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E-COMIC MATHEMATICS OF LAMPUNG FOLKLORE "BUAYA PEROMPAK" FOR CHILDREN WITH DYSCALCULIA

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Abstract

Learning media has become a primary need to support the achievement of learning goals. Technological developments also influence the diversity of learning media, as well as the learning media needed by students with dyscalculia. The characteristics of dyscalculic students require media that is contextual and easy to understand through attractive and imaginative packaging. Therefore, the e-comic folklore of the pirate crocodile is very appropriate to develop so that it can be used to support the learning process of students with dyscalculia. E-comic development is carried out using the ADDIE stages, namelyAnalyze, Design, Develop, Implementation, and Evaluation. Metode. Through these stages, the results obtained are:The average assessment by material, design and communication expert validators was 4.12 with appropriate criteria. Rating by users is 3.8 with appropriate criteria. The average N-Gain score was 4.4 with moderate or effective criteria. The teacher's positive response was 98% and the student's positive response was 69.33% with effective criteria. Thus it can be concluded thatThe e-comic media of the "Buaya Perompak" folklore is suitable and effective for use for dyscalculic students.

Keywords: Lampung folklore; dyscalculia; e-comic mathematics.

Abstrak

Media pembelajaran sudah menjadi suatu kebutuhan utama untuk mendukung tercapainya suatu tujuan pembelajaran. Perkembangan teknologi juga mempengaruhi keberagaman media pembelajaran, begitu juga media pembelajaran yang dibutuhkan oleh siswa diskalkulia. Karakteristik siswa diskalkulia membutuhkan media yang bersifat kontekstual dan mudah dipahami melalui pengemasan yang menarik dan imajinatif. Oleh sebab itu, e-comic cerita rakyat buaya perompak menjadi sangat tepat untuk dikembangkan sehingga dapat digunakan untuk mendukung proses belajar siswa diskalkulia. Pengembangan e-comic dilakukan menggunakan tahapan ADDIE yaitu Analyze, Design, Develop, Implementation, and Evaluation. Metode. Melalui tahapan tersebut diperoleh hasil bahwa rata-rata penilaian oleh validator ahli materi, desain, dan komunikasi sebesar 4,12 dengan kriteria layak. Penilaian oleh pengguna sebesar 3,8 dengan kriteria layak. Perolehan rata-rata skor N-Gain score yaitu 4,4 dengan kriteria sedang atau efektif. Perolehan respon positif guru sebesar 98% dan respon positif siswa sebesar 69,33% dengan kriteria efektif. Dengan demikian dapat dismpulkan bahwa media e-comic cerita rakyat "Buaya Perompak" layak dan efektif untuk digunakan bagi siswa diskalkulia.

***Kata kunci**: Cerita rakyat lampung; diskalkulia ; e-comic matematika.*

INTRODUCTION

The rapid development of technology and communication has had a huge impact on the cultural aspects of society which are gradually experiencing shifts (Setiawan 2018). Basically, culture and education cannot be separated from each other, this is in accordance with the opinion of Setiawan & Sulistiani (2019) which

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states that cultural values must be maintained in harmony in implementing cultural education and national character. In line with the opinion of Eko et al. (2020), the development of national character values and multicultural education needs to be based on local wisdom. Education based on local wisdom will unearth various Indonesian cultures, ultimately building awareness of environmental sustainability (Oktarina & Ribuwati, 2018). Integrating wise standards local knowledge can be used in education to create meaningful learning that results in moral people, culture, and character (Nuraini, 2018). So that local cultural values are very important to be integrated into learning, in the context of implementing character and cultural education.

In connection with the development of technology and information, Munir (2017) said that digital-based media can be used as an alternative for teachers in packaging learning material, especially mathematics, to make it more interesting and can facilitate students to learn more widely, more and more variedly. The application of digital media based on cultural context in the classroom makes the delivery of lessons more enjoyable and able to meet the needs of each student's learning style (Aufa & Multina, 2022). This indicates that the integration of culture into mathematics learning packaged in digital-based learning media can help students with different abilities and characteristics to understand mathematical concepts in an interesting and enjoyable way, including dyscalculic students.

Khasanah et al. (2022) said that students who experience dyscalculia are characterized by an inability to understand arithmetic, difficulty reading clocks, difficulty in carrying out arithmetic operations, difficulty recognizing numbers, and even an inability to understand word problems. According to Kunwar & Sharma (2020) dyscalculia is caused by internal or external factors. Internal is related to knowledge abilities, motivation, attention, attitudes, study habits and physical conditions, while external is caused by the school environment, family environment and community environment. This means that the school environment which is the main learning place for students is a contributor to students' learning difficulties.

Technology-based learning media alone is not enough to overcome these problems, it requires a more realistic presentation of mathematical concepts that depart from students' daily lives using Realistic *Mathematics Education* (RME) (Rahmasantika & Prahmana, 2022). Mathematics learning with the RME approach can use culture-based learning resources or what is called ethnomathematics (Witha, Karjiyati, & Tarmizi, 2020). Ethnomathematics is a learning approach used to motivate students to learn mathematics by linking mathematical material with real examples of mathematical models in everyday life, existing local culture, or existing cultural practices (Zaenuri, Dwidayati, & Suyitno, 2018). Culture is very diverse in scope, as is the local culture of Lampung. One of Lampung's cultures that can be integrated into mathematics learning resources is Lampung Folklore which is packaged in e-comic form. Through this e-comic, dyscalculic students can get two benefits at once, namely realistic and fun mathematics learning, as well as folklore which can enrich cultural insight. As stated by Rahmasantika & Prahmana (2022), Math e-Comic is a

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mathematics learning media that makes it easy and fun for students, including dyscalculic students.

Much research has been carried out on the development of learning media in the form of comics, including research conducted by Rahmata & Ekawati (2021), who developed a mathematical e-comic based on the education of realistic mathematics (PMR), loaded ethnomathematics material and social arithmetic. As well as Khairunnisa, Ardiansyah, & Sutarto (2022), who developed a mathematical e-comic loaded with ethnomatematics of Klaten district on the material of social arithmetic. Therefore, this research attempts to develop a different ethnomathematics-based mathematical e-comic by wrapping mathematics into folklore. The folklore that will be featured in this e-comic is the Lampung folklore entitled "Buaya Perompak".

METHODS

To produce viable and effective products, development research is used, which is usually referred to as *Research and Development (R&D)*. Research and development of this e-comic goes through several stages referred to as ADDIE. The ADDIE stage is one of the development stages most commonly used in the field of instructional design as a guide for producing an effective design (Cahyono, Tsani, & Rahma, 2018). The ADDIE stages depicted in a diagram in Figure 1.

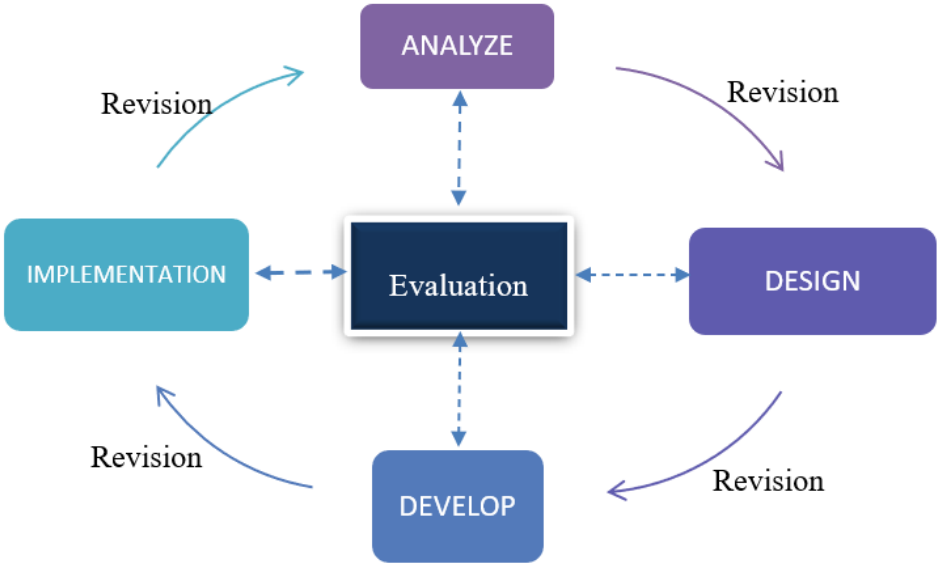

Figure 1. Flow diagram of the ADDIE Development Model

Figure 1 shows that the ADDIE stage begins with Analyze which is carried out to determine the conditions and problems faced by the research subjects. Subjects were selected by first identifying several elementary school students who were diagnosed with dyscalculia. At this stage of analysis, determining the research location, preparing diagnostic tests, and finding data on dyscalculia students at the research location that has been determined is carried out. Then, at this initial stage, an analysis of needs, curriculum and materials, as well as student characteristics, is also carried out.

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Design is the second stage in developing the ADDIE model. This stage aims to design a mathematical e-comic so that the material presented in it is arranged systematically and specifically based on the results of the analysis in the previous stage.

The software used to support e-comic design is *Microsoft Powerpoint*, *Adobe Illustrator*, and *Adobe Photoshop*. The design results at this stage will be distributed to users in file form format *Portable Document Format* (PDF).

Develop is the third stage carried out in e-comic development by utilizing expert validators as a team to assess the products produced at the design stage. This stage aims to provide a feasibility assessment of the product produced. After the resulting product is declared feasible by the validator team, the development stage can proceed to the implementation.

The effectiveness of a product produced in research and development is very important, therefore the implementation stage is also very important. To find out the level of effectiveness of the e-comics produced, product trials were carried out on users. The trial was intended to obtain data in the form of student learning outcomes during the pretest (before the e-comic was implemented) and during the posttest (after the e-comic was implemented). This data will later be analyzed to get an idea of the effectiveness of e-comics.

Evaluation in the ADDIE stage consists of two, namely formative evaluation and summative evaluation. Formative evaluation is carried out to improve the e-comic created at each stage before continuing to the next stage. Meanwhile, summative evaluation is used to assess the feasibility and effectiveness of learning media as a whole.

Research and development was carried out at SD N 2 Sukoharjo III, with research subjects namely 3 students. These subjects were obtained through interviews with class IV teachers, and continued with diagnostic tests using test instruments that had previously been validated by expert validators. The data in this research was collected using various techniques, namely interviews, tests, observations by expert validators using predetermined instruments. Instruments and data analysis at the develop stage use instruments and analysis developed by (Chaeruman, 2015). Figure 2 explains the flow of data analysis to see the feasibility of e-comics at the development stage.

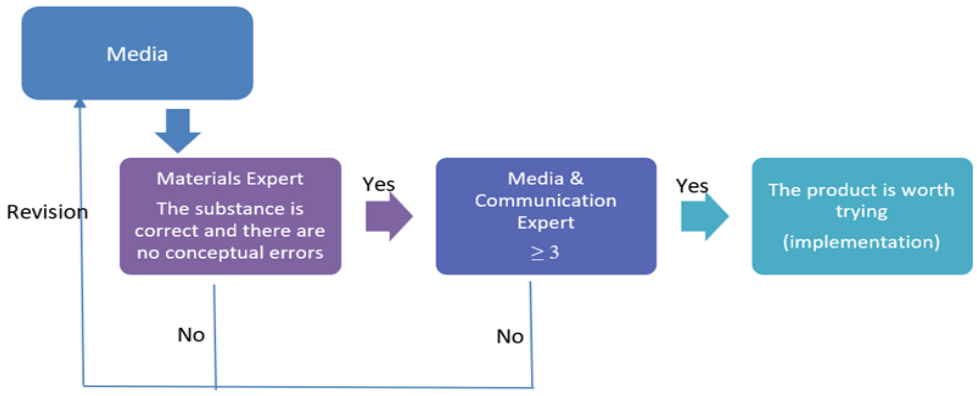

Figure 2. Media Validation Flow Diagram

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The test instruments for carrying out the pretest and posttest were developed independently by researchers and validated by material, language and psychology experts. The pretest and posttest results will be used to compare the learning outcomes of dyscalculic students before and after using e-comics (Hasan et al., 2021). Increased learning outcomes can be seen using the N-Gain formula 1.

$$< g > = \frac{pretest\ stations}{100-pretest} \ldots(1)$$

With the N-Gain criteria for interpreting learning outcome data as in Table 1.

Table 1. Percentage Effectiveness Criteria

Percentage	Criteria
$0,0 < (< g >) \leq 0,3$	Low
$0,3 < (< g >) \leq 0,7$	Currently
$0,7 < (< g >) \leq 1,0$	Height

Learning media in the form of e-comics is said to be effective if it meets medium or high criteria, namely a value of $(< g >) > 0.3$

RESULT AND DISCUSSION

The research results are explained based on the ADDIE stages used in this research. In the first stage, namely **Analyze** The results obtained were that class IV of SD N 2 Sukoharjo III had used the independent curriculum in the learning process. There is some mathematical material that is considered the most difficult for students to understand, namely division material, so that division concepts become the main focus in e-comics. The condition of class IV students at SDN 2 Sukoharjo III are students who are able to use technology, especially using Android. So that cultural-based digital learning media can be used as a learning medium where these media can help students to understand the sharing material in an interesting way (Saripudin et al., 2021); (Syahmi, Ulfa, & Susilaningsih, 2022); (Patras, Juliani, Nurhasanah, Maksum, & Hidayat, 2023); and can also introduce culture to students so that learning becomes more meaningful (Surat, 2018); (Shavira, 2021). Based on the results of interviews with teachers using interview instruments, it was found that there were 7 students who had difficulty learning mathematics. The interview instruments used are as shown in Table 2.

Table 2. Dyscalculia detection interview instrument

No.	Question Items
1	Does your student have difficulty learning to count?
2	Are your students still counting on their fingers after graduating from the third grade of elementary school?
3	Does your student have difficulty reading graphs or charts without help?
4	Do your students not seem to understand the connection between the symbol "4" and the word "four?" Does he make mistakes when reading or following directions that involve words and number symbols?
5	Do your students have difficulty applying fractions to real world objects? Could he not determine that one day was equal to twenty-four hours, or that half a year was equal to six months?
6	Does your student have difficulty solving word problems or multi-step math problems? Does he have difficulty articulating what strategy he will use along the way?
7	Do your students don't seem to understand the difference between addition

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No.	Question Items
	and subtraction? Does he get confused by the + and - symbols when solving math problems?
8	Does your student have trouble writing numbers clearly or keeping their work neat when solving math problems?
9	Do your students have difficulty understanding the nominal value of money?
10	Are your students having trouble connecting number concepts to real world objects? When you ask him how many cookies are left, for example, does he seem confused

(Patricia & Zamzam, 2019).

The student data obtained was based on the results of the interviews, then a diagnostic test was carried out with four aspects, namely intuition about numbers, working memory, calculations and mathematical thinking. The indicators are used in diagnostic tests as in Table 3.

Table 3. Diagnostic test indicators for dyscalculia students

Characteristic Domains of Dyscalculia	Indicators of Dyscalculia in Elementary School	Sub-Indicator
Number Sense (intuition about numbers)		
Suffered	connecting numbers to real life situations, such as knowing that "3" can apply to any group that has three things in it - 3 0ranges, 3 bananas, 3 children, etc.	Count the number of objects in the box.
Sequencing	Having difficulty remembering numbers, and skipping numbers when children of the same age can count remember the numbers and remember them in the correct order.	Order the numbers from largest. Order numbers from smallest. Name the number that has the greatest value. Name the number that has the smallest value.
Recognizing Numbers	Has difficulty recognizing number symbols, such as making the connection between "7" and the word seven.	Write number symbols.
Working Memory		
Short Term Memory	Difficulty recognizing patterns and organizing items by size, shape, or color.	Difficulty recognizing patterns and organizing items by shape.
Calculation		
Difficulty in learning to count	Has difficulty learning to count	Complete addition/subtraction arithmetic operations without saving techniques.
Mathematical Thinking		
Estimate	Estimate the location of a number between two other numbers	Estimate the location of a number among other numbers.
Difficulty in assessing	Assess whether the answer is right or wrong by giving reasonable reasons	Assess whether the answer is right or wrong by giving reasonable reasons.

Source: (Nfon, 2016; Patricia & Zamzam, 2019; May & Ahmad, 2021).

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Based on the results of diagnostic tests using the indicators Tabel 3, the results showed that there were 3 students who experienced dyslexia with the result that the students experienced difficulties in more than 60% of the characteristic domains of dyscalculia. Thus, these 3 students became subjects in this research, with each subject given the initials MJ, DS, and RF.

The second stage of ADDIE, namely **Design (Planning)** The results obtained are in the form of core components, storyboards, and other components needed in making e-comics. The Figure 3 explains the core components that must be contained in the Lampung folktale mathematics e-comic "Buaya Perompak".

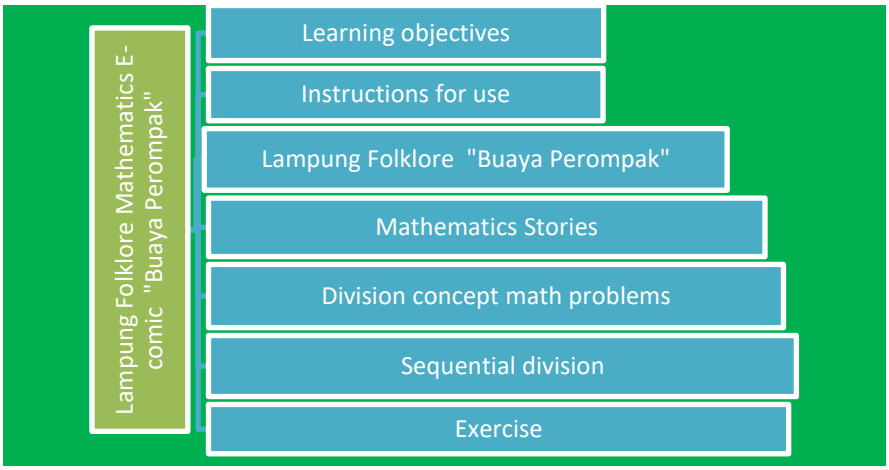

Figure 3. Design *E-comic* Mathematics Lampung Folklore "Buaya Perompak".

The components described in Figure 3 are prepared using software*Microsoft Powerpoint, Adobe Illustrator*, and *Adobe Photoshop* thus producing an e-comic that can be seen in Figure 4.

Figure 4. Cover page and learning objectives

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Figure 5. Instructions for use and folklore from Lampung, pirate fees.

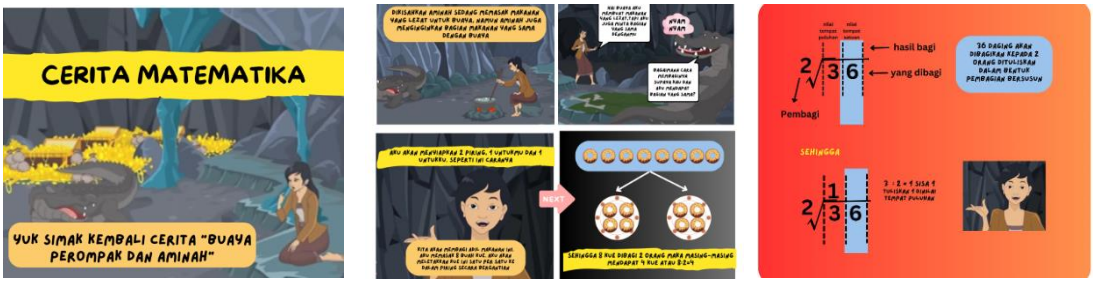

Figure 6. Mathematical stories and mathematical problems.

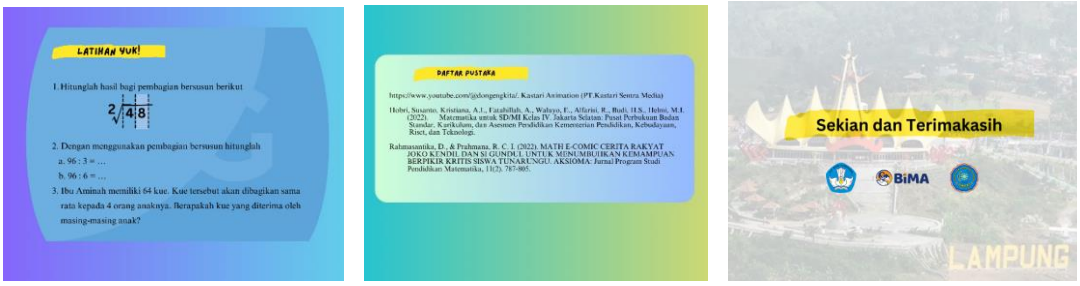

Figure 7. Practice pages, bibliography, and conclusion.

The third stage of ADDIE, namely **Development.** The results obtained were that e-comics were declared feasible by material experts, design experts, and media & communication experts. A description of the assessment by each validator can be seen in Table 4.

Table 4. Evaluation results by expert validators

No	Validator	Average assessment results	Criteria
1	Material expert	4,75	Worth to use
2	Design expert	3,8	Worth to use
3	Member of media & communication	3,8	Worth to use

The assessment of the feasibility of e-comics was also carried out by the user, namely the fourth grade teacher at SD N 2 Sukoharjo III. Users provide an assessment of aspects of the truth of the content of the material and the depth of the material. In this aspect, users gave a rating of 3.8 with the media category being suitable for use.

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The fourth stage of ADDIE, namely **Implementation** carried out 3 times on research subjects and obtained the results described in Table 5.

Table 5. N-Gain Criteria Based on Pretest and Posttest Results

No	No	Posttest	Pretest	Postest-Pretest	Shoes Ideal (100-Pretest)	N-Gain score	Criteria
1	MJ	45	0	45	100	4,5	Currently
2	DR	65	20	45	80	5,6	Currently
3	RF	45	20	25	80	3,1	Currently

Evaluation carried out at every stage starting from the analysis stage to the implementation stage. Summative evaluation was carried out at the implementation stage with a positive response score from teachers of 98%, and a positive response from students of 69.33%.

Based on the research results that have been presented at each stage of ADDIE, an in-depth discussion can be carried out so that a conclusion can be reached that the e-comic media of the Lampung folklore the pirate crocodile is suitable and effective for use for dyscalculic students at SDN 2 Sukoharjo III. Based on the results obtained at the analysis stage, it is known that it is not possible to state that a student has dyscalculia just by perception based on the results of interviews with the teacher. Furthermore, it must be strengthened with diagnostic tests so that the subjects obtained are more representative. Analysis to fulfill the research subject alone is not enough, an analysis of what needs are needed by students with dyscalculia to fulfill their learning process is needed. Dyscalculic students need learning media that trains visualization through interesting pictures and folk tales with local cultural themes. This is the driving force in creating an e-comic design with a local Lampung culture theme based on the folklore of pirate crocodiles.

The mathematical e-comic design is made very attractive with less writing and more pictures and colors that illustrate Lampung folklore. Mathematical symbols are visualized very simply and more concretely in relation to everyday life as shown in Figure 8.

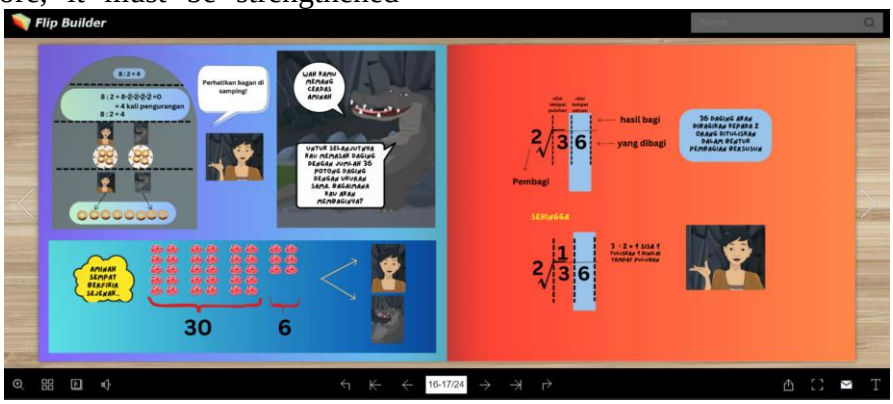

Figure 8. E-comics illustrate the concept of division more contextual

Figure 8 shows that the mathematical problem of division is illustrated through a folklore and explained using pictures, charts or clear plots to make it easier for dyscalculic students to understand. This is in

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accordance with the opinion of (Suzana & Maulida, 2019) which states that presenting mathematical problems contextually can help dyscalculic students solve their problems. A part from that, dyscalculic students also experience difficulties in reading (Purnomo, Azizah, Hartono, Hartatik, & Bawono, 2017). Therefore, the mathematical e-comic, Lampung folklore, the pirate crocodile, presents problems in the form of a story accompanied by concrete pictures according to the story as shown in Figure 9.

Figure 9. E-comics present problems through stories accompanied by pictures

The picture aims to help students with dyscalculia understand the writing they read. Students will be able to understand the story well and correctly when there is the help of illustrative pictures.

The development of e-comics also goes through a development process, namely the process of evaluating e-comics in terms of material, design and communication. This assessment is carried out by expert validators who are competent in their fields. The material expert's assessment shows that the e-comic meets the aspects of correct content of the material, free from conceptual errors, up to date or contemporary material, coverage and depth of the material, and adequate references. If seen based on the quantitative score obtained, namely 4.75, then e-comics in terms of material are categorized as media that is suitable for use by students with dyscalculia.

Apart from the material side, e-comics are also seen for their feasibility from the design side. This assessment was carried out by experts in the media field. Based on the assessment, it was found that e-comics fulfill the media aspect, namelyaccuracy of media delivery strategies so as to enable ease and speed of understanding and mastery of material, concepts or skills; the level of possibility of encouraging students' abilities to think critically and solve problems; accuracy and attractiveness of educational media; and relative advantage with an average of 3.8. So it can be concluded that e-comic media is suitable for use from a media design perspective.

Language as a symbol of communication is also important to help students understand sentences. Therefore, an assessment by a communication expert validator is needed which gives the results that 1) Narratives, simulations and language and communication styles according to student characteristics; 2) selection of narratives, simulations with appropriate objectives and material content; 3) The packaging of the "e-comic" learning multimedia is attractive but there are revisions to the color display which is

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less striking; 4) The accuracy and attractiveness of the "e-comic" learning media with an average of 3.8. So it can be concluded that e-comic media is suitable for use.

The assessment of the e-comic was also carried out by the user, namely the fourth grade teacher at SD N 2 Sukoharjo III, who gave the results that the material in the e-comic met the aspects of truth and was free from conceptual errors, the material met the contemporary aspect, the material met the aspects of coverage and depth, and The material uses adequate references. The user rating is 3.8, which indicates that the mathematics e-comic is suitable for use. A description of the assessment results by validators and users can be seen in Figure 10.

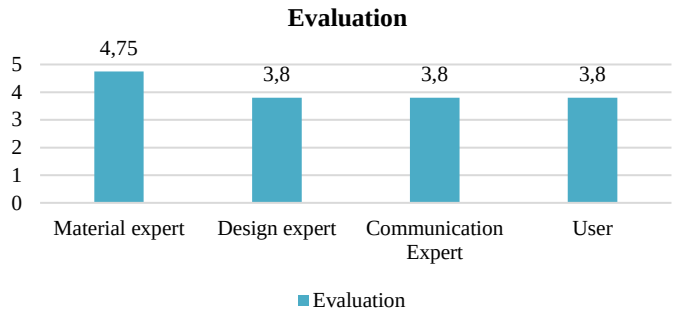

Figure 10. Evaluation of mathematical e-comic validation by validators and users

A part from feasibility, effectiveness is also a criterion for measuring e-comics. Effectiveness is known through implementation activities by first conducting a pretest on students before the e-comic is implemented and a posttest after the e-comic is implemented. The results show that the posttest score shows a significant increase which causes the average N-Gain Score to be 4.4 which indicates moderate criteria. It can be concluded that the e-comic media of the Lampung folk tale "Crocodile Pirates" is effectively used as a mathematics learning medium for students with dyscalculia.

Evaluation is also important in each stage of ADDIE. At this stage two types of evaluation are carried out. The first is formative evaluation which is carried out at each of the four research stages. At the analysis and design stage, e-comic media was designed by researchers according to the needs and characteristics of dyscalculic children. Then on stage *develop*, the media is evaluated or revised based on input from the validator during the validation test to then obtain media that is suitable for use in learning. Second, the evaluation carried out is a summative evaluation. At stage *implementation*, obtained from the analysis of the teacher's response of 98% while the positive response of students was 69.33% and there was no input from users so the media is said to be suitable and effective to be used as learning media for students with dyscalculia.

These results show that the e-comic mathematical folklore of Lampung, “Buaya Perompak,” became an easy and enjoyable medium for discalculia children. This is because digital comics can increase students' interest in learning with dyscalculia because they are dominated by interesting images. According to Fatwana, Dasari, & Juandi (2023), using visual aids for children with dyscalculia can direct them to see mathematics in a

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real and tangible way. Apart from that, Mutiani & Suyadi (2020) also said that by utilizing technology, teachers can help students discalculate learning mathematics. The results of this research are in line with research conducted by Rahmasantika & Prahmana (2022), who found that folklore mathematics comics are an easy and fun medium for students. So that, through the mathematics e-comic learning medium, the Lampung folklore "Buaya Perompak" is hoped to be a medium that helps dyscalculic students understand mathematics material as well as broaden their knowledge of local culture and maximize students' visual aspects through interesting images.

As for the limitations in this research, in using the mathematical comics of the folklore of Lampung, the role of the teacher is very much needed to guide students to understand the mathematical material contained in the comics. This is because the objective of this research is discalculia students, so digital mathematical comics are only used as a means of attracting interest and making students want to learn, while understanding the mathematics material still requires guidance from the teacher using comic media. It is hoped that the results of this research can be used as a reference for developing digital comic media that can be independently used, especially for discalculia students.

CONCLUSION AND SUGGESTION

Based on the results and discussion previously described, it can be concluded that the media in the form of the mathematics e-comic Lampung folklore "Buaya Perompak" is declared suitable and effective for use by class IV dyscalculia students at SD N 2 Sukoharjo III.

The results of this research also serve as a basis for further research to develop a digital mathematical comic medium for discalculia students. However, the advice that can be given is to improve the related mathematics material contained in the comics so that discalculiated students can use a digital mathematical comic developed independently without depending on the guidance of the teacher.

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