The Development of Planetary Pop-Up Media on Solar System Material for Junior High School Students

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ABSTRACT
This research project was initiated in response to the findings of an initial study conducted by a teacher at Bogor State Junior High School 14. The preliminary study revealed that students in the seventh grade encounter difficulties in comprehending the material pertaining to the solar system. Furthermore, the potential of learning media to facilitate comprehension is not fully exploited. One potential solution to this issue is the optimization of learning media, specifically the incorporation of a pop-up book. Accordingly, the researchers developed the Planetary Pop-Up learning media with the objective of facilitating students' comprehension of solar system material. The research method employed is that of research and development (R&D), utilizing the ADDIE model. This research was conducted with the participation of expert lecturers, seventh-grade teachers, and seventh-grade students. The researchers evaluated the efficacy of the media with a sample of seventh-grade students from SMP Negeri 14 Bogor. The objective was to ascertain the suitability of the researchers' media as a learning tool. The findings indicated that 88.81% of the media were deemed suitable for use as a learning aid.

ABSTRAK
Penelitian ini dilatarbelakangi oleh hasil studi pendahuluan yang dilakukan oleh seorang guru di SMP Negeri 14 Bogor. Hasil studi pendahuluan menunjukkan bahwa siswa kelas VII mengalami kesulitan dalam memahami materi tata surya. Selain itu, pemanfaatan media pembelajaran untuk membantu siswa memahami materi tersebut belum optimal. Salah satu solusi yang dapat dilakukan adalah mengoptimalkan penggunaan media pembelajaran, khususnya melalui pemanfaatan buku pop-up. Oleh karena itu, peneliti mengembangkan media pembelajaran Planetary Pop-Up dengan tujuan untuk membantu siswa memahami materi tata surya. Metode penelitian yang digunakan adalah penelitian dan pengembangan (Research and Development atau R&D) dengan menggunakan model ADDIE. Penelitian ini melibatkan dosen ahli, guru kelas VII, dan siswa kelas VII. Peneliti menguji kelayakan media dengan melibatkan siswa kelas VII SMP Negeri 14 Bogor. Pengujian tersebut bertujuan untuk mengetahui kelayakan media yang dikembangkan sebagai sarana pembelajaran. Hasil penelitian menunjukkan bahwa media tersebut memperoleh persentase kelayakan sebesar 88,81%, sehingga dinilai layak digunakan sebagai media pembelajaran.

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KEYWORDS
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INTRODUCTION

Education is a fundamental right that is intrinsic to human existence as a member of society. In accordance with Section 28, Paragraph 1 of the 1945 Constitution, every individual has the right to develop their potential through the fulfillment of essential needs, unlimited access to education, and unlimited benefits from wisdom, technology, creativity, and cultural heritage to improve the quality of life and prosperity of mankind. Education has always been an integral part of human life (Sinaga et al., 2021).

The field of education encompasses a multitude of scientific disciplines, one of which is physics. Physics is a branch of science that examines the fundamental nature and behavior of the universe, including the properties of matter and energy. The field of physical science encompasses a multitude of phenomena, including motion, sound, light, electricity, magnetism, and radiation. It plays a pivotal role in elucidating the intricacies of the world around us and has significantly contributed to the advancement of modern technology. The investigation of physical entities, whether in their tangible or natural manifestations, is conducted through a systematic approach known as the scientific method (Harefa, 2020).

One of the topics covered in the science learning activities of 7th grade is the solar system. The material pertaining to the solar system encompasses a range of celestial objects, including the sun, the inner planets, the

outer planets, comets, meteoroids, and asteroids (Siadari et al., 2021). The results of interviews conducted with science teachers revealed that students encountered difficulties in comprehending solar system material, largely due to the dearth of optimal utilization of learning media that could facilitate their understanding of the subject matter.

A proficient educator is not only tasked with the creation of learning materials but is also expected to demonstrate ingenuity in the utilisation and development of diverse learning media. By integrating distinctive and forward-thinking elements into their pedagogical approach, educators can facilitate engaging and fruitful learning experiences for their students. Such an approach enables students to become actively engaged in the learning process, thereby facilitating the acquisition of a more profound and enduring understanding. In an era of rapid technological advancement, it is imperative that educators adapt their practices to integrate technology as a pedagogical tool. The effective use of technology by teachers can facilitate the creation of an engaging and inspiring learning environment. This will facilitate students in achieving learning objectives in a more efficient and effective manner. In other words, educators can leverage technology to develop novel learning experiences and foster substantial positive outcomes in student development (Solviana, 2020).

It is an irrefutable fact that the utilisation of learning media as an instrument is an indispensable necessity in the context of learning and teaching. Teachers recognize the importance of utilizing learning media as a means of conveying messages and learning materials to their students. It is prudent for educators to acknowledge that the absence of learning media in the classroom can render lessons comprising intricate concepts challenging to comprehend. It is therefore evident that the utilisation of learning media is an indispensable requirement for the advancement of comprehension and the stimulation of students' interest in learning. The selection of suitable learning media enables educators to illustrate concepts in a visual manner, provide concrete examples, and enhance students' learning experiences, thereby increasing the efficacy of the learning process (Bariah, 2019).

State Junior High School Bogor 14, as an educational institution at the junior high school level, has the objective of enhancing the quality of student learning. Accordingly, this study aims to ascertain the viability of utilizing the selected media as a learning tool for the Solar System topic among seventh-grade students at State Junior High School 14 in Bogor. It is hoped that this research will result in the creation of an effective and engaging learning strategy that will enhance the teaching and learning process at Bogor State Junior High School 14, particularly in the context of the solar system.

Furthermore, it is anticipated that this strategy will contribute to an improvement in the quality of learning for students at Bogor State Junior High School 14. It is anticipated that the findings of this study will have a beneficial impact on the level of interest, comprehension, and academic success observed among students in the 7th grade at Bogor State Junior High School 14. Furthermore, the insights gained from this study may serve as a valuable reference for other educational institutions seeking to enhance the quality of science education at the junior high school level.

METHODS

Research Methods

This study employed a research and development (R&D) method based on the ADDIE model, which encompasses a series of stages: analysis, design, development, implementation, and evaluation. This approach provides a comprehensive framework for the design and development of innovations within the context of this research (Rohaeni, 2020). The research team conducted all phases of the study, beginning with the analysis and concluding with the evaluation.

Development Procedure

The procedure undertaken in this development research is conducted in several stages, as follows:

1. **Analysis**

   The analysis stage is of paramount importance, as it entails identifying potential causes of discrepancies and evaluating the necessity of learning media as a tool to facilitate instructional and learning processes within the educational setting. The necessity for this learning medium is predicated on the premise that students encounter difficulties in comprehending the subject matter, particularly the material pertaining to the solar system in the Science curriculum of Grade 7 Junior High School, which encompasses a student population of 32.

2. **Design**

   The design stage refers to the phase of product design. The process of designing this learning media entails several key steps, including the selection of materials for the construction of pop-up books, the

creation of pop-up book designs or designs, the determination of colors to be utilized, discussions pertaining to materials, and the formulation of practice questions.

3. Development

In the ADDIE development research procedure, the term "development" encompasses the actions undertaken to actualize the product design. At the design stage, a conceptual framework is established for the creation of pop-up book learning media. During the subsequent development stage, this framework is transformed into a tangible product that is ready for utilization. The objective of this stage is to produce learning media in the form of pop-up books, accompanied by five questions.

4. Implementation

The planetary pop-up learning media on solar system material, which has been developed, is applied to actual classroom conditions in the implementation process. The trial was conducted at State Junior High School 14 Bogor for class 7.

5. Evaluation

The evaluation stage is the stage of assessing the instructional quality of the product and the process of improving the learning media that has been developed. The evaluation stage is carried out by collecting data that can be used to improve the product, namely through a student satisfaction questionnaire so that the practicality of the product can be determined.

Data Collection Techniques

In this study, the data collection technique employed was the distribution of questionnaires. A questionnaire is a tool utilized for the collection of primary data through a survey method, with the objective of obtaining respondents' opinions. The questionnaire is designed to elicit personal information pertaining to the attitudes, opinions, expectations, and desires of respondents (Oktaviani et al., 2022). The questionnaire was administered to seventh-grade students in this study. The data obtained from the questionnaire will assist researchers in determining whether the use of Planetary Pop-Up can facilitate users in learning about the solar system. A questionnaire employing a Likert scale was utilized by researchers to conduct media validation, material validation, and to administer evaluation questionnaires, which were to be completed by students.

The Likert scale is a method of measuring an individual's perception or opinion about a given event (Pranatawijaya et al., 2019).

Table 1. Likert Scale

Answer	Score
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

Data Analysis Techniques

Once the data has been collected, the subsequent stage is data analysis. The objective of the data analysis technique employed in this study was to ascertain the findings of the research project. In this study, the data analysis technique was quantitatively descriptive. This technique is used to analyze data by describing or describing the data that has been collected in its original form. The data collection and analysis techniques employed in this study utilized questionnaires with a Likert scale to ascertain the validity of the developed learning media and to assess student perceptions of the media. Once the data has been collected, it is processed using the percentage range formula (Karisma et al., 2019), as follows:

$$\text{Percentage} = \frac{number\ of\ scores\ given\ by\ validators}{maximum\ number\ of\ scores} X\ 100$$

Once the data has been calculated, the results of the validation and feasibility of the media can be observed in the table below.

Table 2. Eligibility Decision Making

Category	Decription	Rating (%)
5	Very Decent	$80 < N \leq 100$
4	Decent	$60 < N \leq 80$
3	Decent Enough	$40 < N \leq 60$
2	Not Decent	$20 < N \leq 40$

Category	Decription	Rating (%)
1	Very Not Decent	0 < N ≤ 20

RESULTS AND DISCUSSIONS

The Resulting Product

The module is designed with three main elements: the cover, the content material, and the accompanying images. Meanwhile, the website is designed using the website design features of Weebly.com. On the cover of the module, there is an intriguing title "Planetary Pop-up" accompanied by captivating images of satellites and the emblem of the research institution, along with the name of the institution. Additionally, there is a website that provides a comprehensive discussion.



Figure 1. The Module's Layout



Figure 2. Website Interface

Test Result

Material Expert Validation

Material Validation Results by Expert Lecturers in the field of Dressing was carried out by Dr. Firmanul Catur Wibowo, M.Pd. With the following results.

Table 3. Validation of Material Experts

No	Indicator	Score	Category
1	The alignment of the material with the 2013 curriculum.	4	Agree
2	The alignment of the material with core competencies and basic competencies.	5	Strongly Agree
3	The alignment of the solar system operation material for Grade VII junior high school students.	4	Agree
4	The alignment of the solar system material	5	Strongly Agree
5	The alignment of the material with the students' level of understanding	5	Strongly Agree
6	The alignment of the material with students' abilities	4	Agree

No	Indicator	Score	Category
7	The alignment of the material with student learning	5	Strongly Agree
8	Helping students understand the solar system material	4	Agree
9	Assisting students in developing cognitive skills in the solar system material	5	Strongly Agree
10	The presentation of the material can enhance children's knowledge of the solar system.	5	Strongly Agree
Amount		46	
Average		4.6	

Based on the validation results, the Planetary Pop-Up media developed falls into the category deemed suitable for use by science teachers to aid in delivering lessons on the solar system structure to junior high school students.

Media Expert Validation

Media Validation Results by Expert Lecturers in the field of Dressing was carried out by Dr. Firmanul Catur Wibowo, M.Pd. With the following results.

Table 4. Validation of Material Experts

No	Indicator	Score	Category
1	The safety of the materials used	4	Agree
2	The attractiveness of the design of the Planetary Pop-Up media	4	Agree
3	The clarity of images in the Planetary Pop-Up media	4	Agree
4	The images used are tailored to the seventh-grade junior high school solar system learning material.	5	Strongly Agree
5	The appropriateness of the color composition in Planetary Pop-Up	4	Agree
6	The color combination used is adjusted to fit the solar system material.	4	Agree
7	The design's suitability to the physical form.	4	Agree
8	The appropriateness of the font type used.	5	Strongly Agree
9	The variety of media used.	4	Agree
10	The effectiveness of the media in developing students' skills and knowledge.	5	Strongly Agree
Amount		43	
Average		4.3	

Based on the validation results, the Planetary Pop-Up media developed falls into the category deemed suitable for use by science teachers to aid in delivering lessons on the solar system to seventh-grade junior high school students.

Evaluation Result

The product was tested in a class of 32 seventh-grade students. Evaluation of the product was conducted by distributing a questionnaire to assess student satisfaction with the media developed by the researchers.

Table 5. Evaluation Result

No	Indicator	Score	Category
1	Do you like the colors used in the Planetary Pop-Up media?	4.4	Agree
2	Do you like the images in the Planetary Pop-Up media?	4.3	Agree
3	Are the images in the Planetary Pop-Up media clear?	4.3	Agree

No	Indicator	Score	Category
4	Do you like the design of the Planetary Pop-Up media?	4.5	Strongly Agree
5	Is the material in the Planetary Pop-Up media easy to understand?	4.5	Strongly Agree
6	Did you find it easy to learn about the solar system using the Planetary Pop-Up media?	4.4	Strongly Agree
7	Do you understand the material about the solar system after using Planetary Pop-Up?	4.6	Strongly Agree
8	Do you know about the solar system after using Planetary Pop-Up?	4.5	Strongly Agree
9	Were you able to complete the questions after using Planetary Pop-Up?	4.6	Strongly Agree
10	Do you like the Planetary Pop-Up media?	4.8	Strongly Agree
Amount		44.9	
Average		4.49	

Based on the testing results of Planetary Pop-Up conducted with 32 eighth-grade students at SMP Negeri 14 Bogor, it can be concluded that it is highly suitable.

CONCLUSIONS

The development of Planetary Pop-Up learning media integrated with a website is an initiative that has been carried out through a research and development (R&D) method approach and the ADDIE development model. The principal objective of this development is to address the learning requirements of students at SMP Negeri 14 Bogor, particularly with regard to the provision of efficacious and interactive learning instruments for the comprehension of material pertaining to the solar system. The production of this media has been specifically designed in accordance with the curriculum and learning characteristics of students at State Junior High School 14 Bogor, with the objective of facilitating optimal comprehension of complex material, such as that pertaining to the solar system. The findings of the research demonstrate that the Planetary Pop-Up media is capable of meeting the requisite standards for effectiveness as a learning tool. The findings of this study indicate that the implementation of Planetary Pop-Up learning media is a highly feasible and effective approach to supporting students' learning at State Junior High School 14 Bogor. This is evidenced by the results of student evaluations, which yielded an 88.81% success rate. It is this researcher's hope that the use of this media will have a positive impact on students' understanding and mastery of concepts related to solar system material, and that it will become one of the innovative solutions in improving the quality of education in the school.

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