

Development of Website-Based Teaching Materials on the Solar System for Class V Elementary School Students

Submitted: Frans Aditia Wiguna¹, Dhian Dwi Nur Wenda², Detika Amelia Selan³
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Accepted: frans@unpkediri.ac.id¹; dhian.2nw@unpkediri.ac.id²;
January 17, 2024 Detikameliaselan06@gmail.com³
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January 31, 2024 Primary School Teacher Education, Faculty of Teacher Training and Education, Nusantara University PGRI Kediri ^{1,2,3}

Abstract: The aim of this research is to develop website-based teaching materials on the solar system for fifth grade elementary school students. This teaching material was developed as a learning resource in elementary science learning which was developed systematically and logically. The method in this research uses R&D by adapting the ADDIE development model with stages, namely: 1) Analysis, 2) Design, 3) Development, 4) Implementation, and 5) Evaluation. The location of this research was carried out at Emmaus Elementary School, Kediri Regency with a total of 25 test subjects. The data used to see the feasibility of the product that has been developed is product validity data, product practicality data, and product effectiveness data. The results of product validity tests carried out by material experts obtained an average value of 85%, while the validity results by design experts were 83%. The average product validity test result is 84% with valid criteria. The level of practicality and effectiveness of the teaching materials was carried out through extensive trials with the product practicality level obtaining an average score of 96% in the very practical category. Meanwhile, the results of the product effectiveness test can be seen from the comparison of the average value of classical student learning outcomes, namely 80 with a KKM of 75. Based on the comparison results, the average classical student learning outcomes are higher than the predetermined KKM, so the product can be declared effective for use in teaching. solar system material for fifth grade elementary school students.

Keywords: Teaching Materials, Websites, Solar System

PRELIMINARY

Education is a system that consists of various components and mutually support each other. One system that is very important in the implementation of education is the curriculum. Education cannot be carried out well without a curriculum as a reference in the implementation of education. Curriculum as a reference in developing learning materials and implementing programs that are prepared in a planned manner. The curriculum can be interpreted as a goal that must be achieved by students by receiving guidance from educators which is carried out in a programmed and systematic manner (Rusman, 2020).

In the era of digitalization, mechanical advances in technology affect the quality of education implementation. Where the education that has been implemented in Indonesia has undergone several curriculum improvements until now it uses a new curriculum, namely the Independent Learning Curriculum. The change in curriculum in Indonesia is caused by several factors, one of which is the development of science and technology. The curriculum must always change to suit the changing times. Even though the curriculum changes, the aim is none other than to improve the previous curriculum. According to Hadi (2022) the educational objectives contained in the curriculum include cognitive, affective and psychomotor aspects which as a whole must be taught to students. As an effort that can be made to develop student competence, various strategies, media and learning resources are needed that can support the effectiveness of learning (Firdian, F., & Maulana, I. T., 2018).

In the era of digitalization, mechanical advances in technology affect the quality of education implementation. Where the education that has been implemented in Indonesia has undergone several curriculum improvements until now it uses a new curriculum, namely the Independent Learning Curriculum. The change in curriculum in Indonesia is caused by several factors, one of which is the development of science and technology. The curriculum must always change to suit the changing times. Even though the curriculum changes, the aim is none other than to improve the previous curriculum. According to Hadi (2022), choosing the right learning strategies, resources and media will greatly influence the quality of learning carried out by teachers. In this case, it is very important, especially in learning at elementary school level. There are various subjects in education in elementary schools, some of which have abstract learning material. Because media and learning resources are needed that are able to facilitate the delivery of material so that it becomes more concrete. One of the abstract materials is the material about the solar system which is taught to fifth grade elementary school students. Material about the solar system according to Firdian, F., & Maulana, I. T. (2018) is one of the materials that is considered difficult by students so that appropriate teaching materials are needed to teach this material. The educational objectives contained in the curriculum include cognitive, affective and psychomotor aspects. as a whole must be taught to students. As an effort that can be made to develop student competence, various strategies, media and

learning resources are needed that can support the effectiveness of learning (Firdian, F., & Maulana, I. T., 2018).

Based on the results of observations made at Emmaus Elementary School during science and science learning on the solar system, several problems were also found. Problems here can occur through two aspects, namely problems seen by teachers and problems found in students. Problems that occur with teachers include the method used by teacher center-based teachers where learning is only carried out by providing explanations, asking questions and giving assignments as well as using teaching materials that only refer to one source, namely textbooks. The use of inappropriate learning methods reduces students' activeness in understanding solar system material. Apart from that, the learning resources used by teachers are less varied, only centered on textbooks, teachers have not used learning resources that are relevant to solar system material. The assignments given are also less challenging for students, the teacher only gives assignments in the form of test questions, there are no assignments that can motivate or challenge students to learn.

Apart from problems from teachers, there are also problems from students which can be obtained from observations. The problem experienced by students is that students' motivation or enthusiasm is less than optimal in participating in learning. This can be seen from when learning, many students pay less attention to the teacher in delivering the material. Apart from less than optimal student motivation, learning activities also affect the learning process, making students less concentrated in learning. Observation results also show that teachers have not used teaching materials that suit student characteristics. Teachers still use teaching materials in the form of printed books provided by the school. This makes students bored or not paying attention, resulting in less than optimal student learning outcomes which can be seen from the results of the documentation that has been carried out. Of the 25 students, only 19 students completed the KKM, 6 students' scores were still below the KKM. This is proven by the results of document analysis that researchers have carried out on solar system material.

Apart from making observations, in this research the researcher also conducted interviews with teachers in the fifth grade science and science class at Emmaus Elementary School, Kediri Regency. The interview was conducted after the teacher carried out science learning activities on the solar system material. Based on the results

of the interviews conducted, information was found that students still had difficulty understanding the concepts of the material being taught. Apart from that, students are also less able to solve problems in the material presented by the teacher. From the interview results, information was also obtained about student characteristics, namely that students prefer to learn using technology-based teaching materials, in this case learning resources that use the internet or computers. The fifth grade teacher also informed that students needed reference material that could be studied at home.

Based on the problem analysis that has been carried out, solutions are needed to overcome problems that occur in learning activities, especially in the solar system material. This problem is a challenge that must be resolved immediately. The solution taken to overcome this problem is by developing website technology-based teaching materials. Website-based teaching materials will be developed in an interesting way so that they can increase student learning activities and improve student learning outcomes in studying science subjects on the solar system. Website-based teaching materials are teaching materials that contain a series of materials that are arranged systematically and packaged in the form of a website (Pratiwi, S. I., & Wahyudi, W., 2021). Teaching materials packaged in website form will make it easier for students to use or access whenever and wherever they are.

Website-based teaching materials are a technology that can be applied using computers where teaching materials do not only contain monotonous material but can be developed interestingly in the current era of information technology development. According to (Dian Akmalia, 2021), teaching materials combined with technology can become digital teaching materials that are more interesting and capable of generating new innovations so that they can attract students' attention in learning. Meanwhile, according to Susilowati, Y., (2019), a website is a collection of web pages and has several topics that are interrelated on one page and another. The material developed will be placed on a web server and can be accessed using the internet. Meanwhile, research conducted by Septiana and Wahyudi (2021) entitled development of website-based teaching materials has been proven to be effective in improving the quality of learning for fourth grade elementary school students.

The existence of quality teaching materials will be able to develop students' activeness in learning on their own (Hidayah & Priscylio, 2019). The use of inappropriate

teaching materials will have an impact on students so that they will experience difficulties in following the learning process, especially when the teacher teaches too quickly and is unclear. Seeing this, the use of appropriate teaching materials is one of the factors that determines the quality of the learning carried out. This is also in line with research by Sojayapan & Khlaisang (2020) that the use of teaching materials that integrate technology in the form of websites can make it easier for students to understand the material and increase student activity in learning. This research aims to develop website-based teaching materials on solar system material that are valid, practical and effective. Meanwhile, the benefit of this research is to make it easier for students to understand the material by studying independently or with teacher assistance. Apart from that, the teaching materials developed can make it easier for students to learn because they can be done in the classroom or outside the classroom.

METHOD

Methodologically, the method used in this research is Research and Development (R&D). One of the characteristics of R&D research is that there are products developed through research and development activities. The product being developed will then be tested for its level of feasibility through trial activities. Meanwhile, the development model used is the ADDIE model. This model consists of 5 stages including: Analysis, Design, Development, Implementation, and Evaluation (Rayanto & Sugianti, 2020). The ADDIE development model is very suitable for use in preparing learning because the development used is very simple, systematic and easy to understand so that its implementation is very easy. To make it easier to understand, a systematic explanation regarding the development flow of this research can be seen in Figure 1 below:

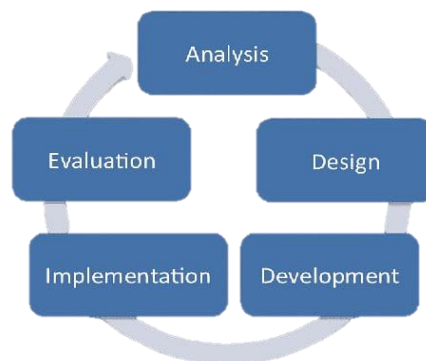


Figure 1. Stages of the ADDIE Development Model

The stages of the ADDIE development model in this research and development can be described as follows: 1) Analysis stage, activities at this stage are carried out to obtain information related to the teaching materials that teachers will use in carrying out learning. 2) Design, at the next design stage, designing teaching materials which includes making flow charts, storyboards, then determining the CP and TP which are used as a reference in making teaching materials. Next, arrange the learning materials that will be used, create questions, and determine the layout. 3) Development, this stage is the development stage where a website-based digital teaching material product is produced, then validated by design experts and material experts. 4) Implementation, the implementation stage is the stage where website-based teaching material products are tested which have been revised based on validation by material and design experts. 5) Evaluation, at this evaluation stage, evaluation and improvement activities will be carried out from the evaluation results at each development stage.

This research was conducted at Emmaus Elementary School (SD) located on Jalan Wilis No. 128, Wonosari Village, Pagu District, Kediri Regency. The test subjects used in this research were all 26 class V students at Emmaus Elementary School. This research activity was carried out in the odd semester of the 2023-2024 academic year. The types of data used in this research are data related to the results of needs analysis, product validity data, practicality data and product effectiveness data. Meanwhile, the instruments used to collect research data are observation instruments, interviews, documentation and questionnaires. A clear description of the types of data, instruments and respondents that will be used in this research and development can be seen in Table 1 below:

Table 1. Data Distribution and Types of Data Collection Instruments

No.	Data Type	Data Collection Instrument	Respondent
1.	Need Assesment	1. Observation: Observation guidelines 2. Interview: Interview guide 3. Documentation: A matter of evaluation 4. Questionnaire: Questionnaire	1. Class V Teacher and 2. Class V students at SDN Emmaus
2.	Product validity data	1. Validation questionnaire for elementary science material experts 2. Learning media expert validation questionnaire	1. Elementary science material expert lecturer 2. Learning media expert lecturer
3.	Product practicality data	1. Teacher response questionnaire 2. Student response questionnaire	3. Class V Teacher and 4. Class V students at SDN Emmaus
4.	Product effectiveness data	Evaluation or test questions	Fifth grade student at SDN Emmaus

The types of data in this research and development are qualitative descriptive data and quantitative data. Descriptive data is obtained based on the results of responses which include input and suggestions by validators. Quantitative data can be in the form of numbers that indicate a level of appropriateness of teaching materials. The data that has been collected will then be analyzed descriptively and quantitatively to determine the level of product validity, practicality and product effectiveness. Clearly the formula that will be used to determine the level of validity, practicality and effectiveness of the product being developed is as follows.

A. Product Validity Data

Analysis of product validity data in research and development is used to determine the level of product validity before it is used in limited and wide scale trials. The formula that will be used to test product validity in this research and development is as follows:

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

Information:

P = Value of expert validation results (%)

n = Total validation score

N = Maximum score from validation results

The score obtained from the product validity analysis results will be converted into the product validity criteria table. The product validity criteria can be seen in Table 2 below:

Tabel 2 Product Validity Criteria

No	Mark (%)	Criteria
1	90—100	Very Valid
2	75—89	Valid
3	60—74	Less Valid
4	45—59	Invalid

(Source: Ministry of Education and Culture, 2013 with modifications)

After the validation process has been carried out, if the results obtained have reached a score of 75% then the website-based science teaching material development product that has been prepared can be developed further.

B. Practicality Data

After the product is declared valid, the next activity will be to analyze data related to the practicality of the product before it is used in limited and wide scale trials. As for the product practicality analysis, the following formula will be used:

$$\text{Practicality Level} = \frac{\text{the score obtained}}{\text{highest score}} \times 100\%$$

The score obtained from the product practicality analysis will be converted into the product practicality criteria table. The product practicality criteria can be seen in Table 2 follows:

Tabel 3 Product Practicality Criteria

No	Mark (%)	Criteria
1	90—100	Very Practical
2	75—89	Practical
3	60—74	Less Practical
4	45—59	Impractical

(Source: Ministry of Education and Culture, 2013 with modifications)

C. Effectiveness Data

After the product is declared practical and valid based on expert assessment, the next activity will be to analyze data on the product's effectiveness based on limited-scale and wide-scale tests. To determine the effectiveness of the product in this research, a comparison will be used between student learning outcomes after being taught using a product developed with a KKM that has been determined by SDN Emmaus, namely 75. The product in this research can be said to be effective if the average value of student learning outcomes is classically higher. the same size as KKM.

RESULTS AND DISCUSSION

The development of this website-based teaching material product was carried out through several stages, including preliminary studies, product development, expert validation, practicality testing and effectiveness testing. The results of each of these stages can be explained as follows.

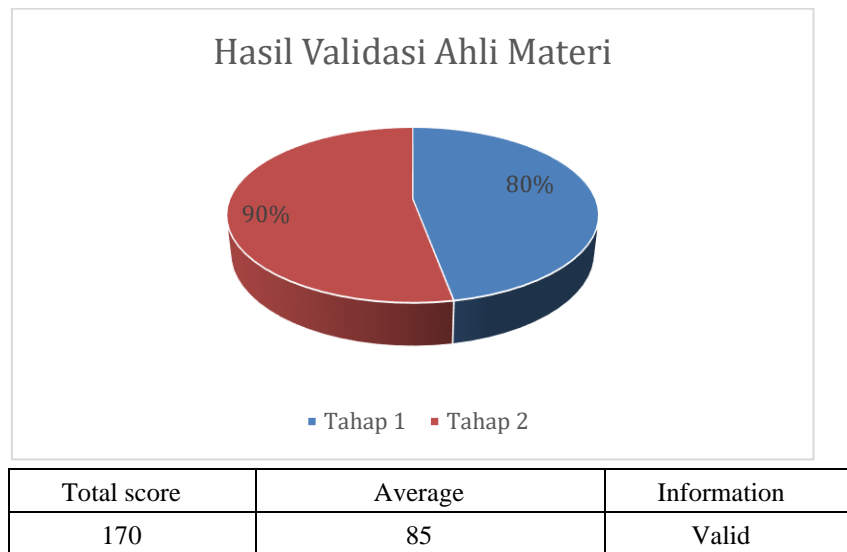
1. Expert Validation Stage

Based on the results of the needs analysis carried out by researchers, data was obtained regarding problems from teachers and students in the learning process. The problems found were related to the learning resources used which only focused on textbooks, teachers had not used learning resources that were relevant to the material being taught. This has an impact on learning activities that do not attract students' attention. Apart from that, one of the problems faced by students is the lack of motivation and enthusiasm for learning, students who are less than optimal in participating in learning because the learning resources used are less interesting so students feel bored. Based on the initial needs questionnaire, it was given to 25 students, there were 15 students who were not interested in learning using textbooks. Seeing this problem, the aim of this research is to develop website-based teaching materials that can increase student learning activities and make it easier for students to understand the material being taught. Apart from that, the results of a questionnaire given to 25 students showed that 20 students liked learning using technology. Based on this data, it is necessary to develop website-based teaching materials on the solar system for fifth grade elementary school students.

Website-based teaching material products that have been developed will be validated to see the validity of the product before field trials are carried out. Product suitability will be validated by two validator experts. The explanation of the expert validation test results can be explained as follows:

a. Material expert validation stage

Product testing was carried out by experts by compiling ten statements, each assessed with a score range of 1 to 5. Based on validation results from elementary school science material experts, this website-based teaching material achieved a total score of 40 out of a maximum score of 45, with an average score of 80%, the category is "Valid". After revision, in the second stage, this product achieved a total score of 43 out of 45, with an average score of 90%, falling into the "Very Valid" category. The average validation results from material experts at stages 1 and 2 show an average of 85%, also included in the "Valid" category. The results of validation from material experts can be seen in the following pie chart:



Gambar 2. Material Expert Validation Result Diagram

b. Design expert validation stage

The product validation process by design experts involves 9 statements with a score range between 1 and 5 for each statement. In the initial validation stage, this website-based teaching material obtained a total score of 28 out of 40, with an average score of 75%, classified as "Valid". After validation, this product was revised and then went through stage 2 validation, achieving a total score of 38 out of 40, with an average score of 91%, falling into the "Very Valid" category. Through an assessment of the average validation results of design experts at stages 1 and 2. The average score of validation results from learning design experts obtained a score of 83%, in the "Valid" category..

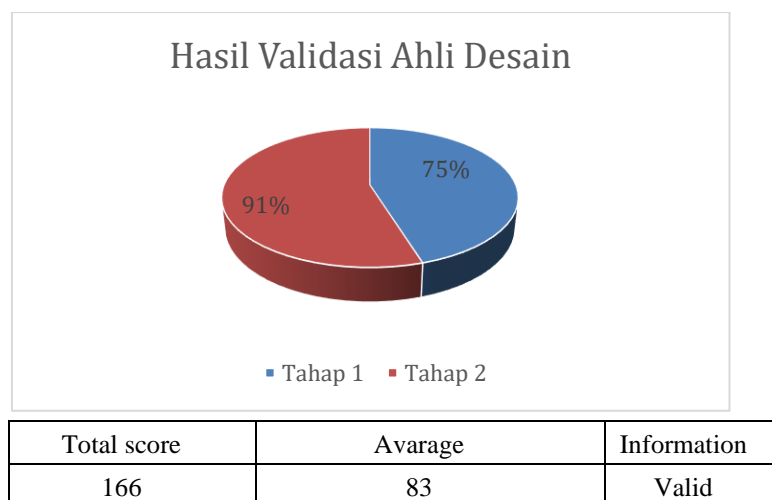


Figure 3. Design Expert Validation Results

2. Product practicality testing stage

Products in the form of website-based teaching materials that have obtained valid criteria based on expert assessments will be used for field testing activities. Field tests are carried out to obtain data related to product practicality and product effectiveness resulting from the development that has been carried out. Field tests were carried out twice, namely limited trials and extensive trials. The limited test results data can be presented as follows:

a. Limited testing

The limited test was carried out by distributing questionnaires to 8 students containing 7 statements with each question having a maximum score of 4 and a minimum score of 1. Based on the evaluation results using the limited test, a total score of 162 was obtained from a maximum total score of 170 with average score 95%. If this score is converted to product practicality criteria, it is included in the "Very Practical" category. The following pie chart shows data from a limited test used to evaluate the usability of the material, as follows:

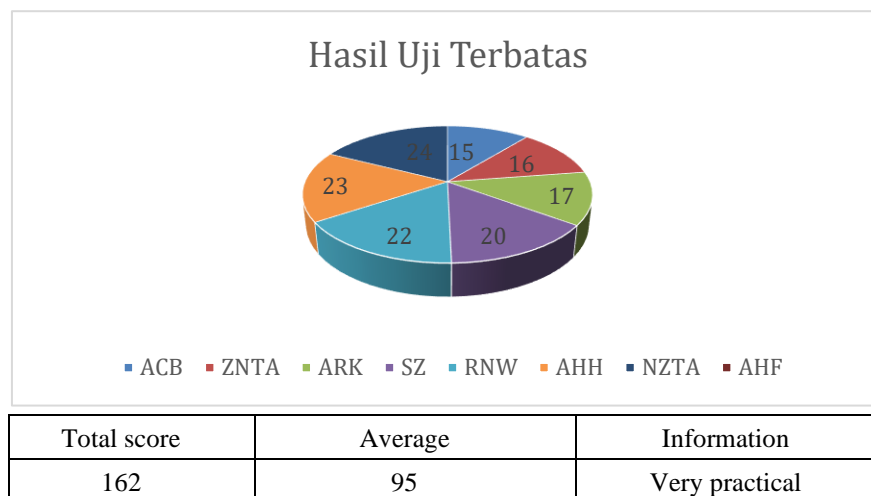


Figure 4. Limited trial results

b. Extensive test

Extensive testing was carried out by sending a questionnaire to 17 students, containing 7 statements with a score range of 1 to 4. The results of the extensive testing group showed a total score of 407 out of a maximum of 420, with an average score of 96%, falling into the "Very Practical" category. .

Complete information regarding the evaluation of the practicality of teaching materials by extensive trials is presented in the following pie chart:

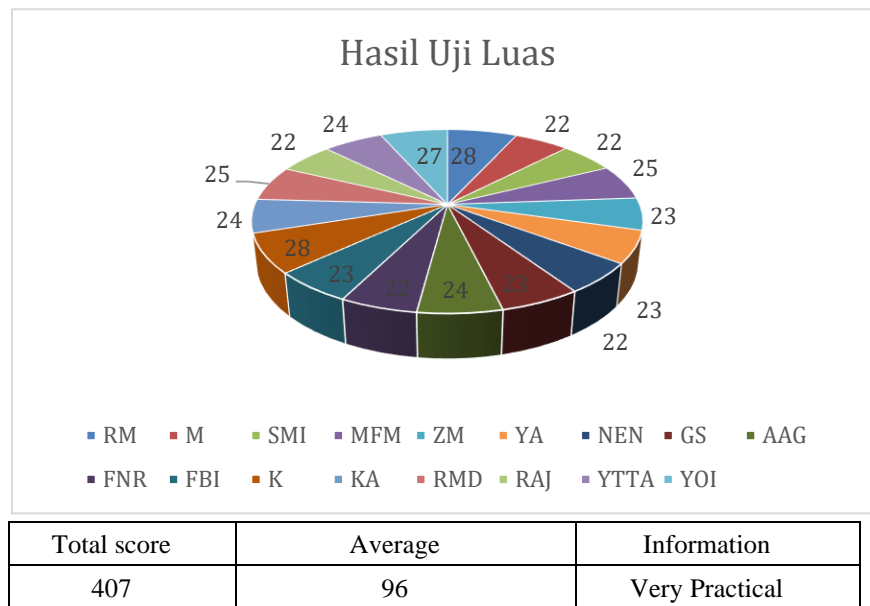


Figure 5. Extensive Trial Results

3. Product effectiveness stage

Apart from being used to obtain product practicality data in limited and extensive trials, it is also used to determine the level of effectiveness of website-based teaching materials. The product in this research can be said to be effective if the student's average score is above the specified KKM. The KKM that has been determined is 75.

a. Limited testing

The results of a limited trial conducted on 8 students were carried out to determine the average student score. The data related to the limited test can be seen in the following table:

NO	Student Name	Grade	Description
1.	ACB	80	Complete
2.	ZNTA	88	Complete
3.	ARK	70	Not Completed
4.	SZ	65	Not Completed
5.	RNW	90	Complete
6.	AHH	85	Complete
7.	NZTA	75	Not Completed
8.	AHF	70	Not Completed
Avarage		78	Complete

b. Extensive test

Meanwhile, the results of extensive tests were carried out on 17 students. The acquisition data related to learning outcomes in extensive trials can be seen in table 4 below:

Table 4. Student Learning Results in Wide Scale Trials

NO	Student Name	Grade	Description
1.	RM	65	Not Completed
2.	M	77	Complete
3.	SMI	80	Complete
4.	MFM	85	Complete
5.	ZM	75	Not Completed
6.	YA	90	Complete
7.	NEN	89	Complete
8.	GS	67	Not Completed
9.	AAG	77	Complete
10.	FNR	85	Complete
11.	FBI	80	Complete
12.	K	75	Not Completed
13.	KA	80	Complete
14.	RMD	85	Complete
15.	RAJ	90	Complete
16.	YTTA	95	Complete
17.	YOI	60	Not Completed
	Avarage	80	Complete

Based on Table 3 regarding student learning outcomes in the limited test and Table 4 regarding student learning outcomes in the extensive trial, it can be seen that the average score of students in the limited trial obtained an average score of 79. Meanwhile, in the extensive test the average score was obtained. 80. It can be seen that from the limited and extensive trial data that has been carried out, an average score that is greater than the KKM value that has been determined is 75. Based on this data, it can be concluded that the average student score is greater than the KKM. So the product that has been developed can be said to be effective.

Discussion

The product produced through this research is in the form of website-based teaching materials, on the solar system for fifth grade elementary school students. The product development process involves a product validation stage by experts who assess

aspects of the material and design of teaching materials. Products in research and development are considered valid if there is interrelated consistency and is based on a strong theory. Therefore, the level of practicality of teaching material products will increase if the results of validation tests by experts show high results, indicating that the product can be effectively used for field trials.

1. Product Validation Level

In this research, the level of product validity is categorized as "Valid" based on the validity assessment. Teaching material products are declared "Valid" because they have been developed by considering various design aspects, as explained by Saputri (2020: 44). Aspects of design assessment involve the suitability of the design of teaching materials, the attractiveness of images, attractive writing colors, choosing the appropriate font size, appropriate image layout, and determining the right image size.

The results of the product validity test on the material aspect show that the product that has been developed is in the "Very Valid" category. This can be seen from the product assessment criteria outlined by Saputri (2020: 44). These aspects include suitability of material with basic competencies, suitability of indicators, learning objectives, provision of material coverage, clarity of material, and ease of understanding the material.

2. Product Practicality Level

In research by Alwi et al. (2020: 12), the practicality of teaching materials is tested based on ease of use and attractiveness for users. The practicality evaluation was carried out through two test groups, namely limited tests and extensive tests, which showed that the product was categorized as "Very Practical". Both limited trials and extensive trials confirm the same level of practicality of this product. These teaching materials were developed in accordance with the eligibility criteria for teaching materials set by the Ministry of National Education (as stated in Rosyid and Khakam, 2019). These criteria include clarity of instructions, ease of understanding for students, clarity of language, attractiveness of appearance, and ease of use.

3. Product Effectiveness Level

Based on the results of the product effectiveness test which can be seen from the comparison between student learning outcomes and the predetermined KKM, namely 75. Student learning outcomes will reflect students' thinking abilities and students' ability to understand the material they have studied. As explained by Tanjung and Nababan (2018),

a learning process is said to be effective if students can participate actively in a meaningful learning process and can understand and seriously study the material taught by the educator.

This is in line with the opinion of Suniasih (2019) who states that a learning tool can be considered effective if the tool achieves the right targets for learning that have been set or there is an increase in learning outcomes as expected. In accordance with this opinion, learning outcomes tests are carried out to measure students' understanding of the material being taught and to determine the achievement of the goals that have been set. The results of the effectiveness test carried out by two groups, limited test and extensive test, show that the average level of effectiveness obtained is greater than the KKM. In the limited trial, the product effectiveness level was 78. In the extensive trial, the product effectiveness level was 80. This score shows that the average student learning outcomes in the limited trial and trial obtained a score greater than the predetermined KKM, so the product that has been developed can be categorized as effective for use in solar system materials.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the research and development that has been carried out, it can be concluded that website-based teaching materials on the solar system are suitable for use in science and science learning for fifth grade elementary school students. The feasibility of the product in this research is seen from the results of the validity, practicality and effectiveness of the product. The results of product validity tests carried out on teaching material design experts and elementary school science material experts obtained an average score of 65.5% with very valid criteria. Furthermore, based on product practicality tests carried out in limited trials and extensive trials, an average score of 95.5% was obtained in the "very practical" category. Based on the results of the effectiveness test in the limited trial, an average score of 79 was obtained and in the extensive trial an average score of 80 was obtained. Based on the results of the product practicality test, it can be concluded that the average classical student learning outcomes in the limited and extensive tests showed value. which is greater than the predetermined KKM, namely 75. This data shows that the product that has been developed can be said to be effectively used to teach solar system material to fifth grade elementary school

students. The teaching materials that have been developed by researchers are designed to be simple. Therefore, it is recommended for further research to consider expanding the material in website-based teaching material products, as well as improving the design to make it more attractive to increase student interest, as well as making more use of existing technological advances in accordance with the times to develop these products.

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