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Development of Comic-Based Integrated Science Teaching Materials for Fifth Grade Elementary School Students

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ABSTRACT

Incorporating engaging and effective teaching materials is essential for enhancing student learning in science education. This research aims to develop comic-based integrated science teaching materials tailored for fifth-grade students, employing the ADDIE (Analysis, Design, Development, Implementation, Evaluation) method. The research and development process follows these five stages to ensure comprehensive material creation and evaluation. The results indicate high validation scores: 96% for material, 98% for language, and 96% for media, categorizing the comics as highly suitable for educational use. Student and teacher responses further affirm this suitability, with 90% and 94% approval rates, respectively. Evaluation of student test results shows an average score of 90.36, with 90% of students meeting the criteria for excellence. This study concludes that comic-based teaching materials significantly enhance student engagement and understanding of science, contributing valuable insights into educational resource development.

Keywords: *Teaching Materials, Integrated Science, Comic*

INTRODUCTION

In order to conduct active, creative, effective, and enjoyable learning, the support of learning media is essential. Learning media serve as channels for delivering lesson material to students. This information can encompass various skills or knowledge that students need to master during the learning process.Learning media can increase the effectiveness of communication and interaction between teachers and students. Learning media is also considered very effective in increasing students' learning motivation which then also improves students' learning outcomes (Baudry, 2018; Shustrova et al., 2017; Yusnita et al., 2023). Along with the development of science and technology, education can be carried out through various media such as magazines, books, and newspapers, or also through electronic media such as radio, television, the internet, and so on (Dutta et al., 2023; Gemelli et al., 2024; Shustrova et al., 2017). One media that is not widely used and developed in Indonesia is comics media.

Comics are media that are simple, clear, and easy to understand, therefore comics can be informative and educative media (Kuswanto, 2021; Nurhayati et al., 2019; Risma et al., 2018; Sabri et al., 2017). The existence of comics as part of the world of art is the result of human creativity and initiative which originates from a combination of stories and images so that they

can be used as a learning medium (Mailizar et al., 2023; Risma et al., 2018; Vasileva & Golubev, 2019). Apart from that, comics also have extraordinary appeal so that the message conveyed is easy to digest and understand, and also does not seem patronizing.

Ahyar et al. (2022) stated that at the beginning of their history, comics started from symbols or images without words or text. Comics consist of verbal and visual aspects that present problems that are relevant to children's lives, for example: about heroism, adventure, or everyday life, which then at the end of the story provides answers to their curiosity, so it doesn't always have to end happily. Apart from that, the storytelling uses a direct and uncomplicated language style. Comics are a form of cartoon that reveals characters and depicts a story connected by pictures and designed to provide entertainment to readers.

In the Manga tradition, since the late 1950s in Japan, there has been a division grouping comic readers. Shoujo manga for girls, Shounen-manga for boys, His for teenagers, and Gekiga(in English it means "theatrical pictures“) for adult readers. Later, manga appeared for professionals and housewives. In France, comics for adults are growing rapidly. In a 1993 survey, four out of ten French people aged 25-44 years read comics. Guntur stated that recently the term “Graphic Novel", namely comics with heavier themes, with better production, and judging from the themes, it is clear that the target audience is adults.

Several institutions in America use comics as a medium of information. For example, the United States Atomic Energy Commission (AEC), and General Electric Corporation, explain atomic science, electricity, and other sciences in comic form. Community organizations Anti Defamation League (Anti-Hostile League) uses comics to spread the principles of tolerance and brotherhood. In China, Mao Ze Dong used comics as a tool for his party's propaganda. Now you can find comics that try to train people's emotional and social sensitivity, such as comics published by Mizan, or science comics by KPG. Without realizing it, various instruction manuals, brochures, and advertisements also use comic language to make them easier for the wider public to understand.

At the Gallery of the Indonesian Academy of Art and Design (ASDI) Solo, there was a comic exhibition entitled "Good Afternoon Indonesian Comics". The exhibition was attended by groups of comic artists from various regions, namely: Swacomsta (Yogyakarta), Papillon (Semarang), Bengkel Comics, Studio Sempit (Solo), and the Indonesian Comics Society (Jakarta). So far, comics have been considered a moral destroyer. A child becomes lazy about studying if he is addicted to comics. Comic lovers will waste their money to buy dozens of serialized comic series because they are curious about the ending of the story. This is different from the opinion of a comic artist who is famous for his Gundala stories, Harya Sura Minata, or who is often called Hasmi. He considers comics to be a means effective for the learning process so that it can make the nation smarter. With pictures, according to Hasmi, someone will more easily understand a meaning. Likewise, school children should need image media to learn, especially children from Paya Kalui State Elementary School to Junior High School. Hasmi gave an example, in European countries and the United States, public figures are depicted through comics because the image media is easiest for them to digest and understand. As a result of initial observations at the school that was the research location, information was obtained that science learning, especially using comic-based reading materials, had not been carried out optimally. So far, according to the teacher who handles science learning at the Paya Kalui State Elementary School, East Aceh Regency, he refers to the integrated thematic books in the 2013 curriculum. class V published by the Ministry of Education and Culture of the Republic of Indonesia which contains reading texts with graphic illustrations that are still dominant with free pictures or photos does not yet imply a series of material that is arranged systematically.

Furthermore, the results of observations and interviews conducted by researchers with science teachers at the Paya Kalui State Elementary School, East Aceh Regency, obtained

information that the teaching strategies implemented still tend to be mechanistic, this is characterized by learning activities carried out with students being asked to read independently, then the students listen and take turns reading, and then the students are asked to answer the questions in the reading. This has an impact on the development of critical thinking skills and student learning outcomes are not optimal.

To improve this, many ways can be done, including using the comic-based Integrated Science Learning method. Integrated Science Learning is a learning strategy that emphasizes the process of full student involvement to be able to discover the material being studied and relate it to real-life situations to encourage students to be able to apply it. Comic media is an alternative form of learning media. The technique of using comic media departs from an approach that prioritizes communication and reading activities by paying attention to illustrated stories as well as practicing existing conversations so that directly or indirectly, students will bring out the potential that exists in each of them (Dudzińska, 2013; Fitria et al., 2023; Lestari et al., 2021). An analysis of the language of comics by Thorndike shows that children are interested in reading comics with almost twice the number of words that can be read in reading books. A good comic is a comic that fits the learning objectives.

Some research results on comics as a medium that can improve learning processes and outcomes include: (1) research (Mikamahuly et al., 2023) shows that the use of comics in learning can potentially improve students' science communication (2) research (Purnamasari & Putra, 2020) found the use of comics as an alternative that can be used to improve chemistry learning outcomes, (3) research (Puspitorini et al., 2014) shows that the use of comics in learning has an impact on increasing students' cognitive abilities, and (4) research (Andriyani & Kusmariyatni, 2019) found that the use of comics in integrated science learning can improve learning outcomes. In its application, educators and education staff are required to develop learning using comic media, compiling an illustrated story referring to themes in integrated learning in elementary schools. The main role of comics in the learning process is their ability to create interest in students. The use of comics combined with good teaching methods makes comics an effective learning medium.

Science learning cannot be separated from the media and teaching materials used, however, the media and teaching materials circulating in the field are not yet in line with the government's expectations regarding integrated science material (Lancaster, 2023; Li et al., 2023; Subiyantoro et al., 2024). Apart from that, the media and teaching materials that are commonly and frequently used are textbooks or modules which are characterized by containing a lot of writing or explanations with sentences and a few pictures which tend to make students bored and less motivated, students tend not to like textbooks, especially those which not accompanied by attractive pictures and illustrations, and empirically students tend to like picture books, full of color, and visualized in realistic or cartoon form.

In addition, with the assumption that science is a difficult subject and full of theory, learning is boring and the use of less innovative media and methods will result in students being lazy about learning science so that students' interest in science decreases. Research results (Astuti et al., 2012) show that learning motivation has an effect of 48.1% on science learning achievement. This is supported by research results (Puspitorini et al., 2014) that students who have high learning motivation will find it easier to follow the learning process because they feel learning is important, on the other hand, students with low motivation appear less enthusiastic, and therefore have difficulty understanding concepts and processes. learning is not conducive.

This is confirmed by data from The Programme for International Student Assessment (PISA) with assessment subjects consisting of basic literacy tests in the fields of reading, mathematics, and science. Since PISA was first held in 2000 and Indonesia participated, it was ranked 39th out of 41 countries. After 15 years of Indonesia becoming a PISA participant, the

same incident continues to repeat itself. Indonesia's achievements are still at a lower level compared to other participating countries. This can be seen from Indonesia's achievements in 2015, which was only ranked 64th out of 69 participating countries.

Efforts to improve students' basic science literacy skills and enable students to build their reality through critical thinking skills are the Integrated Science Learning method as an alternative. For this reason, this research gave birth to a comic-based integrated science learning product, which is learning material designed for the learning needs of students in elementary schools. This comic-based integrated science learning product is to fill the "space" in integrated science learning which predominantly uses text narratives. The space is to present learning material by using comics to convey its message to students, where comics with interesting pictures will make students interested and motivated to learn so that students' critical thinking abilities and learning outcomes increase.

METHODS

This research is included in the type of development research (Research & Development). Research & Development (R&D) is a research method carried out to produce certain products and test the effectiveness of these products (Sugiyono, 2017). Meanwhile, according to (Sukmadinata, 2010), research and development is a research approach to produce new products or improve existing products.

From the explanation above, it can be concluded that this development research uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) method, which stimulates the main processes of the learning system development process. The ADDIE development method consists of five stages which include analysis, design, development, implementation, and evaluation (Sugiyono, 2017).

Figure 1. ADDIE Development Model

RESULTS AND DISCUSSION

Results

The results of research and development prove that comics in the form of integrated science learning teaching materials are categorized as very suitable for use. The following is a summary of the validation results of media, material, and language experts on comic-based Integrated Science learning teaching materials to improve learning outcomes for class V students at Paya Kalui State Elementary School as follows.

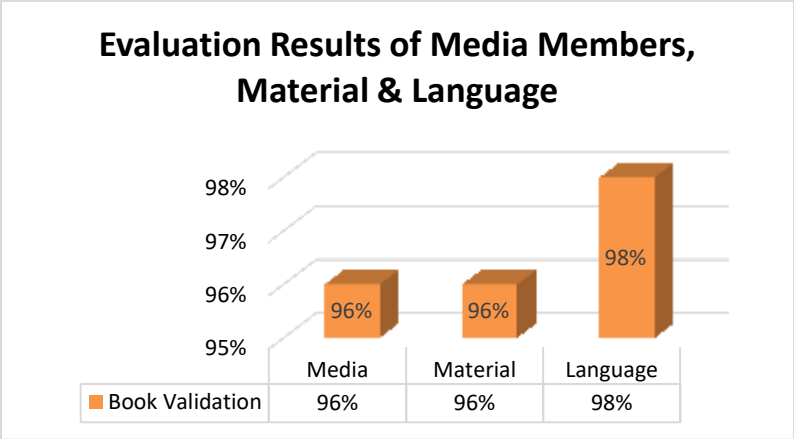

Figure 2. Design, Material, and Language Expert Assessment Diagram

After being declared very suitable by the validator, the comic-based Integrated Science learning teaching materials can be applied in the classroom. From May 20 to June 14, 2024, the researcher implemented comic-based Integrated Science learning teaching materials to class V students at Paya Kalui State Elementary School, totaling 30 students, with details of 15 boys and 15 girls. The following are the stages carried out when implementing the materials to teach comic-based Integrated Science learning.

Table 1. Learning Implementation

Activity Description
Opener
1) The teacher says hello and the students answer. 2) The teacher and students pray together 3) Students and teachers sing the video of the Garuda Pancasila song together. (TPACK) https://www.youtube.com/watch?v=1oxKo5gPwf4 4) The teacher asks about student attendance 5) The teacher informs the material being studied, namely about "changes in the form of objects". 6) Students listen to the teacher's explanation regarding the learning objectives. 6) Students listen to information regarding the steps in learning activities carried out today. 7) Students are given motivation by conducting questions and answers: • Do you know what the properties of objects are? • Have you ever heard of changes in the shape of things? • Have you ever bought ice cream, then the ice melted in the sun?
Core Activities
Syntax 1: Student orientation to the problem 1) The teacher explains the existence of comic teaching materials. 2) Students follow the teacher's directions regarding the use of learning comics. 3) Students and the teacher conduct questions and answers related to the content of the comic. 4) Students listen to a short explanation given by the teacher. **Syntax 2: Organizing students to learn** 1) Students are informed about the tasks carried out individually. 2) Students are informed about tasks to be carried out in pairs and groups. 3) Students are also informed about what things are needed to complete the tasks that will be carried out during learning. **Syntax 3: Guiding and investigating group individuals**

1) Students work together to work on the LKPD that has been given by the teacher.
2) Students hold discussions with group members with teacher guidance.
3) Students listen to the teacher giving directions to express opinions and each group member respects the opinions given by other groups.

Syntax 4: Develop and present results

1) Students present the results of the LKPD they have worked on.
2) Students present the results of the discussion with teacher guidance.
3) Students from other groups provide responses, input, and suggestions regarding their friends' displays.
4) Students are given motivation and rewards to ask and answer questions about the material presented.
5) The teacher invites students to do ice-breaking with a YouTube video guide: https://youtu.be/dITNmezPV5A?si=jPhxZO7E_Xtmdw88

Syntax 5: Analyze and evaluate processes

1) The teacher distributes evaluation question sheets and reflection sheets to students.
2) Students work on evaluation question sheets and learning reflection sheets and then submit them to the teacher.
3) Students are given appreciation by the teacher for the material they have mastered, such as giving praise or rewards.
4) Students and the teacher discuss material that they have not yet mastered.
5) Students together with the teacher make conclusions about the problems encountered.
6) Students listen to reinforcement and conclusions about the material.

Closing

1) The teacher reviews all the activities that have been carried out.
2) Teachers and students conclude what they have learned today.
3) The teacher provides information regarding learning activities at the next meeting. The teacher closes the lesson and takes turns allowing other students to lead a prayer together after finishing the lesson and continue with greetings.

After the implementation stage is carried out, the next stage is assessing the learning materials. Evaluation of teaching material products from the aspect of effectiveness is seen from the results of student scores after the implementation stage. Evaluation is used to determine the effectiveness of the product that has been made, evaluation value is obtained through implementation Post-Test which was carried out aimed at finding out improvements in student learning outcomes using comic-based Integrated Science learning teaching materials. The following is an analysis of evaluation data using the Gain/N-Gain test and continued with hypothesis testing;

Uji Gain

The increase in student learning outcomes in understanding is marked by the Gain value. Gain is the difference between the posttest and pretest scores. Gain shows the increase in

students' abilities after the learning process. The normalized NGain test was carried out to show how much students' abilities increased in cognitive aspects after following comic-based Integrated Science learning teaching materials. The N-Gain calculation is the difference between the posttest and pretest scores divided by the difference between the highest score and the pretest score. Following are the NGain score results:

Table 2. N-Gain

	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_Score	24	.25	,100	.9145	.23522
Ngain_Persen	24	25.00	100.00	91.4522	23.52174
Valid N (listwise)	24				

Table 4.11 shows the results of the N-Gain Score mean value of 0.9145, this value is greater than 0.3 (0.91>0.3), so the category obtained is high/high effectiveness. N-Grain Percent mean value 91.34522, value is greater than 76% (91%>76%), then it is interpreted as effective. So it can be concluded that the use of comic-based Integrated Science learning teaching materials to improve student learning outcomes has proven to be effective.

Research Hypothesis

Based on the results of the N-Gain test, it has been proven that the use of comic-based Integrated Science learning teaching materials can improve the learning outcomes of class V students at Paya Kalui State Elementary School. The basis for decision-making is that the hypothesis is accepted if the mean value is > 0.3. The following is the hypothesis used:

Ho: student learning evaluation score >75

Ha: student learning evaluation score <75

So based on the conclusion of the hypothesis, it is stated that Ho is rejected and Ha is accepted. Based on the results of data analysis on values Pre-Test and Post-Test Class V students at Paya Kalui State Elementary School in science learning use comic-based Integrated Science learning teaching materials with details in the following table:

Table 3. Value *Pre-Test and Post-Test*

Indicator	Pretest	Posttest
Minimum	55	80
Maximum	88	95
Average	70	91

The following is a value graph Pre-Test and Post-Test;

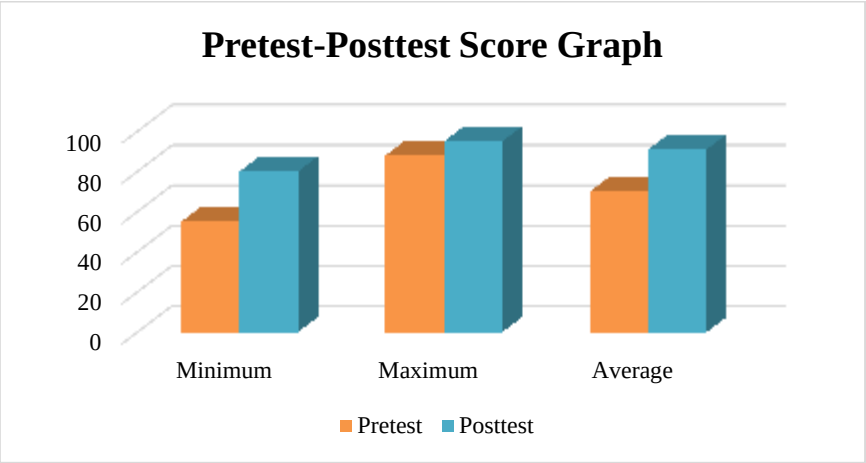

Figure 3. Graph Pretest & Posttest

Discussion

The comic-based Integrated Science learning teaching material developed is a development of the science learning book which was developed into a comic-based Integrated Science learning teaching material that has different elements. The teaching materials developed are comic-based which contain material and questions about environmental changes and changes in the form of objects.

The product being developed is carried out following the development procedures used in developing this learning media, adapted from (Lee & Owens) 2004. The development model focuses on multimedia development, namely the ADDIE model with five stages, namely: analysis (needs analysis), design (product plan), development (Creation of comic-based Integrated Science learning teaching materials, Validation of design, material and language experts), implementation (product application, product feasibility), and evaluation (product effectiveness).

The information that has been obtained from observations in class V of the Paya Kalui State Elementary School still lacks references to science learning and student learning outcomes in science learning are still low. Learning only uses conventional books, namely books and worksheets provided by the school and there is a lack of learning materials for teachers to use.

Researchers are trying to develop a product in the form of science learning teaching materials to increase teacher references in science learning. The researcher developed comic-based Integrated Science learning teaching materials. The researcher presented an attractive design that suited the characteristics of the students, with a concept that was short and easy for teachers and students to understand. Attractive design, able to stimulate students to be more interested in learning. The following is an explanation of the steps in developing comic-based Integrated Science learning teaching materials.

The first stage of this development is to carry out an analysis, namely needs analysis, identifying what books teachers and students need to improve student learning outcomes and create a more interesting learning process. Based on the results of the analysis, data showed that the average student score was 71.4 and the percentage of completeness was 71%. Based on this data, it is stated that student learning outcomes are still low which is caused by the implementation of learning that is not varied and teachers only use one reference, namely books from the government. Therefore, researchers developed comic-based Integrated Science learning teaching materials which were felt to provide new variations to the science learning process as well as an action that they felt could improve the learning outcomes of class V students at Paya Kalui State Elementary School.

Next, the second stage is the design stage, namely product design. The researcher's product design first determines learning indicators, and materials and determines the design of teaching materials. At the material design stage, researchers refer to CP and TP in science learning. Comic-based Integrated Science learning teaching materials are designed according to the teacher's needs and serve as a use in adding teacher references or teaching materials for the teacher to use.

Then, after the comic-based Integrated Science learning teaching material product has been developed according to the plan, a design, material, and language validation process is carried out to determine the validity of the product that has been developed. The comic-based Integrated Science learning teaching materials were validated by lecturers at Bina Bangsa Getsempena University, Banda Aceh. Based on the overall assessment of product experts, it can be concluded that an average of 97%, media experts 96%, materials experts 96%, and language experts 98% are obtained by comic-based Integrated Science learning teaching materials which can be implemented in class V State Elementary School students. Paya Kalui is in the very worthy category.

Next, the fourth stage is implementing teaching materials for science learning directly to students. From the results of calculating student and teacher responses above, it can be seen that based on data acquisition, the data obtained from teacher responses obtained a score of 94% and this can be categorized as comic-based Integrated Science learning teaching materials which are very good and practical teaching materials to develop. The data obtained from the results of student responses obtained a score of 90% and this can be categorized as comic-based Integrated Science learning teaching materials are interesting learning materials for students. This shows that the Integrated Science learning teaching materials are comic-based which aims to add teacher references as material for teachers to use. This can be categorized as comic-based Integrated Science learning teaching materials which are very suitable learning materials for students.

In the final stage, namely the evaluation stage, researchers measured whether comic-based Integrated Science learning teaching materials could improve student learning outcomes through test questions. Based on the results of the evaluation of test questions for class V students, they obtained a percentage result of 91% in the effective category. Proven by the N-Gain Score mean value of 0.9145, this value is greater than 0.7 (0.91>0.7), so the category obtained is high/high effectiveness. N-Grain Percent mean value is 91.4522, this value is greater than 76% (91%>76%), so it is interpreted as effective.

The teaching and learning process is a communication process that occurs from teacher to student or between students. In the process of conveying the message, a medium is needed so that the message can be received well. The use of teaching materials provides benefits in the learning process, including: 1) clarifying the presentation of messages and information so that the learning process runs smoothly and improves learning outcomes, 2) increasing student motivation, by directing students' attention to enable students to learn independently according to their abilities and interests. Learning materials are one of the supporting materials that can be used by teachers, but a teacher must be careful and precise in selecting learning materials so that the learning materials will be able to motivate students, increase student activity, and arouse students' interest in learning so that students' attention is focused on the topic of the material being discussed. One of the learning materials that can be used as a learning resource which is felt to be able to help students and teachers in the learning process is by using comic-based Integrated Science learning teaching materials which can improve the learning outcomes of Paya Kalui State Elementary School students.

CONCLUSION

In the process of developing comic-based Integrated Science learning teaching materials using the ADDIE model (Analysis, Design, Development and Implementation, Evaluation) the researcher carried out all stages. Based on the results of the analysis, data showed that the average student score before the action was 71.4 and the completion percentage score was 71%%. The results of the development research show that the comic-based Integrated Science learning teaching materials for grade V elementary school students are said to be very feasible. This is proven by the media expert validation results showing a very good category (96%) from the average validator. Material expert validation results show a very good category (96%) from the average validator. Linguist validation results show a very good category (98%) from the average validator.

The results of the student response product trials showed the very good category (90%) and the results of the teacher response product trials showed the very good category (94%). In the evaluation of the test results, students obtained an average result of 90.36 with a percentage score of 90% with very good criteria with details of 30 students completing. So from this research, the criteria have been fulfilled, namely the very good category in validation results, teacher and student response results, and test question results, so these results are

proof that comic-based Integrated Science learning teaching materials are very feasible and can be used as learning materials that can improve student learning outcomes.

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