

Development of electronic digital comic learning media based on Gentala Arasy Jambi's ethnomathematics to improve mathematical literacy

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ABSTRACT

This research was conducted by looking at the educational situation, especially elementary schools because of the lack of teaching variation in the use of digital learning media. The lack of variety in learning media makes students less enthusiastic about participating in learning activities. For this reason, media is needed so that students can see, hear, and read, one of which is comics. The research aims to develop e-comic media containing ethnomathematics, Gentala Arasy, and Jambi Province to increase mathematical literacy, foster a spirit of love for the country, and increase student motivation in learning. The development of digital comic research uses Research and Development as well as the 4D development model. The subjects in this research consisted of class V teachers at SDN 214/IV Jambi City and class V students at SDN 214/IV Jambi City. The effectiveness test of e-comic media was analysed using the t-test and N-Gain based on data obtained through motivation questionnaires and creative thinking ability tests given to 12 class V students of SD 214/V Jambi City. The type of data collection carried out is by conducting observations, interviews and questionnaires. The data was analysed using qualitative descriptive and quantitative descriptive analysis techniques. The research results showed that the average expert validity test score was 88%, so it was included in the very valid criteria and product trials on students were 95% in the very good category. Thus, the results of the research concluded that the Gentala Arasy Jambi-based comic EDC learning media can increase mathematical literacy in learning.

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Introduction

Education is currently developing rapidly following developments in information and technology (Darmayanti et al., 2023). Various kinds of new creations in learning are emerging to make education in Indonesia more advanced (Ruskhan Fauza et al., 2022). In the world of education, development is very necessary in the learning system, especially in learning which is often considered difficult by students (In'am et al., 2023). Mathematics is often considered a difficult and complicated subject to learn (Rahmah et al., 2022). Mathematics learning needs to be provided at all levels from elementary school to university with the aim of equipping students with the ability to think logically, systematically, critically and creatively, as well as the ability to work together (Farapatana et al., 2019). To achieve this ability, teachers must package mathematics learning material into fun subjects so that they can arouse student motivation and make students understand the material (Darmayanti et al., 2023).

This contrasts with the facts in the field, based on the results of observations made when guiding Pre-Service PPG PPL students at schools, it was found that the quality of mathematics learning outcomes was still low. After analysis, this is caused by the learning activities carried out in class which are still limited to knowledge that has not yet extended to the ability to apply and connect mathematics learning with everyday life, so that students' mathematical problem-solving abilities are low.

Another factor that makes a significant contribution to student learning outcomes is the teacher's role in selecting and utilizing learning media (Udil & Sangur, 2020). According to (Zaini & Dewi, 2017), learning media is a means of transmitting messages from the sender to the recipient with the aim of stimulating students' thoughts, feelings, attention and interests and desires in such a way that a learning process occurs to achieve effective learning. This is in line with what was expressed by (Wibowo & Koeswanti, 2021) who said that interesting learning media will make it easier for students to understand the material, learning media that is designed to be very interesting will make students not get bored easily and students can be motivated to be enthusiastic in learning. One way of presenting material is by using learning media that is interesting and easy for students to understand, namely by using comics. Comics are part of popular culture because previously the learning process only used ordinary textbooks (Rochyanti, 2021). Comics can be an alternative media that can be used to motivate and make it easier for students to learn and understand mathematical concepts (Nida et al., 2017). In accordance with (Septy et al., 2015) research, students prefer pictures compared to writing.

There are several research results that show the positive impact of comics as a learning medium, including 1) the use of comic learning media causes the tendency of many people to enjoy and read comics (Latif et al., 2019); 2) comic media also has a role in improving students' skills, such as making it easier for students to understand material with the help of pictures and colours packaged in a series of stories so that they can optimize brain performance in thinking. This is reinforced by the research results of (Muhaimin et al., 2023) say that comics are a combination of text and images which can increase students' understanding of the concepts/material to be studied 3) comics can also increase students' motivation in learning (Rosadi et al., 2022), this is in line with (Buchori & Setyawati, 2015) who said that comic media used in the teaching and learning process can generate new desires and interests.

The development of culture-based comics has also been developed by several other researchers, for example research conducted by (Suryaningsih et al., 2023) with research including 1) the importance of using interesting media in learning geometry to improve students' logical thinking abilities , 2) Integration of cultural elements This local area is expected to make geometry material more relevant and interesting for students , 3) The assessment results show that the comic meets the criteria for validity and readability, which means the material can be understood well and is suitable for learning purposes, 4) has not been implemented, 5) provides contribution to the study of geometry. The potential impacts of this research include increasing learning

motivation, developing logical thinking abilities, utilizing local culture in learning, as well as increasing teacher creativity, providing a useful framework for developing learning media, encouraging further research on the effectiveness of the media being developed.

Furthermore, research by (Khairani & Sukmawarti, 2022) concluded that there were 3 positive things in the development of comics as a learning medium, namely, first, cultural relevance. to facilitate students' understanding of geometric concepts through an approach that is more contextual and relevant to their socio-cultural environment. This can foster a sense of belonging and appreciation for one's own culture while increasing interest in mathematics. Second, visualization of geometric concepts, comics as a visual medium are very effective in helping students visualize abstract geometric concepts to become more concrete. With the help of pictures and stories, students can more easily understand concepts such as angles, lines and other geometric shapes. Third, increasing interest in learning, a combination of interesting stories and interesting illustrations can increase students' interest in learning mathematics so that learning is more enjoyable and reduces students' fear or anxiety about mathematics. Apart from that, 3 negative things were also found, firstly, generalization limitations: students from other cultures or regions may be less able to understand or feel related to the cultural content presented, so that the effectiveness of this media is reduced. Second possibility of misunderstanding: If it is not designed well, there is a risk that students could misunderstand geometry concepts because they focus more on the story or cultural aspects rather than the mathematical material. Third, distribution limitations: Developing materials based on specific cultures requires quite large resources, both in terms of time, energy and costs. This could be an obstacle if the material is to be widely applied in various schools with different cultural backgrounds.

Comics created through electronic media can also be called e-comics or webcomics (Arliani & Khabibah, 2022). E-comics have changed printed comics into electronic comics. This innovation is expected to convey abstract mathematical concepts with illustrations in the storyline so that it attracts students' attention. This is because e-comics can contain stories that aim to encourage students to learn mathematics by looking at events they have experienced and events that students can imagine (Muhaimin et al., 2023). Therefore, stories in mathematical e-comics can be activities in everyday life that are related to mathematical concepts. Real activities in society are in the form of habits, wisdom or culture that are formed within the local community. Building a learning environment can be done by including culture as part of the learning process. One lesson that can be a bridge between culture and education, especially mathematics, is ethnomathematics. (Tsfamicael & Nakkeen, 2021) ethnomathematics also examines every form of culture, knowledge, social activity or characteristics of social and/or cultural groups that can be carried out by other groups.

One of the ethnomathematics in Jambi Province which was developed into a digital comic learning medium is Gentala Arasy. Using Gentala Arasy in e-comic as a medium for ethnomathematics-based mathematics learning in Jambi can provide a unique and relevant learning experience. Identify mathematical concepts such as symmetry, patterns and fractions that can be studied through Gentala Arasy. Analyze the patterns found in Gentala Arasy to teach the concept of symmetry and patterns. Geometric shapes and structures found in Gentala Arasy designs, such as triangles, rectangles, or other shapes. Design elements to teach fraction and calculation concepts. For example, counting the parts of the Gentala Arasy pattern or dividing the design into different parts. Based on the description above, it is necessary to develop e-comic mathematics learning media containing ethnomathematics in Jambi. This research aims to obtain appropriate e-comic mathematics learning media, so that it can be used in classroom learning.

Method

This research includes research or research and development (R&D). According to (Sugiyono, 2015) explains that the purpose of development research is to produce certain products and test their effectiveness so that they can benefit the wider community. The product developed is an e-comic learning media based on Gentala Arasy Jambi's ethnomathematics to improve elementary school students' mathematical literacy. The development model used is a 4D model which consists of the Define, Design, Develop and Disseminate stages.

The Define stage in the 4D development model is the initial stage or planning stage in the process of developing ethnomathematics comic media. At this stage, an analysis of information gathering needs is carried out, determining learning objectives, themes or topics, targets shown to students, and content to be conveyed in ethnomathematics digital comic media. At the design stage there are several things to do, including preparing the initial product, preparing the initial product which is made using the Canva for education application which is designed in the form of a mathematical comic containing a storyline about the history and culture of Gentala Arasy. Second, at this stage the character or characters in the digital ethnomathematics comic are also determined. In determining the character, it is adjusted to elementary school age. Third, the preparation of the initial product, namely digital comic media developed in this research, is based on the ethnomathematics of Jambi Arasy. The application used is Canva. Ethnomathematics comic media will be packaged in the form of a flipbook or e-book. Fourth, this stage also determines the content, prepares a scenario script for the content of the comic, and determines the characters and technology needed in the production of digital comic learning media. Fifth, outline the storyline in the comic. The development stage in the 4D development model is the stage where comic media is developed or created based on designs that have been prepared in the previous stage. At this stage, the process of preparing a storyline that is adapted to Gentala Arasy's ethnomathematics concept begins. The final step in this

development stage is creating a comic design. At the dissemination stage, the learning media that has been developed will be distributed to target users, namely elementary school students. However, this research is only limited to product development that is validated by experts and small group trials. The dissemination stages will be explained in another article as part of this research.

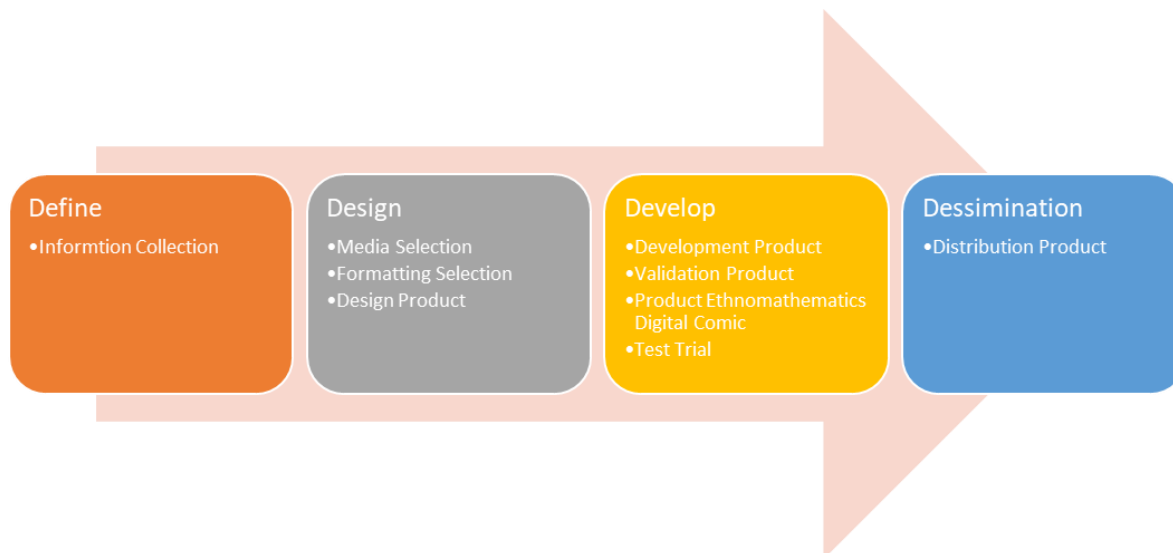


Figure 1. Research Procedure for 4D Model Development

The research subjects for product trials were 6 class V students of SDN 214/IV Jambi City for small group trials and 30 people for large group trials, 2 elementary school teachers as practitioners, 1 material expert, 1 media expert, and 1 expert. 1 person 's language. The data collection technique used in this research is by using a questionnaire. The questionnaire consists of two, namely a feasibility questionnaire and a response questionnaire. The feasibility questionnaire was addressed to material experts, media experts and language experts in the form of a closed questionnaire. Apart from that, the eligibility questionnaire was also addressed to practitioners, namely elementary school teachers. Meanwhile, the response questionnaire was addressed to 12 students of SDN 214/IV Jambi City who had taken mathematics material in the e-comic that was created.

The data analysis technique used is qualitative and quantitative descriptive analysis. Qualitative descriptive analysis techniques are used to describe the development stages which describe the results of observations of the implementation of learning media development. Quantitative data analysis is used at the development stage to show the results of the validity test of the feasibility of the learning media being developed and the practicality of the product for students.

Result and Discussion

Define Stage Results

The Define stage in the 4D development model is the initial stage or planning stage in the process of developing ethnomathematics comic media. At this stage, an analysis of information gathering needs is carried out, determining learning objectives, themes

or topics, targets shown to students, and content to be conveyed in ethnomathematics digital comic media. collection to obtain initial data on development needs is carried out through questionnaires. Researchers distributed interest questionnaires to comics to 30 students. It was found that 78% of students had read comics and 22% had never read comics, and 60% were interested in reading comics because of the storyline, while 40% were interested in reading comics because of the pictures. Thus, it can be concluded that students are familiar with comics and are interested in reading comics.

During interviews with students, information was obtained that they preferred and were interested in textbooks and learning media with pictures, colors, and had attractive illustrations because this could increase students' sense of interest, interest in learning and students' enthusiasm for reading and studying the content. the book or learning media. By using interesting learning media and presenting clear and complete material, mathematics learning will be more meaningful for students with subject matter that is easy to understand.

The next stage is a field study regarding the ethnomathematics that will be used. Based on the results of interviews and observations carried out by researchers, there is a gap that occurs at SDN 214/IV Jambi City, namely the low numeracy literacy skills of students which is caused by students' lack of interest in learning mathematics in the use of learning media and learning models that support students' interest in learning. Therefore, researchers are thinking about solutions and innovations so that students' interest in learning increases. The next step is setting instructional objectives. At the end of phase C, students can determine the perimeter and area of various flat shapes (triangles, quadrilaterals and polygons) and their combinations. They can calculate the duration of time and measure the size of angles.

Design Steps

The next stage is design, where the researcher designs learning media for mathematics comics with illustrations of Jambi culture using a problem-based learning approach to increase student interest. At this stage, all elements of the analysis will be realized, and the initial design of the mathematics comic will be further developed based on input from the expert team to ensure the quality of the product and its use in learning.

At this stage there are several things to do, including first preparing the initial product, preparing the initial product which is made using the Canva for education application which is designed in the form of a mathematical comic containing a storyline about the history and culture of Gentala Arasy. Second, at this stage the character or characters in the digital ethnomathematics comic are also determined. In determining the character, it is adjusted to elementary school age. Third, the preparation of the initial product, namely digital comic media developed in this research, is based on the ethnomathematics of Jambi Arasy. The application used is Canva. Ethnomathematics comic media will be packaged in the form of a flipbook or e-book. Fourth, this stage also determines the content, prepares a scenario script for

the content of the comic, and determines the characters and technology needed in the production of digital comic learning media. Fifth, outline the storyline in the comic.

Developing

The development stage in the 4D development model is the stage where comic media is developed or created based on designs that have been prepared in the previous stage. At this stage, the process of preparing a storyline that is adapted to Gental Arasy's ethnomathematics concept begins. The final step in this development stage is creating a comic design. In making comic media, such as digital comic learning media, designing comic media scripts needs to be beautified to make them more interesting to read, of course adjusting existing colours and images and carrying out quality tests by media experts and material experts. This is done so that ethnomathematics-based digital comic media can function as expected. At this stage, trials were also carried out on students to see user interactions and experiences in comic learning media. If problems or errors are found, corrections will be made before the implementation phase begins.



Figure 2. Link to digital comic (<https://online.fliphtml5.com/rddrw/atph/>)

Product Validation

At this stage, prototype I, namely a comic based on the initial design, is assessed by two validators. Prototype I was assessed by one mathematics education lecturer and one mathematics teacher. Each validator is given a comic along with a comic validation sheet. The validation results are in the form of scores to test the level of validity of the comic, as well as suggestions and criticism from validators which are used as revision material to produce prototype II. The validation results from the validator are as shown in Table 3 below:

Table 3. Comic Validator Assessment Results

No.	Rated aspect	Mark	Qualification
1.	Comic Media Design	78	Legitimate
2.	Construction	77	Legitimate
3.	The truth of the concept of each material	77	Legitimate

Based on Table 3, the results of the analysis of the validation sheet and the validity criteria that have been determined, the values obtained for each aspect are considered to meet the valid criteria. Furthermore, improvements to prototype I of the comic were carried out based on suggestions from the validator, namely adjusting the writing and

enlarging the paper with the aim of making it more interesting and the material in the comic very good. Apart from material validation, media experts also assessed the readability of comics. The results of assessing the readability of the comic prototype are as shown in Table 4 below.

Table 4. Readability Assessment Results

No.	Rated aspect	Mark	Qualification
1.	Comic Media Design	78	Legitimate
2.	Construction	78	Legitimate
3.	The truth of the concept of each material	78	Legitimate

Based on Table 4, the results of the media readability sheet analysis show that the value of each aspect is considered to have met the readability criteria. The comment given by the teacher to test the readability of the comic was that the comic developed was creative and interesting as a mathematics learning medium so it does not stop here but must be developed for the advancement of the world of education.

After carrying out an analysis based on the validation results and readability of the comic being developed, the comic being developed was declared to meet the criteria worthy of being called the final prototype for the development of Quadrilaterals and Triangles Based on Jambi Ethnomathematics. comic material for fourth grade elementary school. It is hoped that the comic being developed can help attract students' interest to maximize their learning outcomes, as has been experienced by several researchers. Comics influence students' learning outcomes and interest in reading in mathematics subjects (AMINAH, 2024; Cahyono et al., 2023; Nida et al., 2017; Saputro & Soeharto, 2015). Comics can facilitate student learning, such as cognitive development, motivation and information processing (Rahmah et al., 2022).

Apart from that, the development of ethnomathematics-based comics by Gentala Arasy adds to the existing repertoire of Indonesian culture-based comics (Arliani & Khabibah, 2022; Buchori & Setyawati, 2015; Cahyono et al., 2023; Septy et al., 2015; Suryaningsih et al., 2023). The comic media developed also enriches Jambi Cultural ethnomathematics research as a means of learning mathematics, such as the development of mathematics worksheets based on Jambi batik motif ethnomathematics (Anggreyani et al., 2024); development of traditional game-based LKPD (Nabila et al., 2024) and development of ethnomathematics-based animated videos in the Gentala Arsy building for second grade elementary school students (Monika et al., 2024).

Dissemination

The disseminate stage in the 4-D development model is the final stage in the learning media development process. At this stage the learning media that has been developed will be distributed or distributed to target users, namely elementary school students. However, this research is only limited to product development that is validated by experts and small group trials. The dissemination stages will be explained in another article as part of this research.

Conclusion

Development research based on Plomp's 4-stage framework produced a comic prototype based on Gentala Arasy's ethnomathematics in mathematics learning that met the criteria for validity and readability. This research needs to be continued to the implementation stage for elementary school students in Jambi Province as a continuation of the research stage for the development of Plomp.

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