E-Comic*-based mathematics teaching materials on the topic of multiplication and division using the RME approach. Another goal is to find out the validity and responses of students. Teaching materials are in the form of a complete and systematic arrangement of subject matter (Sungkono, 2009). Teaching materials developed by researchers will be packaged in electronic form. Electronic teaching materials are packaging of material components in the form of visual, audio, and audio-visual forms on teaching materials that are made in electronic format (Sriwahyuni et al., 2019). The format of electronic

teaching materials is increasingly attracting the interest of readers because it has advantages over the format of printed teaching materials. The advantages of electronic teaching materials include easy access by using electronic devices which are currently urgency in the online learning process so that electronic teaching materials can be accessed, read, and stored on the device. However, the lack of electronic teaching materials, one of which is that there are still some who have difficulty operating electronic devices to access the electronic teaching materials format provided. Various learning resources each have their advantages and disadvantages, so the researcher will use an electronic teaching materials format that is easily accessible for teachers and students, namely using the *FlipBook HTML5* format. Teaching materials in the electronic realm are *e-books*, *e-learning*, *e-comic*, and others. *E-Comic* is a media with an electronic format that is arranged in the form of an illustrated story so that it can be developed as a presentation of educational content. (Budi et al., 2016). If the teaching materials are developed based on *E-Comic* or electronic comics in learning mathematics. According to Nuroeni, comics multimedia can be used as a medium in learning mathematics (Guntur et al., 2017). In mathematics, there are multiplication arithmetic operations that have the concept of repeated addition (Nurhayati et al., 2018). Conceptually, multiplication $C \times D = D + D + D + \dots + D$ is not the same as $D \times C = C + C + C + \dots + C$, but when looking at the numbers produced by the multiplication, $C \times D = D \times C$ (Wulandari, 2019). According to Heruman, a division is a method of subtraction that is repeated until the numbers run out (Suharno, 2017).

The developed *E-Comic*-based mathematics teaching materials obtained valid results from experts. The results from subject matter experts on *E-Comic* teaching

materials showed that the subject matters and questions match with realistic mathematics because of the relevance in everyday life that is packaged with picture accuracy. The linguist provided valid results in terms of text for sentences, terms, and grammar that are easy to understand. Media experts provided valid results in terms of picture display, creativity, and ease of use. This is in line with research from (Syafa'ah, 2014) through the media developed in the form of illustrated story/comic-based teaching materials that have gone through a validation process by experts in terms of subject matter, attractive picture design, and communicative language got valid results used as additional teaching materials for mathematics subject matter used for students.

Based on these results, *E-Comic*-based teaching materials can be used as additional teaching materials in learning multiplication and division. This is under the requirements in making teaching materials according to (Rohmah, 2016), namely, 1) supporting the presentation of the subject matter with examples in the form of interesting illustrations, 2) providing practice questions, 3) the subject matter presented following the nuances of the students' environment, 4) using simple language.

The other data results are based on a small group trial that *E-Comic* teaching materials could increase students' motivation. This is in line with research from (Fadillah, 2018) learning by using comics media makes students learn independently and change the way of learning to be more interesting based on the results of field trials. In the results of data obtained from large group trials, *E-Comic* teaching materials are dominant in students' cognition and motivation, this could be seen when research and filling out student response questionnaires stated that the subject matter was easy to understand and felt

happy to learn mathematics using *E-Comic*. This is similar to the results of research from (Mujahadah et al., 2021), mathematical comics media can encourage children's interest in learning from before using the media until after using the media so that it had a positive effect on learning outcomes from a cognitive perspective in understanding subject matter concepts and motivating students in their learning interest in learning mathematics. The results of research stated that *E-Comic* can make it easier for students to relate to everyday life because the subject matter is connected to everyday life so that it can be understood by students with the mathematization process. This is similar to the results of research from Satriani (2020) through the media developed by researchers with mathematical arithmetic operations associated with realistic mathematics, the media packaged subject matter by connecting it to everyday life showed high response results from students who stated that it was easier for students to understand the subject matter.

The results of the combined data showed that comics build learning interest from the subject matter students receive and were helped in understanding the subject matter by relating realistic properties or to everyday life. Based on a review of opinions according to Sudjana and Rivai in (Budi et al., 2016), comics have the advantage of packaging the subject matter described more attractively to foster student's interest so that it is helped in understanding the concept of abstract mathematics subject matter which is then associated with realistic properties. The disadvantages of comics based on data results from one of the students responded that students still did not understand in connect multiplication and division arithmetic operations with everyday life through the developed comics. This is by the opinion review according to (Sutrisno, 2018) which

stated that each student's learning style is different.

CONCLUSIONS

Based on the results of the research and discussion above, the conclusions obtained are that the *E-Comic*-based mathematics teaching materials were said to be very valid and responded with high criteria, so the media that the researchers developed can be used as additional teaching materials for teaching the concepts of multiplication and division.

The *E-Comic*-based teaching materials developed still have limitations both in design and subject matter, it is hoped that future research can develop products in the form of *E-Comic* that are more attractive in terms of design and more varied subject matter. In the implementation of *E-Comic*-based mathematics teaching materials for parents and teachers, it is expected that there is assistance for students so that the use of media runs effectively. Suggestions from researchers for future researchers, due to the limitations of developing *E-Comic* which only accommodates one learning style, it is hoped that further research can accommodate all learning styles.

REFERENCES

- Astuti. (2017). *Pengembangan Media Pembelajaran Kartu Domino Modifikasi Pada Mata Pelajaran IPA Materi Struktur Akar dan Batang Tumbuhan Untuk Siswa Kelas IV A SDN Caturtunggal 4*. (DOCTORAL DISSERTATION, Universitas Sanata Dharma Yogyakarta).
- Budi, Cahyono, Romadiazari, & Maslikah. (2016). Pengembangan Perangkat Pembelajaran melalui E-Comic Berbasis Scientific Approach pada Mata Pelajaran Matematika Materi Limit Fungsi. *Jurnal Pendidikan Matematika FKIP Unissula*, 4(1), 71–83.
- Fadillah, A. (2018). Pengembangan Media Belajar Komik Terhadap Motivasi Belajar Siswa. *JTAM | Jurnal Teori Dan Aplikasi Matematika*, 2(1), 36. <https://doi.org/10.31764/jtam.v2i1.259>
- Fauziah, R., Reffiane, F., & Sukamto, S. (2019). Analisis Kesulitan Belajar Materi Operasi Hitung Pembagian Pada Siswa Kelas 3 Sdn Gebangsari 02. *Jurnal Basicedu*, 3(2), 838–843. <https://doi.org/10.31004/basicedu.v3i2.177>
- Gazali, R. Y. (2016). Pengembangan bahan ajar matematika untuk siswa SMP berdasarkan teori belajar ausubel. *PYTHAGORAS: Jurnal Pendidikan Matematika*, 11(2), 182–192.
- Guntur, M., Muchyidin, A., & Winarso, W. (2017). Pengaruh Penggunaan Bahan Ajar Matematika Bersuplemen Komik Terhadap Kemandirian Belajar Siswa Tadris Matematika Institut Agama Islam Negeri (IAIN) Syekh Nurjati Cirebon. *Eduma*, 6(1), 43–51.
- Kurnianti, S., Bennu, S., & Linawati, L. (2017). Analisis Kesalahan Siswa Kelas V SD Negeri 8 Mamboro Palu Utara dalam Menyelesaikan Soal Perkalian dan Pembagian Pecahan. *Jurnal Elektronik Pendidikan Matematika Tadulako*, 4(4), 543–554.
- Lestari, Wahyuni, & Yushardi. (2016). Pengembangan Bahan Ajar IPA Berbasis Komik Pada Pokok Bahasan Gerak Di SMP. *Jurnal Pembelajaran Fisika Universitas Jember*, 4(5), 564–572.
- Lubis, M. S. (2016). Pengembangan Perangkat Pembelajaran Topik Bilangan Dengan Pendekatan Pendidikan Matematika Realistik Di Madrasah Ibtidaiyah. *Jurnal Tarbiyah*, 23(1), 101–123.
- Maolani, & Cahyani. (2015). *Metodologi Penelitian Pendidikan*. Rajawali Pers.
- Maskur, Permatasari, & Rakhmawati. (2020). Pengembangan Bahan Ajar Matematika Berbasis Rhythm Reading Vocal pada Materi Konsep Pecahan Kelas VII SMP. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 11(1), 78–87.
- Mujahadah, I., Alman, A., & Triono, M. (2021). Pengembangan Media Pembelajaran Komik untuk Meningkatkan Hasil dan Minat Belajar Matematika Peserta Didik Kelas III SD Muhammadiyah Malawili. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, 3(1), 8–15. <https://doi.org/10.36232/jurnalpendidikan-dasar.v3i1.758>
- Nadiroh, & Susilowibowo. (2018). Pengembangan Lembar Kegiatan Peserta Didik (LKPD) Berbasis Android Pada Mata Pelajaran Akuntansi Perbankan Syariah Kelas XI Perbankan Syariah di SMK Negeri 1 Lamongan. *Jurnal Pendidikan Akuntansi*, 6(3), 355–359.
- Nuraini, E. (2020). *Analisis Proses Matematisasi Horizontal dan Vertikal Siswa Dalam Menyelesaikan Soal PISA* (Doctoral dissertation, UIN Sunan Ampel Surabaya).
- Nurhayati, Aswar, & Arifin. (2018). Komik Sebagai Media Pembelajaran Matematika Bagi Siswa Sekolah Dasar. *Jurnal Imajinasi*, 2(2), 25–34.

- Ramadana, S., Sumiyadib, & Kosasih, E. (2019). The Development of Enrichment Book Based on Papseng of Bugis Tribe in Short Story Learning at Senior High School. *Kadera Bahasa*, 11(2), 136–146.
- Rohmah, N. (2016). *Pengembangan Bahan Ajar Matematika Berbasis Buku Fabel Berkarakter untuk Meningkatkan Hasil Belajar Tematik Materi Bangun Datar Kelas IV A SD Islam As-Salam Malang* (Doctoral dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).
- Saidah, I. N., & Nugroho, M. A. (2015). Pengembangan Media Pembelajaran Berbentuk Permainan Edukasi Akuntansi Cari Kata (Acak) Menggunakan Adobe Flash CS5. *Jurnal Pendidikan Akuntansi Indonesia*, 13(1), 65-74. <https://doi.org/10.21831/jpai.v13i1.5190>
- Satriani. (2020). *Pengembangan Student's Worksheet Penjumlahan dan Pengurangan Berbasis Taksonomi Bloom Dikaitkan dengan Matematika Realistik*. (Doctoral dissertation, Universitas Muhammadiyah Jakarta).
- Sriwahyuni, Risdianto, & Johan. (2019). Pengembangan Bahan Ajar Elektronik Menggunakan Flip Pdf Professional Pada Materi Alat-Alat Optik di SMA. *Jurnal Kumparan Fisika*, 2(3), 145–152.
- Suharno. (2017). *Pengembangan Alat Peraga Matematika Materi Pembagian untuk Anak dengan Berkesulitan Belajar Matematika (DISKALKULIA) di SD Negeri Mertelu*. (Doctoral dissertation, Universitas Sanata Dharma).
- Sungkono. (2009). Pengembangan Dan Pemanfaatan Bahan Ajar Modul Dalam Proses Pembelajaran. *Majalah Ilmiah Pembelajaran*, 5(1).
- Sutrisno. (2018). *Pengembangan Komik IPA Fisika Sebagai Media Pembelajaran Peserta Didik Pokok Bahasan Gerak*. (Doctoral dissertation, Universitas Islam Negeri (UIN) Raden Intan Lampung).
- Syafa'ah, A. (2014). *Pengembangan bahan ajar berbasis cerita bergambar/komik materi pokok konsep pembagian dengan pendekatan inquiry siswa kelas III SDN Jatimulyo II Malang* (Doctoral dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).
- Tegeh, J., & Pudjawan. (2014). *Model Penelitian Pengembangan*. Graha Ilmu.
- Wahyuni, & Yolanda. (2017). Mental Calculation Berupa Strategi Stringging Siswa Pada Materi Perkalian Dengan Pendekatan Pembelajaran Pendidikan Matematika Realistik Indonesia Di Kelas 3 SD Pekanbaru. *Jurnal Pendidikan Matematika Dan Matematika*, 3(2), 137–146.
- Wulandari. (2019). *Pengembangan Bahan Ajar Matematika Berbentuk Komik Perkalian (KOPER) Untuk Mengatasi Miskonsepsi Perkalian Pada Siswa Kelas II SD Plus Sunan Pandanaran Blitar*. (Doctoral dissertation, Universitas Islam Negeri (UIN) Maulana Ibrahim Malik).
- Yusmanita, S., Ikhsan, M., & Zubainur, C. M. (2018). Penerapan Pendekatan Matematika Realistik untuk Meningkatkan Kemampuan Operasi Hitung Perkalian. *Jurnal Elemen*, 4(1), 93-104. <https://doi.org/10.29408/jel.v4i1.469>