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Contextual Aspect Of PjBL-Based Physics Module On Planetary Motion In The Solar System For 10th Grade Students

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ABSTRACT

Module is a learning material needed by learners to study independently. According to the Buck Institute for Education, PjBL is a teaching method in which learners build understanding of a topic or subject matter through various problem-solving activities, enabling them to enhance learning outcomes and creativity. This study utilized the research and development (R&D) method. The Research and Development method encompasses several types. In this study, the 4-D development model was employed. The results obtained from this research can be concluded as follows: firstly, the PjBL-based module on planetary motion in the solar system for 10th grade, which has been validated by experts. The calculation of expert validation yielded a validator score of 75%, indicating it falls within the category of "appropriate" or "suitable". Therefore, the results obtained from the development of the PjBL-based module on planetary motion in the solar system in Physics indicate that it is appropriate to be used in the teaching and learning process by educators for learners..

INTRODUCTION

The aim of education is to cultivate a conducive learning environment, where both students and instructors can contribute to growth as learners (Fitri, 2021). Instructors are frontline workers who engage with students in their roles as subjects and objects of study (Damanik, 2019). To assist those who are unaware to become knowledgeable, teachers act as guides who show the way to information. In order for learning to proceed smoothly, a teacher must possess several skills, such as those related to method selection, content mastery, attitude, and the creation of instructional media or materials (Sari & Anggreni, 2018).

The materials used in the classroom that contribute to students' collective learning are referred to as "teaching materials" (Nursyana & Desiningrum, 2020). The term "module" refers to a specific type of educational resource. This helps teachers overcome resource scarcity by creating additional learning

modules (Friantini et al., 2020). Systematically organized lessons that students can use independently to acquire desired skills and knowledge are called "learning modules" (Puspita, 2019). The learning module is a sequence of lessons built around the individual needs of students (Widiya, et al., 2021). Modules are a type of educational content created to assist instructors in delivering knowledge to their students (Sangib & Muhib, 2019). Written modules are designed to allow students to learn at their own pace. The learning activities within the module are structured to help students achieve predetermined learning outcomes, making the module a self-contained unit (Friatini, et al., 2020).

Project-based learning (PjBL) is a teaching method in which students construct their understanding of a topic and demonstrate what they have learned through various presentations (Erlinawati, et al., 2019). According to Surya, et al. (2018), learning outcomes are the changes that occur in students as a result of learning activities, which include changes in knowledge, attitudes, and skills. According to Surya, et al. (2018), creativity is the ability to create something unique and difficult to imitate by others; the result is something new that is, of course, functional. Project-based learning (PjBL) is an educational approach aimed at enhancing students' ability to learn and their capacity to express their unique creativity through various engaging and interactive projects. Students can benefit from this PjBL learning paradigm in several ways, including exposure to new ideas and experiences, improved learning outcomes, and a more inventive approach to problem-solving and product development (Surya, et al., 2018).

METHOD

The method used in this research is the research and development (R&D) method. It utilizes the 4D model (Four D model) of development. The 4D model was developed by Thiagarajan (Utami *et al*., 2018). In this 4D development model, there are four stages: defining, designing, developing, and disseminating. However, in this study, the conducted stages consisted of three steps, specifically up to the development stage or "develop."

In the defining stage, it consists of steps such as analyzing the background and identifying a problem. It involves establishing and defining development requirements and includes initial analysis (front-end analysis), student analysis, task analysis, concept analysis, and learning objective analysis (Damayanti et al., 2019). In the second stage, the design stage, it involves the preparation or process of designing the initial sketch or design of the learning module. In the third stage, the development stage, it is the process of modifying the media based on the assessment results. The validity test in this research aims to determine the validity of the created module. Validation is conducted by expert assessors, who are experienced professors in their respective fields. In the fourth stage, Disseminate, the aim is to distribute the developed learning module to high schools at the secondary education level (SMA/MA) (Musril et al., 2020). The data collection techniques used in this study include literature review and validation.

Calculating the average of the obtained scores using the formula below:

$$\bar{x} = \frac{\sum x}{n}$$

Explanation: $\bar{x}$ = average

$\sum x$ = the total score obtained

n = the number of validators

Calculating the percentage of assessment results using the formula:

$$\text{Results} = \frac{Total\ obtained}{Maximum\ score} \text{ x } 100\%$$

RESULT AND DISCUSSION

The development of this module is in the form of a learning module, which is structured based on the stages of *Project-Based Learning* in the topic of planetary motion in the solar system for 10th-grade students. The objective is to obtain a well-designed learning module. The procedure for developing this module follows the 4D development model (*Define, Design, Develop, and Disseminate*).

a. The *Define* stage (Defining stage)
   In this stage, an analysis of module development is conducted, focusing on learning objectives and student analysis. The analysis results of module development in learning objectives are incorporated into the module, specifying the learning objectives for each sub-topic in accordance with the competency standards (KD). The results of student analysis indicate that students prefer learning related to simple and practical things because they believe that simple and practical concepts are easier to understand and remember. Based on the findings of the analysis, as authors, we took the initiative to create or design a module that is well-received by students and helps achieve the learning objectives.
b. The *Design* stage
   After conducting the analysis, the next step is to design the module by conducting a literature review from various references related to the content of the module to be created, in accordance with the predetermined competency standards (KD). The first step that needs to be taken in creating a *Design* is to make an initial draft consisting of a title, table of contents, and concept map. Finally, structure the content framework of the module, which consists of subtopic materials, exercise questions, and a *Projeck* that students must understand and follow carefully. The results of the module design stage are as follows.

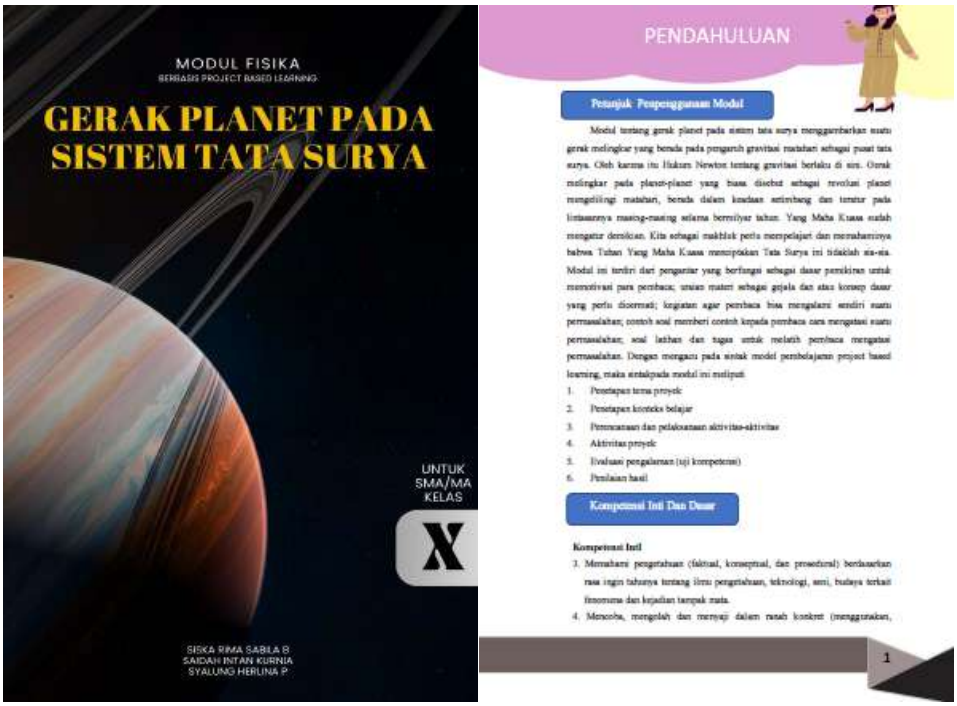

Figure 1. Cover and Introduction

Figure 1 above shows the design of the cover and introductory pages of the PjBL-based module being developed. The introductory pages contain instructions for module usage, core competencies, and basic competencies, as well as the main subject matter. The components on the introductory pages also provide brief information so that readers can understand what will be learned in this module.

Figure 2. Learning activities.

Figure 2 is an example of learning activities in the module. This page contains various materials, tasks, and projects that will be discussed in each session. Additionally, there are achievement indicators aimed at assessing learning outcomes in each session.

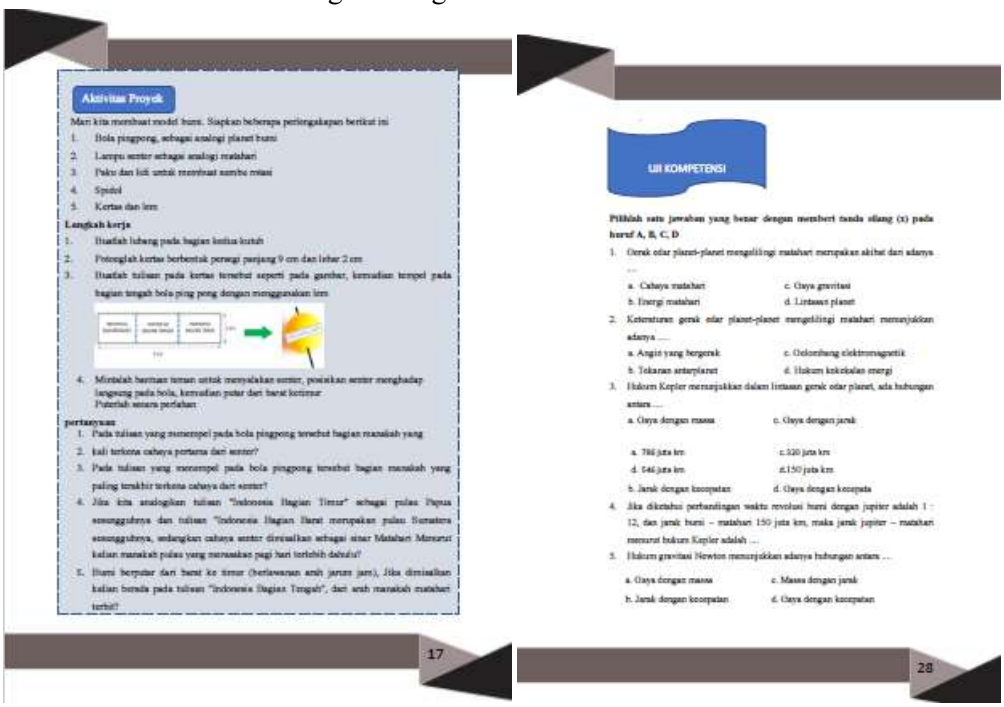

Figure 3. Project activities and competency assessments.

This module also includes project assignments that are carried out through direct practical application to enhance students' creativity during the learning process. Additionally, to assess students' abilities and learning achievements, this module also contains evaluation questions accompanied by answer keys and scoring guidelines, allowing students to gauge their proficiency in understanding the motion of planets in the solar system.

c. The *Develop Stage*

This stage is the module development stage according to the previously established framework. The *develop* stage can also be described as the process of materializing the earlier design into reality, which involves writing the module and its development based on predetermined criteria. Module development accommodates contextual learning components, including constructivism, discovery, questioning, reflection, and authentic assessment. After creating the module, contextual aspects are then validated by contextual experts to determine the suitability of the module for use. If there are any shortcomings, the module will be revised until it is deemed valid.

Based on the obtained validation results, the score for students' ability to connect the material with its application in daily life is 3. Additionally, constructivism also obtained a score of 3. Therefore, the validator's results are as follows:

$$Results = \frac{The\ total\ score\ obtained}{The\ maximum\ score} \times 100\%$$

$$Result = \frac{3+3}{4+4} \times 100\%$$

$$Result = \frac{6}{8} \times 100\%$$

$$Result = 75\%$$

From the calculations above, the overall score obtained from the validation results by the validator is 75%, categorizing it as acceptable. Thus, the results obtained from the development of the Physics Module based on *Project-Based Learning* (PjBL) on Planetary Motion in the Solar System are deemed suitable for use in the learning process.

d. The *Dissemination* Stage

The final stage is the *Dissemination Stage* or the dissemination phase. Based on the validation results provided by the validator above, the Physics Module based on *Project-Based Learning* (PjBL) on Planetary Motion in the Solar System is deemed suitable for use by students. Therefore, this module is ready to be disseminated to students as a medium to facilitate learning activities. Through this module, it is expected that learning can be more student-centered, focusing on fostering students' creativity, while the teacher acts as a facilitator. This approach, which places the student at the center of learning, increases the likelihood that the material will be easier to understand and effectively absorbed by the students.

CONCLUSION

The research findings concluded that, firstly, the PjBL-based module on the topic of planetary motion in the solar system for grade X has been validated by experts. The validation process conducted by the experts yielded a validator score of 75%, which can be categorized as acceptable. Therefore, based on the obtained results, the Physics Module based on PjBL on the topic of planetary motion in the solar system is deemed suitable to be used in the learning process by educators for the students.

REFERENCES

Damanik, R. 2019. The relationship between teacher competence and teacher performance: *A study in the Journal of Educational Administration.* 8(2):1-8.

Damayanti, P. A., dan A, Qohar. 2019. The development of interactive mathematics learning media based on PowerPoint for the topic of cones: *A study in the Journal of Creative and Innovative Mathematics.* 10(2): 119-124.

Erlinawati, C. E., S. Bektiarso, & Maryani. 2019. *Project-Based Learning* Model Based on STEM in Physics Education. *Fkip E-Proceeding.* 4(1):1-4.

Fitri, S. F. N. 2021. The Issues of Education Quality in Indonesia: *A study in the Tambusai Education Journal*. 5(1):1617-1620.

Friantini, N. R., Winata, R., Permata, I. J. 2020. The Development of Contextual Module on Social Arithmetic for Grade 7 Junior High School: A study in Cendekia Journal: Journal of Mathematics Education. 4(2): 562-576.

Nuryasana, E., & N. Desiningrum. 2020. The Development of Teaching and Learning Materials on Instructional Strategies to Enhance Students' Learning Motivation: *A study in the Journal of Research and Innovation.* 1(5):967-974.

Musril, H. A., J., M, Hurrahman. 2020. The Implementation of Virtual Reality Technology in Computer Assembly Learning Media: *A study in the National Journal of Technical Informatics Education.* 9(1) : 83-95.

Puspita, L. 2019. The Development of Process Skills-Based Module as Teaching Materials in Biology Education: A study in the Journal of Science Education Innovation. 5(1): 79-88.

Sangid, A., & M. Muhib. 2019. The Strategy of Muhadatsah Learning. *Tarling: Journal of Language Education*. 2(1):1-22.

Sari, T. R., Anggreni, S. 2018. The Implementation of Project-Based Learning (PjBL) Model: Efforts to Enhance Students' Creativity. A study in Varia Pendidikan journal. 30(1): 79-83.

Surya, A. P., Relmasira, S. C., Hardini A. T. A. 2018. The Implementation of Project-Based Learning (PjBL) Model to Improve Learning Outcomes and Creativity of Grade 3 Students at Sidorejo Lor 01 Public Elementary School in Salatiga: A study in Pesona Dasar Journal. 6(2): 41-54.

Utami, R. E., A. A. Nugroho., dan I, Dwijanti. 2018. The Development of E-Module Based on Ethnomathematics to Enhance Problem-Solving Skills: *A study in the National Journal of Mathematics Education.*2(2): 268.

Widiya, M., E. Lokaria, & S. Sepriyaningsih. 2021. The Development of Science Learning Module Based on Local Wisdom for Upper Grades in Primary School: *A study in the Basicedu Journal.* 5(5):3314-3320.

