

Development of Carabisatulus Chatbot Learning Media Based on Environment to Improve Science Learning Outcomes

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Abstract: According to the results of observations conducted by researchers at SD Negeri Bakalrejo 1, problems were found in the form of limited learning media and student learning outcomes which were still in the low category in science subject content. Based on this problem, the researcher aims to develop, test the feasibility and test the effectiveness of the environment-based Carabisatulus chatbot learning media on the learning outcomes of class V students at SD Negeri Bakalrejo 1, especially on science lesson content. The type of research used is research and development (RnD) using the Borg and Gall model which was modified into 9 stages. Data collection through observation, interviews, questionnaires and documentation. The results of the product assessment are validation of learning media carried out by experts in the field of materials and media with a percentage of 92.5% and 95% with a classification of "very feasible". Media effectiveness using the T test obtained a significance value of 0.000. The results of the N-gain calculation found a value of 0.6641 with "medium" criteria. So the environment-based Carabisatulus chatbot learning media can be said to be very feasible and effective to apply in improving student learning outcomes. Researchers recommend always developing digital-based learning media and maximizing existing applications to encourage educational progress in Indonesia.

Keywords: Chatbots; Environmental science; Learning outcomes; Media development

Introduction

Based on the preamble to the 1945 Constitution, in the fourth paragraph there is one of the mandates, namely to make the nation's life intelligent. From there, we know that education is an important aspect that can improve the quality of life (Setiawan et al., 2023). Education is a significant factor for the nation's generation because it can improve the quality of human resources (Parinduri et al., 2022). Efforts to realize targeted education in accordance with national education goals require an educational curriculum.

The Ministry of Education and Culture launched a new curriculum, namely the independent curriculum, and made it the national curriculum (Angga et al., 2022). In the regulations of Law Number 20 of 2003 concerning

the National Education System (Adiwijaya, 2022) there is article 37 paragraph 1 which requires the content of natural science lessons at the primary and secondary education levels. Natural Sciences is a scientific discipline that studies living things and non-living things in the universe. Science studies the natural environment (I. R. Sari et al., 2019) and focuses on mastering concepts, using procedures and logical thinking so that students are able to draw conclusions (Kurniawan & Astalini, 2018; Sari et al., 2022). Science subjects essentially have four main elements, namely product, process, application and attitude (Lase & Lase, 2020). This is in line with research (Isdaryanti et al., 2023) that science focuses on aspects of science as a product, process skills, attitudes, and science as technology. These elements are very closely related to the

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surrounding environment. Students through science learning are generally expected to be able to arouse students' interest and positive attitudes towards the natural environment and the use of technology today.

Digitalization technology is now increasingly rapid and involves various fields, such as banking, retail, urban, energy, transportation, education, publishing, media and health (Bhutani & Y, 2015; Buck et al., 2023; Cai et al., 2021; S. Li et al., 2023; X. Li et al., 2022; Ye et al., 2021). Digitalization also has a good impact on the education sector. There is a close connection between science learning and the development of digital technology (Hidayat et al., 2023). As technology advances, it is easier for people to get information via the internet (Aeni et al., 2022). The rapid dissemination of information will increase knowledge, especially for students who are involved in learning (Ahmed et al., 2021). Therefore, education should be able to utilize technology for the teaching and learning process and evaluation (Abba et al., 2020; Herman et al., 2022).

The education model in the 21st century must be adapted to the interests of the alpha generation based on digital technology to understand subject matter more easily. Learning media can be in the form of visual and audio-visual media and can be adjusted to achieve learning objectives in the teaching and learning process optimally (Kandia et al., 2023). Learning media can also overcome boredom when teaching and learning takes place (Mulyanto & Mustadi, 2023).

According to the results of observations at SD Negeri Bakalrejo 1, problems were found related to the limited learning media used by teachers. Usually teachers only use concrete image media and lecture methods. Based on the data obtained by the researchers, it was found that in terms of light material and its properties, the average value of students' daily tests was 72.21 and as many as 19 of the 43 students had not completed it considering that the standard minimum of value applied was 70. The low learning outcomes in science subjects were caused by the large majority Students consider science to be difficult, so the grades they get are not optimal and there is a need for more learning media in teaching and learning activities. Apart from that, in the material on the properties of light, there is a lot of material discussion related to implementation in the surrounding environment. This is what causes students to still feel confused in distinguishing between theory and practice in the surrounding environment.

The solution to overcome existing problems is by implementing appropriate methods and using learning media. In technological developments, chatbots can be used as a learning medium. Currently, the use of chatbots has been applied in various fields and is beneficial for humans, including in the field of education

(Zulkarnain et al., 2020). In the world of education, chatbots are used to answer questions related to material and act as assistants and guides for students and tutors (Touimi et al., 2020). According to the opinion of Sekarwati et al. (2021), it is explained that chatbots are dialogue conversations that use the internet and utilize websites. Chatbot learning media can improve student learning outcomes (Rosmiati et al., 2023). This encouraged researchers to develop the digital learning media chatbot Carabisatulus (Light can be interpreted, can be refracted, can be reflected, propagates straightly, and penetrates clear objects) with the help of environment-based Smojo.Ai which is hoped to make it easier for students to understand the process of light and its properties. With the help of the Smojo.Ai platform, you can create interactive, creative and interesting learning media that is easily accessible on various website browsers (Ardiansyah, 2023). Apart from that, the interactive learning media of the Carabisatulus chatbot can increase the effectiveness and learning outcomes of science in class V. However, there is also a weakness in the Carabisatulus chatbot, namely limitations in the range of questions and answers available (Fryer et al., 2019). Apart from that, knowledge about the conditions of the surrounding environment and several implementations in our surrounding environment also needs to be known starting from elementary school age children (Marinda, 2020).

This research is also strengthened by several relevant previous studies, including research conducted by Haristiani et al. (2022) which revealed that the media was stated to be interesting and recommended for use by vocational school students to increase learning independence. Based on research (Raihan et al., 2023), the presentation feasibility results were 100% for teaching materials experts, 87.5% for language experts, and 90.6% for media experts, with an average pretest of 56.8 and posttest of 87.5. Then research by Haristiani & Rifai (2021) applied the ADDIE model and interesting and innovative media categories to support Japanese language learning. Furthermore, research Parina et al. (2022) shows that chatbots help students to be more interactive and able to adapt to today's digital environment. The development of chatbot media was carried out by Abilowo et al. (2020), revealing an accuracy level of up to 90% as Javanese language teaching material. Research by Sarosa et al. (2020), the test results for the effectiveness of chatbots as English teaching materials were 97.5%. Research conducted by Muhammad & Adila (2021), states that chatbots are related to English language learning and function well as learning media with 100% accuracy.

Based on this background, the researcher will discuss three problem formulations, including: (1) the

design of the Carabisatulus chatbot learning media, (2) the feasibility of the Carabisatulus chatbot learning media, and (3) the effectiveness of the environment-based Carabisatulus chatbot learning media to improve science learning outcomes fifth grade student at SD Negeri Bakalrejo 1.

Method

This research uses a quantitative approach based on the philosophy of positivism, and can be used to evaluate the discovery of new products and the development of existing products. This quantitative approach uses several research instruments to test hypotheses determined based on quantitative data analysis and data collection on certain populations or samples (Sugiyono, 2021).

This research uses a research and development model, on a product that is developed and then tested for effectiveness (Sugiyono, 2021). According to Borg and Gall modified by Yuliani & Banjarnahor (2021) development research is a process for developing and validating educational products. This research and development applies the Borg and Gall model which is modified into 9 stages, namely Potential and Problems; Data Collection; Product Design; Product Validation; Design Revision; Small Scale Trial; Product Revision; Large Scale Trial; and Final Product Revision (Zulaichah et al., 2021).

Researchers created a product in the form of an environment-based chatbot carabisatulus (Light can be

interpreted, refracted, reflected, travels straight and penetrates clear objects) for use in the learning process. At the potential and problem stage, data collection stage, product design stage to create environmentally based Carabisatulus chatbot learning media. Data collection techniques were carried out using tests and non-tests. The test collection technique consists of giving an initial test before media treatment (pretest) and a test carried out at the end after media treatment (posttest) as a comparison to determine the increase in student learning outcomes in class V of SD Negeri Bakalrejo 1. There is a pretest and posttest to determine the results. more accurate before treatment and after treatment (Setiawan & Soniya, 2023). Meanwhile, non-test data collection used is interviews, observations, questionnaires and documentation. Observations were carried out on November 6 2023 to observe the learning process taking place in class and problems were found regarding the need for more understanding of light and its properties as well as the lack of use of learning media. The researcher conducted interviews with the school principal, namely Mr. Punidi, S.Pd. SD and the fifth grade teacher, namely Mrs. Rokhimah Rina Imawati, S.Pd. Distribution of questionnaires given to teachers and students to survey media needs and responses. Meanwhile, for media and material expert validation, there is also a media and material assessment questionnaire which includes benefits, technical use, appearance aspects, suitability of material, accuracy of teaching modules. At each stage of data collection, there is an assessment instrument created by the researcher which has previously been validated by the supervisor.

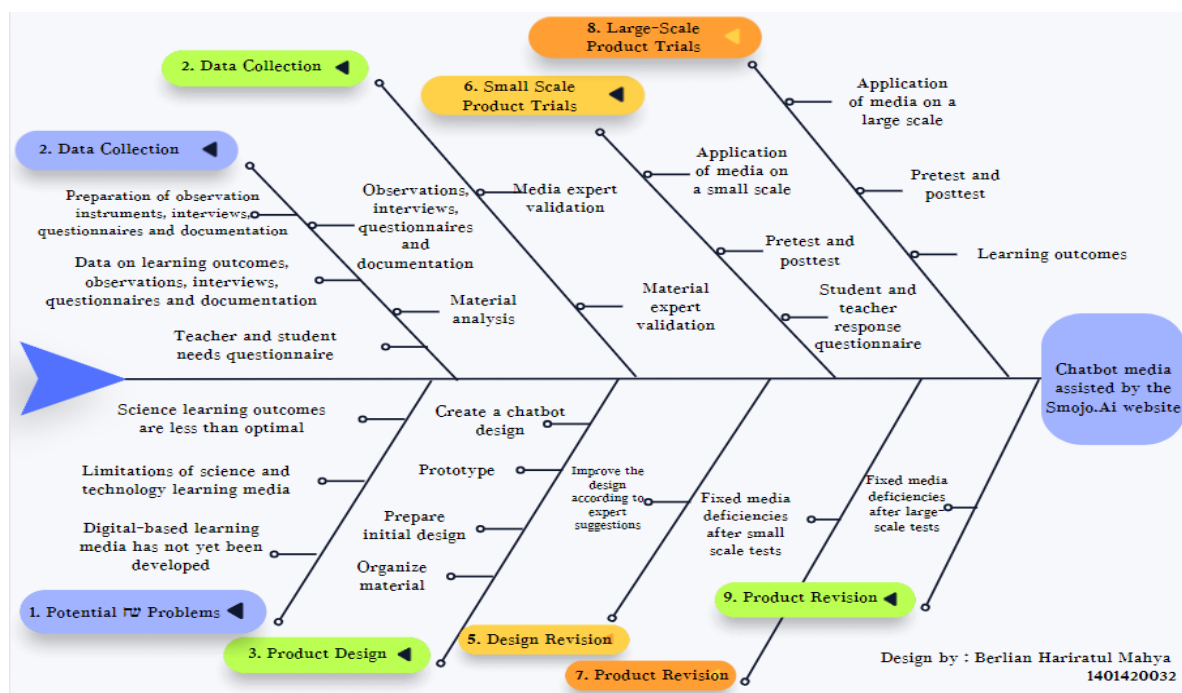


Figure 1. Research and Development Steps

Small-scale trials were carried out to obtain a qualitative evaluation of the chatbot media that had been designed from material expert validators and media experts and were carried out to see student responses regarding the design display test and test that the functions and buttons worked well according to the media that had been developed. The subjects of the small-scale trial were 6 fifth grade students at SD Negeri Bakalrejo 1. The large-scale trial was carried out to determine the effectiveness of the environmentally based Carabisatulus chatbot learning media in improving student learning outcomes. The subjects of the large-scale trial were 37 fifth grade students at SD Negeri Bakalrejo 1 with all members of the population involved using the saturated sampling technique carried out in this research. The large-scale trial uses a one group pretest-posttest design to compare conditions before and after treatment (Sugiyono, 2021). The large-scale trial design is presented in Table 1.

Table 1. One Group Pretest-Posttest design

Before Treatment	Treatment	After Treatment
O ₁	R	O ₂

Note:

- O₁ : Value Before Treatment of environment-based Carabisatulus chatbot learning media
- O₂ : Value After Treatment of environmentally based Carabisatulus chatbot learning media
- R : Application of environmentally based Carabisatulus chatbot learning media

Characteristics of chatbots developed using data analysis techniques using descriptive methods. Media feasibility is analyzed according to validation results by material experts and media experts using the following percentage Formula 1 (Sugiyono, 2021).

$$P = \frac{f}{N} \times 100 \% \tag{1}$$

Note :

- P : Percentage value
- F : Score obtained
- N : Maximum score

The resulting data percentages were then conventionalized based on the criteria of very feasible, feasible, quite feasible, and less feasible using the formula according to Aini & Wahyuni (2023), namely as follows Table 2.

Data analysis was carried out to determine the effect of using the environmentally based Carabisatulus chatbot media which was developed to improve student learning outcomes based on before and after implementation which was calculated using the gain index (Lestari & Yudhanegara, 2017).

Table 2. Product suitability assessment criteria

Percentage (%)	Criteria
76 - 100	Very worthy
51 - 75	Worthy
26 - 50	Decent enough
00 - 25	Not worth it

$$\text{Normal gain} = \frac{\text{postest Score} - \text{pretest Score}}{\text{max score} - \text{pretest}} \tag{2}$$

The calculation results are then categorized according to the following N-gain test results criteria (Lestari & Yudhanegara, 2017).

Table 3. N-gain Score interpretation criteria

Average Score	Criteria
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Medium
$0 \leq g \leq 0.3$	Low
$g \leq 0$	Failed

The independent variable in this research is the environment-based Carabisatulus chatbot learning media, while the dependent variable is improving grade V science learning outcomes at SD Negeri Bakalrejo 1.

Result and Discussion

The product produced in this research and development is the environmentally based Carabisatulus chatbot. The chatbot was developed using the Smojo.AI website which is accessed via the web using a laptop or Android. The media design is made to be attractive according to the needs of students and the materials in elementary schools. Several images and videos in the media support the material, such as how to do simple practical work related to the correct nature of light. The language used is also communicative and easy for students to understand.

The first step that researchers must take is to collect information on the potential and problems that exist at SD Negeri Bakalrejo 1 Demak Regency. Information gathering was carried out by observation, interviews, distributing questionnaires, and documentation. Based on the information obtained, there are several problems, namely, in science learning, teachers have not fully developed and implemented learning media, teachers refer more to teacher and student books that are already available, so the impact on students' science learning outcomes tends to be low. At the data collection stage, researchers collected various information related to product development, so that the resulting product was able to overcome the problems that existed at SD Negeri Bakalrejo 1 and was in accordance with the needs of teachers and students.

Product design is carried out based on the results of media needs questionnaire analysis for teachers and students. At this stage the researcher designs a learning media product that contains a combination of attractive chatbot displays. There is a suitable color combination equipped with a display menu that can be selected by the user in the form of understanding and properties of light, application of the properties of light, there is also a display in the form of video in the chatbot and a unique background. For material on the application of the properties of light, the researchers discussed further regarding its application in everyday life. For example, a pencil inserted into a glass is an example of the application of the refractive property of light. Then the event of the appearance of a rainbow, including the

application of light, can be explained and there are many other implementations that are added with simple practical videos. Carabisatulus chatbot media can be created via the website <https://smojo.ai/editor> and assisted with editing via Canva for a more attractive chatbot appearance, then the coding can be adjusted to the innovation of the creator, to look for coding references used, there are various websites that now provide coding codes. Learning media can be accessed via the following link <https://app.smojo.org/berlianmahya13/carabisatulus>. The display of the environmentally based Carabisatulus chatbot learning media can be seen in the Figure 2.

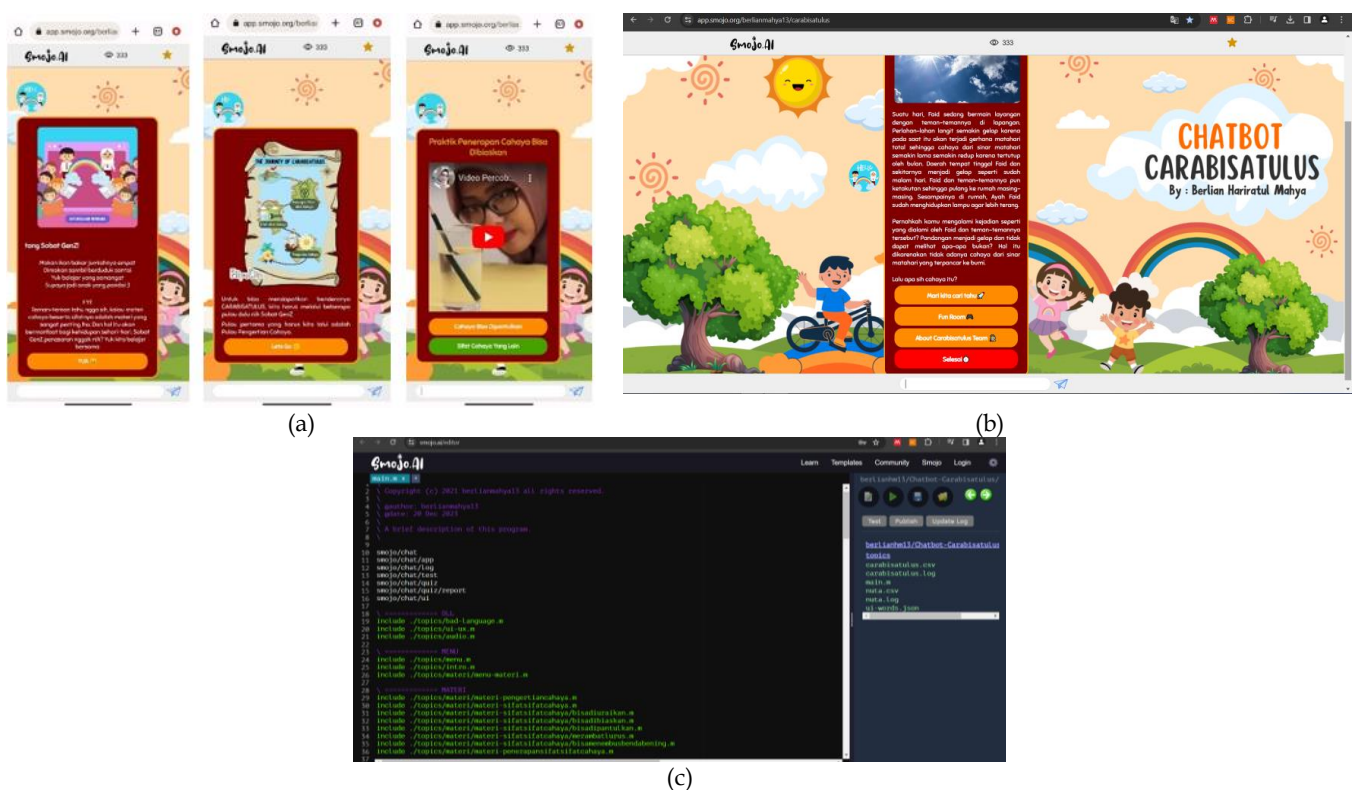


Figure 2. Display of Chatbot Media: (a) Chatbot display using Android; (b) Chatbot display using a laptop; and (c) Coding display during the Carabisatulus chatbot media creation stage

At the product validation stage, researchers tested the Carabisatulus chatbot media with the help of the Smojo.Ai website that had been created, with media experts and material experts. Based on assessments from media experts and material experts, the following results were obtained.

After assessment and validation from experts, media results were obtained which were said to be "very suitable" for use in the learning process. Several weaknesses were found in the product related to the appearance of the font in the guidebook which was still not attractive and had to be added with background

sound that was appropriate to the material, so that the product did not appear quiet. There is also the issue of adapting teaching modules to learning that is done twice and conforming to appropriate syntax and learning objectives. The weaknesses of the product are corrected to produce a product that is suitable for use.

Researchers conducted a concept understanding test using pretest and posttest questions for class V students. The pretest and posttest questions were made the same, totaling 40 multiple choice questions. The pretest questions are given before the learning media

treatment and the posttest is given after the learning media treatment.

Table 4. Product Validation Results

Validator	Score	Criteria
Material	92.50	Very worthy
Media	95.00	Very worthy
Average	93.75	Very worthy

Small-scale product trials were carried out on several class V students of SD Negeri Bakalrejo 1 Demak Regency to prove the effectiveness of the product to be developed. Product effectiveness testing is carried out using testing instruments so that complete data is obtained regarding the application of the product and used as material for improving chatbot media so that it meets applicable standards effectively. At this stage there are 6 students taken from the 2 top ranks, the 2 middle ranks, and the last 2 ranks, with the aim that the implementation of small-scale trials can run evenly and in balance. The small scale results obtained a score of 100%, indicating that the chatbot is very good and there are no criticisms or suggestions, so it can be used for large scale trials.

The eight trials were used on a large scale on class V students at SD Negeri Bakalrejo 1, Demak Regency, a total of 37 people to test the feasibility and effectiveness of the Carabisatulus chatbot learning media product assisted by the Smojo.Ai website that had been created. The results obtained were 2 out of 37 or 5% of students who said there were still designs that were considered less attractive. The following are the results of normality tests on small-scale and large-scale trials.

Table 6. T-test results Paired Differences

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Uper			
Pair 1	Pretest Posttest	-1.666.216	431.576	0.7095	-1.810.111	-1.522.322	-23.484	36	0.000

It can be seen in the table that sig (2-tailed) $0.000 < 0.05$ so it can be concluded that there is a significant difference between the pretest and posttest results in the large group. Next, test the increase in the average score (N-gain) by comparing the increase in the pretest and posttest scores calculated using gain index analysis. The results are as follows.

Based on the Table 7, it can be interpreted that the average student score has increased from both small-scale trials and large-scale trials with medium criteria after implementing the Carabisatulus chatbot learning media. The teacher response questionnaire reached 100% without any revisions or suggestions from the relevant class teachers.

Table 5. Normality Test Results

	Tests of Normality					
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	0.113	37	0.200*	0.970	37	0.401
Posttest	0.126	37	0.143	0.095	37	0.103

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The Table 5 shows the results of the normality test of pretest and posttest values using the Kolmogorov-Smirnova and Shapiro-Wilk tests assisted by the SPSS 25 application. The normality test criteria are said to be normal if the significance value is >0.05 so that the data is normally distributed. The normality test results above show a significance of >0.05 , namely in the Kolmogorov-Smirnova pretest the significance reaches 0.200 and the posttest value normalization test shows a significance of 0.143. Then, using Shapiro-Wilk, the significance results were 0.401 and 0.103, so the data was normally distributed.

Then test the effectiveness of the media using the t-test. The criteria for testing the paired sample t-test is if the sig value. (2-tailed) < 0.05 , then there is a significant difference between learning outcomes in pretest and posttest data. On the other hand, if the sig value. (2-tailed) >0.05 , so there is no significant difference between learning outcomes in pretest and posttest data. With the help of the SPSS 25 application, the t-test results were obtained as follows.

Table 7. Results of Small and Large Scale Trials

	N	Min	Max	Mean	Std. Deviation
NGain	6	-0.25	1.00	0.5581	0.45365
Valid N (listwise)	6				
NGain	37	0.40	1.00	0.6641	0.16235
Valid N (listwise)	37				

The environment-based Carabisatulus chatbot learning media was developed effectively after going

through the testing phase in small-scale and large-scale trials. Apart from being reviewed based on student learning outcomes, it is also reviewed based on the results of teacher response questionnaires and student response questionnaires to determine the success of the media being developed. This proves that the environmentally based Carabisatulus chatbot media has succeeded in helping students understand the material of light and its properties.

Conclusion

The results of research and discussions related to the development of Carabisatulus chatbot learning media based on environmental material to improve the learning outcomes of class V students at SD Negeri Bakalrejo 1 have been declared valid, practical and effective. The validity of the learning media developed obtained an average score of 93.75. Then, based on the effectiveness test, it reached $0.000 < 0.05$, so it can be concluded that there is a significant difference between the pretest and posttest results. And in the average increase test, the N-gain value was 0.5581 on a small scale and 0.6641 on a large scale in the medium category.

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Author Contributions

The contribution of the writers involved in preparing this scientific article consisted of Berlian Hariratul Mahya (Author 1) who acted as a researcher whose role was to make observations at one of the schools that was the subject of the research and write this scientific article. Mr. Deni Setiawan (Author 2) as supervisor who has guided, evaluated and directed the author in the preparation of this scientific article.

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Conflicts of Interest

The authors declare no conflict of interest

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