



Development of Science Learning Media Based on Science Literacy on the Topic of Series and Parallel Circuits in Junior High School

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Abstract: Students at St. Agustinus Langa who lack scientific literacy are less able to react to local natural events and technological advancements. The purpose of this study is to describe the procedures used to create science learning resources based on scientific literacy using series and parallel series materials. This study employs the five stages of the ADDIE model – analysis, design, development, implementation, and evaluation – as a research and development (R&D) methodology. SMP St. Augustine Langa's class VIII students served as the research subjects. The study's findings demonstrate that using scientific literacy-based science learning materials in series and parallel series content can improve students' comprehension of the subject matter. The educational materials according to the research findings, St. Mary's Middle School students' understanding of scientific literacy has increased as a result of the creation of science learning materials based on scientific literacy in series and parallel circuit content. Langa, Augustine. Therefore, science learning media based on scientific literacy is appropriate for use in the science learning process. The implications of learning media created in the teaching and learning process include helping teachers explain learning material, improving the quality of the teaching and learning process in this case, and creating a pleasant learning atmosphere with the teaching and learning.

Abstrak: Rendahnya literasi sains di SMP St. Agustinus Langa berdampak pada kurangnya respons siswa terhadap perkembangan teknologi dan fenomena alam di sekitar tempat tinggal mereka. Penelitian ini bertujuan untuk menjelaskan langkah-langkah yang diambil untuk mengembangkan media pembelajaran IPA yang berbasis literasi sains dengan materi rangkaian seri dan paralel. Untuk penelitian ini, model ADDIE digunakan sebagai metode penelitian dan pengembangan (R&D), yang terdiri dari lima tahapan: analisis, desain, pengembangan, implementasi dan evaluasi. Subjek dalam penelitian adalah siswa kelas VIII SMP St. Agustinus Langa. Hasil penelitian menunjukkan bahwa penggunaan media pembelajaran IPA berbasis literasi sains pada materi rangkaian seri dan paralel mampu meningkatkan pemahaman siswa terhadap materi tersebut. Media pembelajaran yang dikembangkan dinyatakan valid dan layak digunakan dalam proses pembelajaran IPA, khususnya pada materi rangkaian seri dan paralel. Berdasarkan hasil penelitian, pengembangan media pembelajaran IPA berbasis literasi sains pada materi rangkaian seri dan paralel terbukti bermanfaat dalam meningkatkan pemahaman literasi sains siswa di SMP St. Agustinus Langa. Implikasi media pembelajaran yang dibuat dalam proses belajar mengajar yaitu membantu guru dalam menjelaskan materi pembelajaran, meningkatkan kualitas proses belajar mengajar dalam hal ini suasana belajar yang menyenangkan.

A. Introduction

Education is a significant aspect of community life. The importance of education for today's youth is to foster individual character, make them better people, and align with the values contained in Pancasila. Through education, humans are expected to grow into responsible, honest, civilized, and characterful individuals (Sujana, 2019). Education also plays a vital role in shaping a person's character and personality so that they can interact and communicate well in community life. The current education system is expected to prepare students with 21st-century skills to face increasingly complex challenges in the present and future (Karaca-Atik et al., 2023).

Teachers have a vital role in improving the quality of human resources and are the spearhead of enhancing the quality of education in a nation. According to the Great Dictionary of the Indonesian Language, a teacher is a person whose profession is teaching and makes this job a livelihood (Indrawan & Warlinah, 2020). A teacher has academic qualifications, competence as a learning agent, physical and mental health, and can realize national education goals (Priyanto & De Kock, 2021). Various factors influence the quality of education, including human resources and infrastructure that support the success of the learning process. The ability to maximize the use of educational media to enhance the effectiveness of the teaching and learning process is one of the critical skills that a teacher needs to possess. According to research on learning practices, students must constantly engage with the available learning resources to accomplish learning objectives. This is because the learning process significantly impacts how healthy education is improved.

Since it is essential to achieving learning goals, educational media is integral to the learning process. Learning effectiveness can be increased using suitable media (Rajagukguk et al., 2021). Because learning media can pique students' attention and lessen their boredom with the subject, they can better comprehend the material that teachers offer. With the rapid advancement of technology, teachers are increasingly challenged to prepare learning resources that can engage students actively during the classroom process. One approach to supporting the development of learning activities is using learning media. According to Novita et al (2019), learning media encompasses all physical or technical tools that assist educators in delivering content, making it easier for students to comprehend. Using these media helps teachers achieve their learning goals and effectively conveys abstract concepts to students (Tafonao, 2018). When developing learning media, it is essential to consider the characteristics of students to ensure that the press used effectively supports the attainment of learning objectives.

Particularly in science and technology, the modern digital era is developing exceptionally quickly (IPTEK). This change significantly impacts the Indonesian educational system. Teachers' roles in the digital age have expanded beyond simply imparting knowledge; they have also become facilitators and motivators who provide space for students to explore their learning abilities and search for and process information independently (Hutapea et al., 2020). The rapid development of science requires individuals to continue to adapt to various aspects of life. To realize increasingly advanced education,

quality human resources (HR) are needed, and one way to achieve this is through increasing scientific literacy.

However, science literacy skills in Indonesia are currently still relatively low. Based on a survey, science skills and literacy in Indonesia are low, with an average score far from expectations (Wicaksono et al., 2020). However, Indonesia's ranking in the 2022 PISA test showed an increase, which illustrates the resilience and potential of the Indonesian education system (Avvisati & Ilizaliturri, 2023). Science literacy describes the level of an individual's understanding of science; scientifically literate people are expected to understand scientific knowledge and apply it in everyday life (Suparya et al., 2022). Science literacy includes the ability to read, write, and communicate about scientific issues and social problems related to culture, as well as an individual's understanding of relevant concepts in everyday life. In addition, science literacy also includes an understanding of the procedures used to develop new knowledge in science and technology (Wahyu et al., 2020).

According to Fuadi et al (2020), scientific literacy is an individual's capacity to apply knowledge to identify, construct, explain, and draw conclusions based on observations and scientific evidence to solve scientific challenges. According to this interpretation, scientific literacy is the capacity to comprehend and use scientific data for problem-solving. Science learning includes planning and learning strategies to create a learning environment to improve students' scientific literacy (Pertwi et al., 2019). Essential things in scientific literacy include understanding theory, scientific attitudes, scientific stages, knowledge, and their application in everyday life. Scientific literacy also contributes to an individual's ability to understand science-related issues and apply scientific thinking in life as a critical-thinking citizen (Rohmaya, 2022). Scientific literacy skills are critical for students to understand the environment, health, economy, and the challenges of modern society that depend on technology and science.

Students with good scientific literacy can apply their knowledge to solve problems at the personal, social, and global levels. Scientific literacy includes understanding scientific concepts or facts learned in school and relating them to natural phenomena in everyday life. This shows that scientific literacy is different from learning outcomes, which emphasize the achievement of learning objectives. Science learning aims to support the development of students' scientific literacy skills (Sutrisna, 2021).

Differentiated learning is a popular approach to improving students' literacy and numeracy. In the Independent Curriculum, differentiated learning is adapted to students' character, interests, needs, styles, and learning profiles because each individual has different abilities, experiences, interests, talents, and learning styles (Sutama et al., 2022). Differentiated learning aims to adapt classroom learning to the learning needs of each individual (Abidin et al., 2021). However, at SMP Santo Agustinus Langa, the low scientific literacy skills of students are caused by learning methods that are less interactive and do not attract students' interest. Teachers tend to use monotonous lecture methods to make students feel bored and not motivated to learn science. As a result, students' scientific literacy does not develop optimally.

Given these issues, literacy plays a significant role in education, particularly in science education, which emphasizes the need for a scientific approach to learning, the production of scientific results through various experiments and research, and the development of a scientific mindset. According to the study's findings, instructors' lack of originality when utilizing instructional materials contributes to the poor level of science literacy at SMP Santo Agustinus Langa, both manual and digital, resulting in low student abilities in science literacy. Therefore, to overcome these problems, researchers found a solution by developing science learning media based on science literacy on series and parallel circuit materials to improve student understanding.

The key difference between this study and previous research is that this study explicitly examines students' scientific literacy skills through science learning media focused on series and parallel circuit materials. This research aims to contribute to learning media development in science education, particularly in understanding the impact of science literacy-based learning media on enhancing students' scientific literacy skills. A similarity with prior studies is that both explore students' scientific literacy within the science learning process. For instance, Warmadewi (2022) analyzed the application of a guided inquiry learning model based on science literacy in science education to evaluate its effectiveness in science material delivery (Warmadewi, 2022). Similarly, Irsan (2021) research, titled The Implementation of Science Literacy in Science Learning in Elementary Schools, focuses on integrating science literacy to strengthen students' character education (Irsan, 2021)."

This study sought to ascertain how science learning materials, particularly those about series and parallel circuits, affected students' scientific literacy. One of the scientific study elements that students need to become proficient in is series and parallel circuits. The urgency and issues present in classrooms are the foundation for creating scientific literacy-based science learning materials. The issue at SMP Santo Agustinus is that students' scientific literacy is low since there is a dearth of educational materials designed to help the learning process go well. The researcher created educational materials based on scientific literacy about series and parallel circuits in response to these issues that can be used as a source of student learning.

B. Method

The study uses a Research and Development (R&D) approach based on the research problem. Using the five steps of the ADDIE development model—analysis, design, development, implementation, and evaluation—this study focuses on creating science learning materials for series and parallel circuits grounded in scientific literacy. The research subjects for the study were a group of eighth-grade pupils at SMP Santo Agustinus Langa. The study focuses on scientific literacy-based science learning resources for series and parallel circuits. Data collection methods include validation sheets and questionnaires assessing the responses of both teachers and students.

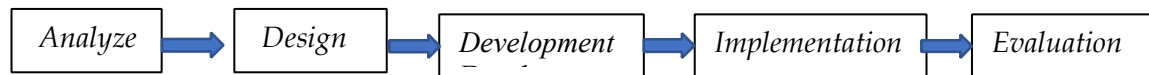


Figure 1. ADDIE Model Development Flow

The following are the stages in the research:

1. **Analysis Stage:** At this stage, an analysis of the material is carried out, which includes learning achievements, learning objectives, and the flow of learning objectives according to the school curriculum. Needs analysis is carried out to determine the goals of developing learning media, especially on series and parallel circuit material.
2. **Design Stage:** Researchers design a concept for learning media based on learning objectives. At this stage, teaching media products for series and parallel circuit materials are intended to align with the teaching materials.
3. **Development Stage:** Learning media products are developed and validated by three experts, namely media experts, material experts, and language experts, to ensure their validity.
4. **Implementation Stage:** At this stage, the product is tested on students and teachers as prospective users. Their responses are collected through a questionnaire to evaluate the product's practicality.
5. **Evaluation Stage:** The evaluation is conducted based on the feasibility test results from the validator and the practicality test feedback from teachers and students. The purpose is to assess the validity and practicality of the product and determine whether it is suitable for use in science instruction.

Through this stage, the research aims to produce valid, practical, and effective science literacy-based science learning media to improve students' understanding of series and parallel circuit materials.

The formula for calculating validity:

$$P = \frac{F}{n} \times 100\%$$

Description:

P: Percentage

n: Highest Score

F: Total score of data collected

The practicality criteria of the learning media to be used can be seen in Table 1 below.

Table 1. Practicality Criteria

| Final score | Criteria |
|-------------|-----------------|
| 0%-20% | Not practical |
| 21%-40% | Less practical |
| 41%-60% | Quite practical |

| Final score | Criteria |
|-------------|----------------|
| 61%-80% | Practical |
| 81%-100% | Very practical |

After the data was analyzed using the previously developed percentage formula, the results showed the quality of the learning media. The learning media was declared to meet the criteria based on the validity category, as shown in Table 2 below:

Table 2. Percentage and Category of Media Eligibility

| No | Percentage | Category of eligibility |
|----|------------|-------------------------|
| 1 | 76%-100% | Very eligible |
| 2 | 51%-75% | Eligible |
| 3 | 26%-50% | Not eligible |
| 4 | 0%-25% | Very uneligible |

In addition to using the percentage and category of media feasibility, media development is assessed through a practicality test using student and teacher response questionnaires. The categories of teacher and student responses can be seen in Table 3 below:

Table 3. Percentage and Categories of Teacher and Student Responses

| No | Percentage | Eligibility category |
|----|------------|----------------------|
| 1 | 81%-100% | Very good |
| 2 | 61%-80% | Good |
| 3 | 41%-60% | Quite good |
| 4 | 21%-40% | Not good |
| 5 | 0%-20% | Very not good |

C. Result and Discussion


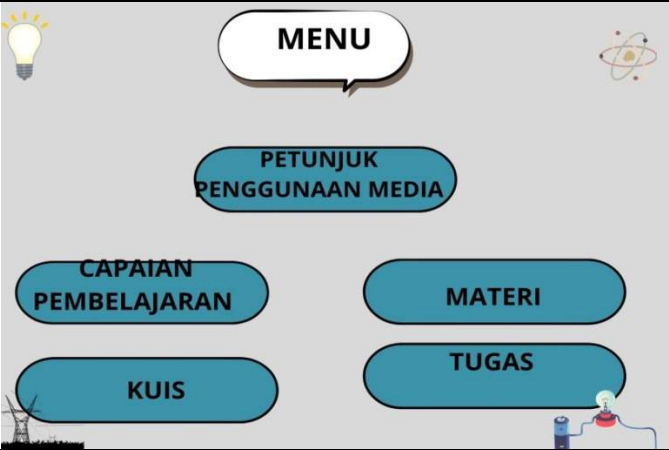
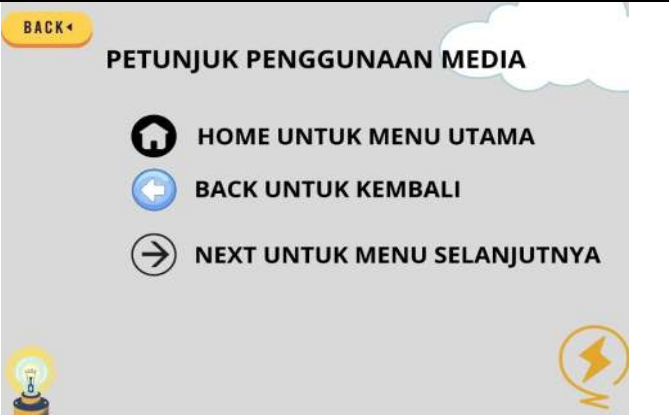
Result

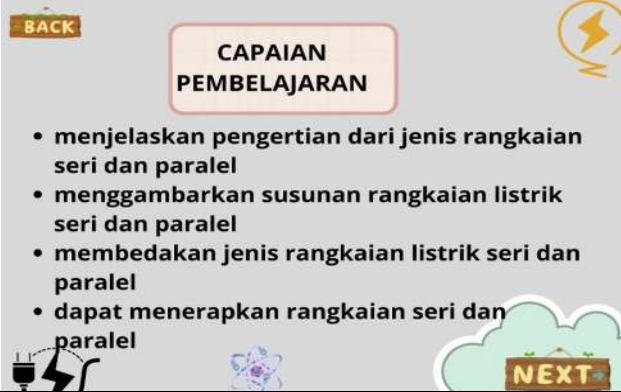
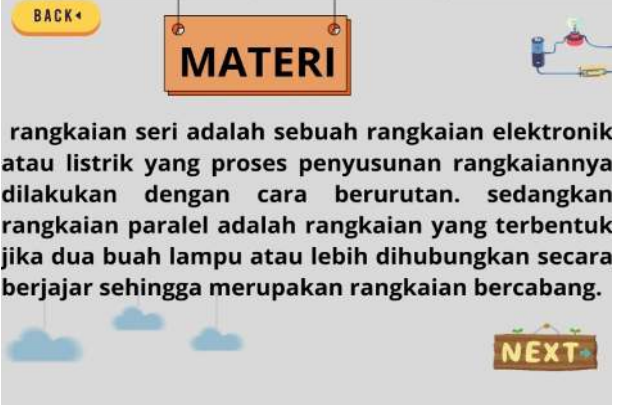
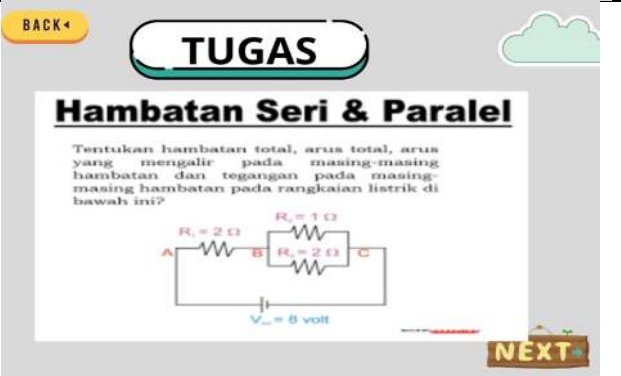
This research produces science learning media based on scientific literacy on series and parallel circuit material. The purpose of developing this media is to create a more practical, effective, and efficient science learning environment while improving students' scientific literacy skills at SMP Santo Agustinus Langa. The process of analyzing and developing this learning media is based on the stages of the ADDIE model, as follows.

Analysis Stage: Researchers conducted material and needs analysis. Material analysis focused on developing core and essential competencies by the school curriculum, especially on series and parallel circuit material. Needs analysis was conducted through observation and interviews with teachers and students. The study showed that the available learning materials were limited to textbooks, so students had difficulty understanding the material. To overcome this problem, researchers developed science learning media based on the scientific literacy of the material. **Design Stage:** Researchers designed learning media by adjusting series and parallel circuit material to ensure its effectiveness and appeal. Media

design includes visual elements, such as images and text, to increase students' interest in learning. Development Stage: Researchers developed products by improving and perfecting series and parallel circuit material based on research that has been conducted. The process of developing science learning media aims to ensure that the media produced is by students' needs and is effective for learning. The learning media that has been designed for series and parallel circuit material can be seen in the following table:

Table 4. Science Learning Media for Series and Parallel Circuit Material

| No | Display | Display function |
|----|--|--|
| 1. |  | <p>The cover contains the title of the material intended for junior high school students.</p> |
| 2. |  | <p>The main menu display consists of five menus: instructions for using media, learning outcomes, materials, assignments, and quizzes.</p> |
| 3. |  | <p>The display of instructions for using the media explains the features available in this learning media.</p> |

| No | Display | Display function |
|----|---|--|
| 4. |  | The learning achievement menu display contains the learning achievements that students will achieve in the series and parallel circuit material. |
| 5. |  | Display of the material menu containing series and parallel circuit material |
| 6. |  | The task display contains tasks that students will complete related to series and parallel circuit material. |

After developing the science learning media based on scientific literacy for series and parallel circuit materials, the next step is to validate the media created by experts in media, material, and language. The results of the media validation are presented in the following table:

Table 5. Expert Validation Results

| Aspect | Score | Percentage | Category |
|--------------------------------|-------|------------|------------|
| Media expert validation | | | |
| Appearance | 40 | 90% | Very valid |
| Writing | 15 | 80% | Very valid |

| Aspect | Score | Percentage | Category |
|-----------------------------------|-------|--------------|-------------------|
| Media expert validation | | | |
| Programming | 18 | 80% | Very valid |
| Average | | 83,3% | Very valid |
| Material expert validation | | | |
| Material | 40 | 80% | Very worthy |
| Language | 10 | 80,5% | Very worthy |
| Learning | 15 | 90% | Very worthy |
| Scientific literacy | 20 | 83,3% | Very worthy |
| average | | 83,45% | Very worthy |

The validation results from media experts, shown in Table 5, indicate that the science learning media based on scientific literacy for series and parallel circuit materials fall into the 'very valid' category. The validation by media experts covers several aspects: display (90%), writing (80%), and programming (80%), with an overall average of 83.3%. Following the media expert validation, a validation test was conducted by material experts. The results of this validation show that the series and parallel circuit materials are highly suitable for application in teaching. The validation by material experts yielded the following percentages: material aspect (80%), language aspect (80.5%), learning aspect (90%), and science literacy aspect (83.3%), with an average of 83.45%. The high validation scores from the material experts demonstrate that the science learning media based on scientific literacy for series and parallel circuits offers high-quality information and is well-suited for use in science education.

In addition to validation tests by media experts and material experts, validation tests were also conducted by language experts. The language expert validation test results showed several aspects with the following scores: conformity with the Indonesian language rules at 95%, conformity with student development at 80%, straightforwardness at 85%, and an average percentage score of 90%. The high validation results by language experts indicate that science learning media based on scientific literacy on the material of series and parallel circuits have valid language quality.

Table 6. Results of Validation by Language Experts

| No | Linguist | Score Percentage | Category |
|----|---|------------------|------------|
| 1. | Conformity with Indonesian language rules | 95% | Very valid |
| 2. | Suitability to the level of development of students | 80% | Very valid |
| 3. | Straightforwardness | 86,6% | Very valid |
| 4. | Average | 90% | Very valid |

The next step is product implementation, which includes product evaluation. If the evaluation results show that the product is less effective, then revisions are made to improve product quality. To find out the responses of teachers and students to the media developed, researchers used teacher and student response questionnaires. The results of the analysis of

teacher and student responses regarding the practicality of this science learning media can be seen in Table 7 below:

Table 7. Data from Teacher and Student Response Questionnaires

| Assessment Aspect | Score | Category |
|--|-------|----------------|
| Teacher response questionnaire | | |
| General view of media | 100% | Very practical |
| Instructions for using the media | 80% | Practical |
| Ease of Teachers in the process of delivering material | 80% | Practical |
| Ease of Teachers in the evaluation process | 100% | Very practical |
| Student response questionnaire | | |
| General view of the media | 80% | Practical |
| Material presented | 80% | Practical |
| Satisfaction in the learning process | 80% | Practical |

The science learning materials based on scientific literacy on the applied material of series and parallel circuits fall into the convenient category, according to the results of the teacher response questionnaire in Table 7. Aspects of the assessment that were assessed include the attractiveness of the media display, which received a score of 100% and falls under the efficient criteria; the ease of understanding instructions for using the media, which received a score of 80% and falls under the practical criteria; and the convenience of the teacher in the learning evaluation process, which received a score of 100% and falls under the efficient criteria. Teachers' positive answers show that the content in the science learning media based on scientific literacy on the material of series and parallel circuits has proven to be very practical, both in terms of the accuracy of the material and the level of understanding.

In addition to the teacher response questionnaire, there is data from the student response questionnaire, which shows that the results fall into the practical category. Related to learning outcomes, student responses cover several aspects, namely: the element of the images presented with a score of 80%, which falls into the practical category; the aspect of the material presented with a score of 80%, which also falls into the proper category; and satisfaction in the learning process which reaches a score of 80%, with a practical category. The positive response from students to this media shows that the science literacy-based learning media content on the series and parallel circuit material has proven effective in helping students understand the material.

Discussion

The creation of scientific literacy-based science learning resources for series and parallel circuits is efficient and highly effective in improving students' scientific literacy, according to research done at SMP Santo Agustinus Langa. The developed media's high validity, usefulness, and efficacy scores make this clear. Validity is essential to increase the efficacy of data collection throughout the media production process. This instructional

resource was created primarily to help students better comprehend the principles of series and parallel circuits.

The validation results from media experts showed a score of 83.3%, placing it in the 'very feasible' category. Validation by material experts yielded a score of 83.45%. Additionally, teacher feedback resulted in a score of 93.25%, while student responses reached 86.78%. Using science learning media based on scientific literacy for series and parallel circuit materials has enhanced student understanding at SMP Santo Agustinus Langa. This learning media is crucial in helping teachers improve students' comprehension of the material.

The developed learning media aims to increase students' participation in science learning. Interactive interactive media can encourage students' direct involvement, making them more active. This media also provides a technology learning experience that is relevant to the development of the current digital era. In addition, students' responses to this learning media positively impact their interest in learning. Science learning media based on scientific literacy on series and parallel circuit material can create a more enjoyable learning atmosphere, increasing students' enthusiasm for learning. This study differs from other research in that it concentrates on building science education materials to enhance students' scientific literacy, particularly regarding series and parallel circuit content. The study's findings demonstrated that the creation of this educational resource was successful in raising students' motivation for learning, particularly in science courses, and in enhancing their comprehension of the concepts of series and parallel circuits.

D. Conclusion

Creating science learning resources based on scientific literacy for series and parallel circuits was successful and advantageous for SMP Santo Agustinus Langa students. Students' scientific literacy has improved considerably due to the viability of the developed media. The science learning media for series and parallel circuits is legitimate and practical for use in the learning process, according to validation results from media experts, material experts, and language experts, as well as input from educators and students.

This research aims to discover the benefits of developing learning media based on scientific literacy on series and parallel circuit material for students at SMP Santo Agustinus Langa. In addition, researchers can gain new insights into the learning process by developing learning media and must be creative in creating an effective and efficient learning atmosphere for students. The success of a learning process must be supported by various methods and learning media prepared by a teacher.

Suggestions for further researchers are that conducting research must be well planned so that the research process is not disturbed by the schedule of activities held at the school where the research is conducted. How to enhance pupils' comprehension To improve students' understanding of scientific literacy, various methods can be used in addition to developing learning media. In addition, growing research by focusing on research objectives and themes, developing learning methods that can make students actively learn and

creating learning media to improve student concentration.

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