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DEVELOPMENT OF SOLAR SYSTEM SIMULATOR MEDIA FOR ELEMENTARY SCHOOLS.

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ABSTRACT

This This study aims to develop a solar system simulator learning media for solar system material in grade VI elementary school, and determine the quality of the media through the results of validation, validity, and practicality.

The type of research used in this research is development research using modified and simplified 4-D development research methods, namely defining, designing, developing and without disseminating. Development in the form of a solar system simulator media which is made to describe a small version of the solar system equipped with a user manual. Sources of data in this development research are students of class VI UPT SD Negeri 110 Gresik, totaling 30 students. The data collection techniques used in this study were the validation of learning media, student response questionnaires, and learning outcomes tests. The data analysis technique used in this research is the analysis of the validity of the learning media, the analysis of the effectiveness of the learning media, and the analysis of the practicality of the learning media.

The results of descriptive analysis of the validation results and test data obtained that the development of learning media for solar system simulators for class VI solar system material at UPT SD Negeri 110 Gresik met the good criteria, namely as follows: a) The results of the validation of learning media conducted by the validator obtained a percentage 87.5% which is categorized as valid and can be used during the learning process, b) Categorized as effective from the results of learning mastery analysis, the results of the percentage of classical learning mastery are 86.7%, it can be said that students' learning mastery is achieved, c) Categorized practically from the results of the analysis of student responses, the percentage of student responses is 94.7%, it can be said that the solar system simulator media is in the good category.

The implication of this research is that it can result in the development of quality media to help deliver material on the solar system so that it has a very good contribution to the world of education. The solar system simulator media can explain directly the process of the solar system with visualization

from the front. So that educators have no difficulty in giving explanations to students about the material of the solar system because it has been helped by the media simulator of the solar system. In addition, this media can make it easier for studentsto understand the concept of the solar system and reduce students' misconceptions in learning the solar system.

This development research produces concrete learning media that are in accordance with the solar system learning material in grade VI elementary school. However, this research is limited to its visualization, the visualization of this media can only be seen from the front.

Keywords : 4-D Model, Solar System Simulator

1. INTRODUCTION

The use of media in the learning process provides several positive impacts for students. Media is able to grow the desire or interest of students to like the material provided, generate motivation, provide stimulation for learning activities, have a positive impact on the psychology of students, and increase understanding. In addition, the media can present material with a more attractive appearance and make it easier for students to interpret the material and condense information (Adam & Syastra, 2015). The use of media in the teaching and learning process in schools can be used or applied to all subjects at various levels of education. The use of media in the learning process must be adjusted to the subject or material to be taught, for example in natural science learning (IPA) in grade VI elementary school.

In natural science learning there are many things that students can learn, one of which is the solar system. The solar system is a collection of components of natural phenomena that exist in the universe consisting of various kinds of planets, satellites, asteroids, and many other objects. In the solar system, objects in the universe move around the sun because the sun is the center of the solar system (Retnoningsih, 2016). In learning the solar system there are several obstacles or problems because the solar system is a material that is considered difficult by students because the material is related to processes in the universe which if observed will take a long time. In addition, some objects in the universe cannot be seen directly by the eye. Based on the results of interviews with sixth grade teachers at UPT SD Negeri 110 Gresik, it was stated that there were several obstacles or problems in the solar system learning process at the school, namely the lack of availability of learning media, the media were only pictures of the solar system. So that educators find it difficult to explain to students related to the solar system. This causes the ability of some students to understand the concept of the solar system is less than optimal and causes some students to experience misconceptions.

Problems at UPT SD Negeri 110 Gresik can be solved by providing a slightly different variation of the solar system learning media. Therefore, the author tries to provide solutions or innovations in the form of developing solar system simulator media. The media is expected to make it easier for educators to convey material while making it easier for students to understand the concepts/materials of the solar system. The thing that strengthens the reason for the development research that will be carried out is oriented to the development of learning media products is the final result of previous studies. Previous research obtained positive results from the research that has been done regarding the development and

application of learning media to the learning outcomes of students in the classroom.

The reference to the previous research is a reference for researchers in developing media in the form of a solar system simulator. The thing that distinguishes the researcher's research from previous research lies in the development of the media display and the completeness of the concept in the media. The media developed by the researchers is in the form of a miniature solar system that can move, movement occurs on all planets and the sun, namely moving in rotation and evolution. In addition, the miniature is equipped with a line of planetary orbits and the sun that can emit its own light with the help of a lamp. These miniatures are arranged as closely as possible to the original object with 2-dimensional visualization and can be seen from before the eyes.

Based on the background of the problem and supported by previous studies, researchers are interested in developing and focusing on the development of learning media for solar system simulators. Furthermore, the researchers wrote it in a thesis research proposal with the title "Development of Solar System Simulator Media for Elementary Schools". The media developed by researchers is in the form of a miniature solar system that can move. Movements in miniature are rotational and revolutionary movements that occur on all planets. This research and development is expected to produce a variety of learning media that makes it easy for students to understand the concept of the solar system. In addition, it is expected to be useful for all, especially for class VI at UPT SD Negeri 110 Gresik.

2. METHODS

This study refers to the 4-D model developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel which uses 3 of the 4 stages of development, namely define (defining), design (planning), develop (development) with the necessary modifications. conducted by researchers.

2.1.1 Defining Stage (Define)

The purpose at this stage is to establish and define the requirements of a teaching. Through an analysis, objectives and constraints for teaching materials can be determined. In addition, there is an analysis of students, materials, and assignments.

2.1.2 Design stage

The purpose at this stage is to develop a plan for making a solar system simulator that is in accordance with the study of the material.

2.1.3 Development Stage (Develop)

According to Thiagarajan, et al (1974) the development stage consists of two steps, namely: validation followed by revision and development trials. At this stage, it produces the final form of a learning media after going through the revision stage of the validator results and test data.

Data collection techniques were obtained from: (1) validation of learning media; (2) test of student learning outcomes; (3) student response questionnaires; (4) the quality of learning media. The validation of learning media is done by giving or showing the media that has been developed in the form of a solar system simulator along with a validation sheet that has been given to the validator, then the validator provides an objective assessment score. Learning outcomes tests are given to students to see the effectiveness of the media. Student response questionnaires were carried out by giving a questionnaire to students to see the practicality of the media. Meanwhile, the quality of learning media

aims to determine the quality of the developed learning media. According to Nieveen (in Yamasari, 2010) a learning media is said to be of quality if it meets three criteria, namely valid, effective, and practical. Data from each data collection technique were analyzed quantitatively (percentage), namely:

2.2.1 Learning media validation

The data from the validation results were analyzed quantitatively with the following formula:
Description =

Grade = $\frac{Va+Vp}{2}$

Va = Validation from material expert

Vp = Validation from media experts

Then the final value of the validator is matched on the validity interval, namely if it gets a score of 76 then the media can be said to be valid media.

2.2.2 Study result test

KBK = $\frac{number\ of\ students\ who\ completed}{total\ number\ of\ studemts} \times 100\%$

Data from learning outcomes tests were analyzed quantitatively with the following formula:
The media can be said to be effective if the percentage of classical learning completeness is 75%.

2.2.3 Student response questionnaire

The data from the student response questionnaires were analyzed quantitatively using the following formula:
Description :

Percentage : $\frac{(5\times SS)+(4\times S)+(3\times KS)+(2\times TS)+(STS)}{(5\times\sum\quad)\times jumlahpesrtadidik} \times 100\%$

SS = strongly agree, rated 5

S = agree, rated 4

KS = disagree, given a value of 3

TS = disagree, rated 2

STS = strongly disagree, rated 1

Media can be said to be practical if it gets a score of 61% based on a predetermined practicality interval.

2.2.4 Quality of learning media

Quality learning media must meet three criteria, namely valid, effective, and practical. Learning media can be said to be valid or ready to be used if the final score from the media validation results is obtained 76%. Learning media is said to be effective if the average score of the student learning outcomes test reaches classical learning completeness with a score of 75%. Learning media is said to be practical if the percentage of student responses has reached 61%.

The results of the study were adjusted to Thiagarajan's development theory, namely the 4-D development mode which was only carried out in 3 stages including the definition stage, the design stage, and the develop stage. The following are the results of the research on the solar system simulator media:

3.1 Define stage

The definition stage begins with identifying the basic problems faced by teachers in learning. The results of the researcher's discussion with the fourth grade teacher that the UPT SD Negeri 110 Gresik stated that the problems in learning the solar system were caused by the lack of learning media, the media used were only pictures of the solar system. This causes students to have different abilities from one another. Judging from the results of the UAS, even the sixth grade students of UPT SD Negeri 110 Gresik showed that most of the students did remedial, because they did not meet the KKM, their incomplete scores were 50% of the total number of students in grade VI. In addition to analyzing problems and students, the researcher also analyzes the material, assignments, and formulation of learning objectives. In the material analysis, it can be seen that the material used is the solar system material, and in the task analysis it can be seen that the main tasks needed in learning activities are identified. Based on the indicators of the solar system material, the tasks include mentioning groups of celestial bodies as members of the solar system, describing the positions of the planets in the solar system, explaining the events of Earth's rotation and Earth's revolution. In addition, there is an analysis of the formulation of learning objectives. The result of this stage is to combine the objectives of material analysis with task analysis. The learning objectives that have been achieved in this research are that students can pronounce the 8 planets in the solar system, students can pronounce the position of each planet, and students can explain the events of the earth's rotation and earth's revolution. So from this analysis the researchers tried to solve the problem in the form of developing a solar system simulator media that was in accordance with relevant material which later could make it easier for students to understand the concept of the solar system.

3.2 Design stage

The design stage begins with the selection of media. The media was selected based on the following criteria, namely providing opportunities for students to directly observe the solar system and providing a clearer visual experience for students to understand the concept of the solar system. Furthermore, the selection of formats is carried out by designing or designing media content. The research process is carried out by designing a miniature consisting of parts of the planet and its trajectory, as well as selecting an electric motor that will be used in making solar system simulator learning media. The final stage of this design is to form the initial design of the solar system simulator media.

3.3 Development stage

The development stage consists of two steps, namely: validation followed by revisions and development trials.

3.3.1 Learning media validation

The validation results can be shown in the following table:

Table 1. Validation result

No	Validation	Score
1	Material Validation	97,5%
2	Media Validation	77,5%
Average		87,5%

The solarThe solar system simulator media that has been designed, then validated by material experts and media experts. The results of expert validation obtained a percentage of 87.5%, so the solar system simulator learning media is included in the validity criteria of the predetermined standard, which is 76% (According to Sugiyono, 2012). The next step is to make revisions based on criticism and suggestions from the validator. The revision is in the form of a simulator background, which was originally black, replaced by mixing other colors that better describe the state of the solar system. Then the moon item is added as a natural satellite of the earth and the last is smoothing the surface of the board to make it safer for students.

3.3.2 Testing

The trials carried out in learning activities ended with the provision of learning outcomes tests and student response questionnaires to determine the effectiveness and practicality of the solar system simulator media.

1) Learning Outcome Test

Obtaining learning outcomes from 30 students who took the learning outcomes test, as many as 4 students did not finish studying because the score obtained was 75. The test results can be shown in the following table:

Tabel 2. Hasil Tes Belajar

No	Students	Score	Description
1	4 students	70	Not Finished
2	1 student	75	Finished
3	11 students	80	Finished
4	7 student	85	Finished
5	5 student	90	Finished
6	2 student	95	Finished

The results of classical learning mastery are calculated using the formula = (number of students who complete: total number of students) × 100% = (26: 30) × 100% = 86.7% indicating that classical student learning outcomes are included in the category completed with a percentage value of 86.7%, meaning that it meets the specified criteria, namely 75% where the solar system simulator media can be said to be effective because it has met the predetermined criteria.

2) Student Response Questionnaire

The results of the student questionnaire responses were calculated quantitatively with the following formula:

$$PD = \frac{(5\times 110) + (4\times 40) + (3\times 0) + (2\times 0) + (1\times 0)}{(5\times 5)\times 30} \times 100\% = 94{,}7\%$$

The results of the calculation of the student response questionnaire show that the

percentage generated from the student response questionnaire is 94.7%, meaning that it meets the specified criteria, namely 61% where the solar system simulator media can be said to be practical because it has met the predetermined criteria and received a positive response from learners.

3.4 Quality of Learning Media

The results of the calculation of the percentage of the validation of learning media by several validators, the completeness of student learning outcomes, and the calculation of the percentage of student questionnaire responses for the purpose of this study resulted in a valid, practical and effective learning media. The solar system simulator learning media is said to be valid because it obtains a percentage of 87.5%. So the solar system simulator learning media can already be used in the learning process. The solar system simulator learning media is said to be effective with the acquisition of the classical learning mastery percentage of 86.7%. The solar system simulator learning media is practically practical with the percentage of students' questionnaire scores reaching 94.7% . So the solar system simulator learning media can already be used in the learning process.

3. DISCUSSION

The process and results of the development of the solar system simulator media can be seen from the validation and trial results. The results of the media validation state that the solar system simulator learning media can be said to be valid because it obtains a percentage of 87.5%. So the solar system simulator learning media can be used in the learning process. Meanwhile, from the test results, we can see from the results of the test and student response questionnaires. The test results show that the completeness achieved by students is 86.7%, namely 26 of the 30 students who complete learning and get a score of more than 75. Based on these results, it can be concluded that the results of the students' learning tests have achieved classical mastery of learning. So that the solar system simulator media can be said to be effective. Meanwhile, based on the results of the analysis of student responses, the percentage of student response questionnaires was 94.7%. This identifies that the response of students to learning activities using the solar system simulator learning media is included in the good category. So that the solar system simulator media can be said to be practical.

Furthermore, this finding shows evidence that the solar system simulator media is a new quality media to help convey solar system material so that it has a very good contribution to the world of education. The solar system simulator media can directly explain the process of the solar system. So that educators have no difficulty in giving explanations to students about the material on the solar system because they have been helped by the solar system simulator media.

4. CONCLUSION

The conclusion of this study is that the solar system simulator media was developed by referring to the modified and simplified Thiagarajan (4-D models) development model. This development research only carried out three stages, namely: the definition stage, the design stage, and the development stage. In addition, the quality of the solar system simulator media can be said to be of high quality because it meets the following aspects, namely: valid because it gets a percentage of 87.5%, effective because it

gets a classical learning completeness percentage of 86.7%, and practical because it gets a percentage of participant response questionnaire scores. students reached 94.7%.

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