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The use of method design thinking in making solar system learning media for elementary school students

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ABSTRACT

This research is based on the absence of innovative media regarding the solar system, rotation and revolution of the Earth. Of course, this affects the achievement of learning objectives. It was found that some students had not memorized the names of the planets, and it was not easy to differentiate between the Earth's rotation and revolution. This research aims to develop and produce a learning media product for elementary school students called "SIRORO" that covers the solar system, rotation, and revolution. This research uses a qualitative design thinking type approach. This research took class 6 subjects, with as many as 22 students, because it was based on problems and needs analysis. This research was conducted by SD Negeri Klitik 1 and carried out in the even semester of the 2023/2024 academic year. Data was collected by observation, giving questionnaires to students, and interviews with teachers. After that, a qualitative descriptive analysis method was used. This research succeeded in creating learning media products that students and teachers need to make learning more meaningful. The results of interviews with teachers show this, and as many as 72.7% of students agree that during the learning process, they use SIRORO media rather than not. Students also understand more about the solar system and can differentiate how the Earth rotates or evolves. Apart from that, every step used in design thinking can be implemented well. In future research, we should add several HOTS questions to the game so that it can train students' high-level thinking skills.

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INTRODUCTION

Currently, the use of learning media is very important for student learning. Learning media can help teachers convey material and information to students. This statement is in accordance with Wulandari et al. (2023) that learning media helps teachers explain material with good teacher-to-student communication. Learning media as a means of communication can help teachers convey material clearly and not only in textual form (Neni Isnaeni & Dewi Hildayah, 2020). In addition, innovative learning media can be used to convey process material, which is quite a lot and difficult for students to do. Understand, however, it is still.

Some teachers still use conventional learning methods today. This conventional method does not use media as an intermediary, unlike the lecture method. In line with Adilah Minsih (2022), most teachers still use the lecture method, so students tend to be passive during learning activities. This is a statement supported by Rahmayani (2019), Adam et al. (2020), and Yanuar & Pius (2023) that conventional learning or teacher-centred learning makes students tend to be passive because it is monotonous and does not use learning media.

This fact is in accordance with the results of observations in the field, precisely at SD Negeri Klitik 1, that students have difficulty understanding Natural and Social Sciences (IPAS) subjects, especially in the focus of science. In learning science, some material is difficult to understand. Based on pre-research conducted at SD Negeri Klitik 1, it is known that teachers have used conventional methods and image media several times. Pictures themselves are included in two-dimensional (Yulinda Media et al., 2023). Teachers at SD Negeri Klitik 1 also still use textbooks as learning support media. The material explanation is available in the package book, but the package book does not have a specific and interesting explanation in it. The package books used by teachers for learning only contain description media material, some illustrations of images, and practice questions with less varied forms of questions. Actually, in the package book, there are several experiments that students can do. If students learn by themselves, they will experience some confusion when doing experiments in the package book.

Based on the results of interviews with grade 6 teachers, it was stated that the media owned was very little, especially in science materials. The teacher admitted that the material was simple. Solar, system rotation and revolution of the Earth are the only media used. The simple media are pictures in the package book, pictures made by the teacher on the blackboard, and the globe. Visually, of course, what the teacher does is less interesting because students cannot feel it. As a result, the learning media is not interesting for students, and the message conveyed does not achieve learning objectives because the visualization of the material is still biased. Therefore, the right learning media is needed to provide a direct experience for students in learning. Adawiyah et al. (2022) and Wardani (2022) suggested that direct experience can also help students understand the learning process directly, which allows students to make direct conclusions about what they can.

The use of appropriate learning media is still very minimal, especially in materials that require visualization. These materials include the five senses, the cycle of living things, the water cycle, the respiratory and digestive systems, and the solar system (Kemdikbud, 2022). One of the materials that require perfect visualization is the solar system. The solar system is a material that requires media to explain how the heavenly bodies are arranged because this material cannot be seen directly by the eye (Dwinata et

al., 2023). Therefore, 3 (three) dimensional Media is needed as a replica of the actual object to help students understand the material more concretely. Science This is proven by several previous studies from experts.

According to research by Adawiyah et al. (2022), the average student score was 84 94% from the results of the trial assessment, supported by student statements that learning using the Sikla (Water Cycle) was very fun and the material learned became easier and more enjoyable. Other research by the magic box. Dwinata et al. (2023) stated that there was an increase in the average score before and after using 3D miniature media of the solar system from 65.0 to 85.0, meeting the Minimum Completeness Criteria (KKM). This means that the application of 3D miniature media is effective. Research by Saputri et al. (2024) shows that the application of Genetic Card Digital Media (Medikagen) to human digestive system material is practical. This is obtained from the results of students' final scores in the limited trial of 91% and the broad trial of 87%, which means they meet the KKM. Based on several previous studies, this research is relevant because it has similarities to the effect of using three-dimensional media on science materials in elementary. School; however, the research is different from some previous studies. This research does not focus on one material but refers to three materials at once in one media, including solar system material, rotation, and earth revolution.

This research aims to design design thinking and create learning using the method media products on the material of the solar system, rotation, and revolution. Earth This is intended to increase students' understanding of the material of the solar system, rotation, and earth revolution. This material also involves students directly in a fun learning experience and can involve different student learning styles. This Media will be packaged interestingly in terms of material and visuals so that students do not feel bored and monotonous. Of course, this Media prioritizes easy use for all groups. Referring to the background explanation, this research is entitled "The Use of Method Design Thinking in Making SIRORO ". Learning MediaSIRORO is an acronym for Solar System, Earth Rotation and Revolution. This research was chosen based on observations made at SD Negeri Klitik 1 that the learning methods by teachers are still conventional, and the learning media used are inadequate, especially in IPAS. Subjects Teachers only use 2 (two) dimensional objects in the form of pictures in package books and on the blackboard for solar system and earth revolution material, as well as globes for earth rotation material.

METHODS

This uses design research and development with a design thinking approach that is approached with qualitative description. The qualitative descriptive method is a research approach to describe the conditions or phenomena that are happening by following scientific rules in answering actual problems (Sugiyono, 2022). According to Brown in Ridwan et al. (2022), design thinking is an attempt to design a product where the product created can be a solution to certain human-centred needs to lead to sustainable innovation. In the process, design thinking applies a human-centred approach that is intended to have the ability to understand a problem and its needs. This research was conducted based on problems encountered at SD Negeri Klitik 1, Ngawi Regency. School The was used as a research location because we found the problem of the lack of 3D learning media. This study took a sample of 22 children in grade 6.

In the approach of design thinking, several stages will be carried out to identify the problem and find a solution. This research will be carried out until the stage test for students of SD Negeri Klitik 1. Design thinking has five stages Including empathizing, defining, ideating, prototyping, and testing (Hwa et al., 2021). Emphasize is the initial stage of finding problems that occur in the research location. At this stage, researchers make observations to see the problems that occur during learning activities. Define is the stage of the process of defining the problems that have been found. This stage is the stage for collecting ideas so that the needs used in solving problems can be met. Ideate is the stage to generate ideas that can provide solutions to problems that have been identified in the previous stage. Prototype is the stage for developing the product design. This stage will help product designers identify the shortcomings of the media (Sari et al., 2020). The test is the stage of testing the product for users.

The sample of this research is purposive sampling. Purposive sampling is a sampling technique that requires certain considerations. This particular consideration means that someone who is considered to understand best what we expect or maybe he is the ruler, making it easier for researchers to investigate objects or social situations to be studied (Sugiyono, 2019). Data collected was gathered through observation, interviews, and documentation. During observation, data was obtained through observations of the school environment, students, and teachers. During the observation, notes were taken, especially on the emphasize step. Interviews were conducted with teachers who were considered to understand the classroom. This study also used documentation to show how the media was developed. Data reduction, data presentation, and conclusion drawing are the data analysis techniques used in this research. Data analysis was carried out using the stage conditions emphasized in the test.

RESULTS AND DISCUSSION

This research uses method design thinking in making SIRORO learning media. In this method, there are five types of stages applied in this research.

1. Emphatize

Emphasize in this research is done by collecting data related to the problem that will be used in determining the product to be made. At this stage, this research uses interview and observation techniques. In February 2024, the initial action taken was observation of the educational environment. Based on the results of the observation, SD Negeri Klitik 1 was found to lack two classes. Teachers: This makes some teachers have to fill empty classes. This is ineffective because at one time the teacher must divide his time between two classes at once.

The shortage of two class teachers can cause students' cognitive, affective, and psychomotor abilities to decline due to divided teacher attention. In the cognitive aspect, students' ability to analyze a problem is lacking. In addition, some students are also less able to remember the subject matter that the teacher has taught. This can happen because their media is little. I learned that so many posters or pictures can be used as media. However, there are very few 3D learning media. If you only look at posters or pictures that have been in class for a long time and are explained by the lecture method, of course the learning is not meaningful. The use of the lecture method has an influence on children's learning outcomes (Muhaiba et al., 2020).

In the affective aspect, some students are good and sufficient. Some students still talk to themselves or play during learning. During the flag ceremony every Monday,

some students are less orderly and still crowded. Meanwhile, the students' psychomotor skills are quite good. Many students are already skilled in using musical instruments, dancing, tools/objects such as microphones, and so on.

2. Define (Identify the problem)

Based on several problems at SD Negeri Klitik 1, this research focuses on the lack of learning media at the school. The 2013 curriculum and the independent curriculum are two curricula that are still being utilized by SD Negeri Klitik 1. To determine what content will later be made for learning media, researchers also interviewed teachers at this problem identification stage. The material of the solar system, earth rotation, and earth revolution was chosen for this research. The material selection was based on the lack of learning. Media The only media used for the solar system material were pictures in the package book and pictures that the teacher made on the blackboard about the eight planets. The teacher explained that it is considered less effective because students need direction. Material examples based on the method taught by the teacher, it is evident that 50% of students memorize the names of the planets, and the other 50% may memorize the names of the planets. These results were obtained through a questionnaire given to students.

Meanwhile, in the earth rotation material, the teacher uses the globe as the learning media. On the Earth Revolution material, the teacher draws on the blackboard and explains directly how the Earth Revolution process. From the teacher's method, 81.8% of students know the difference between earth rotation and revolution. These results were obtained through a questionnaire given to students.

The material of the solar system, revolution, and rotation of the Earth itself is in grade 6 in basic competencies 3.7 and 3.8 (Permendikbud Number 37 of 2018, n.d.). From this material, several problems can be solved by making learning media (Arifin et al., 2023; Darojat et al., 2022; Darsih et al., 2022; Ernadayanti, 2024; Halim et al., 2023; Nadia & Manurung, 2023; Rahmah & Hidayat, 2022; Sentarik & Kusmariyatni, 2020; Suhati et al., 2023). From some of the above studies, there are several shortcomings, such as the use of pop-up books in a form prone to damage because they are easily torn and wet, some media can only explain the material of the planets of the solar system and the Earth's revolution, and many other media have shortcomings (Arifin et al., 2023; Sentarik & Kusmariyatni, 2020).

3. Ideate

Based on the problems at the stage defined, this research decided to make SIRORO media. SIRORO stands for the solar system, rotation, and revolution of the Earth. SIRORO is made in 3D. This is so that students can touch and practice directly how the solar system, rotation, and revolution of the Earth.

SIRORO also has a QR code that can be used for space squirrel adventure videos and games. The space can be used as a squirrel adventure video ice breaking or other tasks. For example, students are asked to work on other tasks, such as LKPD. The asks students to answer questions and make several questions related to the video. This LKPD can increase student understanding and reduce boredom in learning. Misconceptions can be caused by various things, including the lack of reference materials during the learning process and the use of boring and passive lecture methods teaching students so that learning is not interesting and weakens students' curiosity (Nurfadilah & Rochintaniawati, 2021). , innovative learning media is needed to make learning more meaningful. This is because misconceptions are also still found at the primary education level in grade 6 (Utama & Kusumaningtyas, 2023). SIRORO media

is considered to be able to overcome boredom because it contains three learning styles at once. Another QR code in SIRORO media is the presence of educational .games

The game contains KD 3.7 and 3.8 material for grade 6. KD students3.7 reads "Explaining the solar system and the characteristics of the members of the solar system" and 3.8 "Explaining the events of rotation and revolution of the earth and the occurrence of lunar eclipses and solar eclipses" (Permendikbud Number 37 of 2018, n.d.). Both KDs are included in Bloom's taxonomy level C2. Bloom's taxonomy consists of six levels, namely "remembering, understanding, applying, analyzing, evaluating and creating(L. W. Anderson & Krathwohl, 2001). This uses the webgame wordwall . Wordwall is an online web for creating fun games based on quizzes. (Ma'rifah & Mawardi, 2022). Some researchers have also researched wordwall. For example, how word wall affects students' critical thinking skills and how word wall can help students develop their critical thinking skills (Ma'rifah & Mawardi, 2022; Qonita & Handayani, 2023). Thinking critically is one of the components of higher order. This research only uses C2 level questions, which, of course, can improve learning outcomes because C2 has a level below higher order. Learning higher-order thinking techniques is very important for students because it can motivate them to approach problems critically, creatively, logically, and impartially (Noor & Abadi, 2022). This proves that Wordwall has many benefits in the world of education. In addition, students with visual learning styles really like learning, thanks to the display wall. This is also found in SIRORO media.

Visual learning style can be seen because this Media has attractive colours. Games and videos are ready to pamper students' ears and eyes (visual and audio styles). Learning Meanwhile, in the kinesthetic, the first example is that students can be given the opportunity to install planets that are deliberately removed from the learning style by the teacher. Then, students can rotate the Earth during the rotation, revolution, and eclipse processes, provided that the media is not turned on. Learning style itself can have an impact on student success (Putri et al., 2020).

4. Prototype

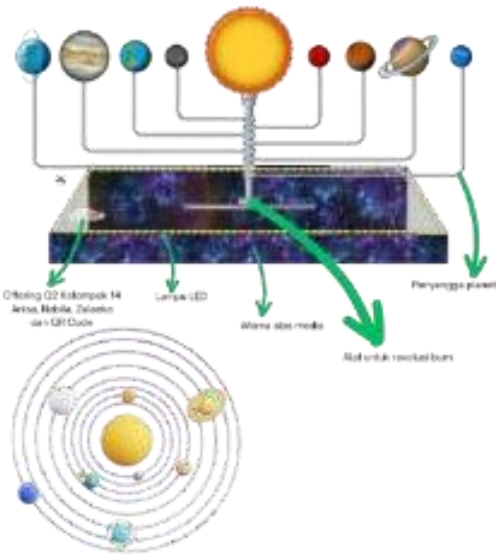

Figure 1. SIRORO prototype

Figure 1 is a prototype of SIRORO learning media. SIRORO can rotate according to the direction of the Earth's revolution. The rotation is driven by a dynamo that uses electricity. In addition to the dynamo, there are LEDs to add light, and the background

of the base is made to look similar to outer space. The planets used are also coloured, making this media more interesting. When the Media is turned on, the LED lights and planets will evolve around the sun. For earth rotation material, planet Earth can be rotated in place. In addition, on planet Earth, there is also a moon. This is intended to explain the material of the lunar and solar eclipse. However, when explaining the material, the teacher should give the students an understanding that the sun is luminous. This is because the sun used in SIRORO is made of styrofoam, so it does not glow. If the teacher does not explain this, it can cause misconceptions in student.

5. Test

After going through the prototype, the researcher then made the product to be tested. This test is to find out how well the product is used. This test was carried out by giving a questionnaire to 22 6th-grade students and interviewing one 6th-grade teacher. For the questionnaire, five options were given to choose from. The options start from number one with criteria such as less good to very good on number five criterion. Figures 3 and 4 show the product and the testing process.

Figure 2. The finished product

Figure 3. Product testing

Based on the questionnaire given to students after SIRORO was used, the results were quite satisfactory. As many as 63.6% of students are very interested when using SIRORO media. This can be due to the attractive colours on SIRORO. As many as 54.5% of students agree that the colour of SIRORO is very attractive. In addition, 59.1% of students also strongly agree that SIRORO is very easy to use. However, only 40.9% of students think that SIRORO can be used anytime. This is because SIRORO requires electricity to make the planets evolve and turn on the lights. Even so, the media is still effective to use even if there is no electricity. This is because users can still rotate manually.

The effectiveness of SIRORO in the absence of electricity is in line with teachers' opinions. Teachers claim that even if there is no electricity, this medium will be very helpful in teaching. processSIRORO media is practical because it covers two basic competencies. Even so, teachers will have a little difficulty if they have to play videos and games in the absence of electricity. However, according to the teacher, this is not the main thing in the media. The main goal is to show students how the eight planets are located in the solar system and the rotation and revolution of the Earth. Teachers also think that the SIRORO media is good visually. In addition, teachers think that SIRORO media can be used in lunar and solar activities. Eclipse material, according to the teacher, SIRORO media has a slight weakness because the sun cannot shine. However, this can be overcome by explaining to students before using SIRORO, the sun produces light and heat energy.

To find out students' understanding, researchers also conducted learning with SIRORO media. As many as 59.1% of students were very excited and happy to learn with SIRORO. Learning using SIRORO is also more fun than not. This is supported by 72.7% of students who strongly agree to learn using SIRORO rather than not. In addition, 63.6% of students felt that SIRORO media was a new learning experience. In addition, SIRORO media also has a QR Code that contains games. As many as 86.4% of students really liked the game. The game can also help students in understanding the material. This is indicated by 86.4% of students strongly agree.

The efficiency of the learning process and the way of communication and content delivery will be greatly enhanced by the use of learning media (Gawise et al., 2022). Therefore, the creation of relevant educational materials has a great impact on learning. The ability to select educational materials that are relevant to the subjects they will teach is a prerequisite for teachers (Wulandari et al., 2023). This research succeeded in finding learning media according to the needs analysis at SD Negeri Klitik 1. This was obtained by using design thinking. Of the five stages of making learning media, everything goes according to the procedure design thinking. Starting from identifying several problems at school, taking problems used in the foundation and making products, selecting ideas, making product sketches, and testing products.

The use of learning media can increase students' curiosity about the subjects given and make subjects easier to understand (Nurfadhillah et al., 2021). This is in accordance with this SIRORO media because 72.7% of students strongly agree to learn using media rather than not. This shows that children's interest in learning learning uses learning media such as SIRORO. Learning interest itself is one of the factors that influence curiosity (Artinta & Fauziyah, 2021). Apart from learning interest, SIRORO also has a positive impact on other aspects. These aspects can be seen in each stage, which will be higher if design thinking is used in this study.

The design thinking method is also used in making other media, such as interactive Google Sites media and Javanese script learning media (Putra et al., 2023; Utomo et al., 2024). In interactive media Google sites, the use of and designing user design interface and user experience of design thinking is used to create interactive media in the form of Google sites with independent flow that can inspire students to play an active role in their education (Utomo et al., 2024). Meanwhile, design thinking is considered capable of being used in the development of user interface design and user experience of Javanese script learning media (Putra et al., 2023). success of the method The design thinking in the two media is also in line with this. Research about each stage of design thinking can be seen in the results section. Research study: This study has limitations in the process of making media, namely tools and time. The tools needed for the Earth to evolve with rotation are difficult to find in the nearest shop. Even if you buy online, the time is not enough because, at that time, the 6th-grade students will soon be farewell. Therefore, the rotation material was chosen so that it could be rotated manually, even though, at that time, the Earth's. The revolution process occurred was it was included so that this media immediately reaches the test stage because grade 6 students have exams and do not attend school. For further research, we can add questions with a high cognitive level every day. This is because the questions used in SIRORO media still use low cognitive levels. This aims to train students' higher-order thinking skills.

CONCLUSION

There are five. First, at the stage, stages of design thinking, several problems were found in the school. Second, at the define stage, it is used as the basis for making the product. Then, several problems were identified; at this stage of research, they decided to make SIRORO. Then, the prototype, at this sketching of the product to be made. At the final stage of stage design thinking, it was found that SIRORO media was good and practical in use and covered several materials. In future research, if you want to make a product with the same material, you should reconsider the size of the product so that it is not a test, more than one meter, and the game that is made can teach students to think higher.

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