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Analysis of Acceptability of Photosynthesis Material Teaching Module Based on Project Based Learning for NS Learning for Grade IV Elementary Schools

Agam Aris Munandar[1] | **Dede Tri Kurniawan**[2] | **Yunus Abidin**[3] |

Affiliation:
[1,2,3] Universitas Pendidikan Indonesia, Bandung, Indonesia

Correspondence:
Jl. Raya Cibiru KM 15 Bandung 40393, Jawa Barat, 40625, Indonesia.
Email:
agamarism@upi.edu

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Abstract
This study aims to analyze the acceptability of a teaching module on photosynthesis material based on Project-Based Learning (PBL) for Natural Science (NS) learning in Grade IV elementary schools. The module was developed to enhance student engagement, self-regulation, and goal orientation in learning. The research employed a quantitative approach using the Structural Equation Modeling - Partial Least Squares (SEM-PLS) method to examine the relationships among user activity, user self-control, and goal orientation. Data were collected through questionnaires administered to teachers and students, focusing on their perceptions and experiences with the teaching module. The results indicate a significant positive relationship between user activity and user self-control, which collectively influence goal orientation. These findings suggest that the PBL- based module effectively supports active learning and self-regulated behaviors, ultimately fostering goal-oriented learning outcomes. This research provides valuable insights for educators and curriculum developers to design innovative instructional materials that promote active and independent learning in elementary education.

Keywords: Photosynthesis Material, Teaching Module, Project Based Learning

1. INTRODUCTION

INatural Science (IPA) is one of the most important subjects in education, particularly at the elementary and secondary levels. It plays a crucial role in developing students' understanding of natural phenomena, scientific laws, and the relationship between humans and the environment. The objectives of science learning are not limited to introducing facts and concepts, but also include fostering critical thinking, analytical skills, and problem-solving abilities through a scientific approach. As a subject grounded in observation and experimentation, science has great potential to stimulate students' curiosity and motivate them to explore the world around them (Herlambang, 2021; Herlambang & Abidin, 2022; Permana et.al., 2024).

One of the essential topics in science learning is photosynthesis, a fundamental concept that explains the life cycle of plants and their role in maintaining ecosystem balance

(Dwilestari & Desstya, 2022; Nurfauziah et al., 2024). However, learning about photosynthesis often faces obstacles, such as low student enthusiasm and difficulties in understanding abstract concepts. Therefore, innovative learning approaches that are relevant to students' needs are required (Yunansah et.al., 2022; Wahid et.al., 2023; Wahid & Asrina, 2024).

A teaching module is a learning tool or instructional design developed based on the curriculum to achieve predetermined competency standards. The module functions as a primary support for teachers in planning the learning process. In its development, the role of teachers is very important, as they are expected to think creatively and innovatively in designing such modules (Nurdyansyah, 2018; Nesri & Kristanto, 2020). Thus, teachers' ability to create teaching modules becomes one of the pedagogical competencies that must continuously be improved. This ensures that classroom learning can run more effectively and efficiently while remaining focused on the established achievement indicators (Maulida, 2022; Salsabilla & Nurhalim, 2024).

In addition, the use of teaching modules supports the implementation of a curriculum that provides flexibility for teachers to design instruction according to students' needs and characteristics. This curriculum promotes a student-centered approach that emphasizes active, personalized, and meaningful learning experiences. One approach that can be applied is Project-Based Learning (PjBL). This approach allows students to be actively involved in the learning process through exploration, investigation, and project completion activities. As a result, students not only understand concepts theoretically but also apply them in real-life contexts (Yulaikah et al., 2022; Ardania & Yusro, 2023).

The PjBL-based learning model begins with an explanation of learning objectives and encourages students to participate actively in problem solving. The problems presented are discussed by students, and the results of the discussion are then presented. At the end of the activity, the teacher facilitates students' reflection on the material learned. A PjBL-based teaching module for photosynthesis is designed to help teachers manage learning that is more interactive, contextual, and meaningful (Ulya et al., 2023; Nurhasanah et al., 2024). This module is expected to increase student engagement, strengthen conceptual understanding, and develop 21st-century skills such as critical thinking, collaboration, and creativity. However, the success of implementing this module depends on the level of acceptance from various stakeholders, especially students and teachers

2. METHOD

The methodology used in this study is a quantitative approach employing a correlational survey model. Quantitative research is an approach that utilizes numerical data and statistical calculations for analysis, as explained by Millena and Jesi (2021). This method involves the implementation of a teaching module and the development of a questionnaire on a Project-Based Learning (PjBL)-based photosynthesis module. The

variables examined are User Activity (UA), User Self-Control (USC), and Goal Orientation (GO). Each variable is measured using five items on a five-point Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree."

The collected data are analyzed using the Structural Equation Modeling (SEM) approach with Partial Least Squares (PLS), which serves as an alternative method to complement previous analytical approaches.

Result

Before conducting the analysis of teaching module acceptance, respondents need to be classified based on their learning experience and employment status:

3. RESULT AND DISCUSSION

tabel 1. Characteristic Quality

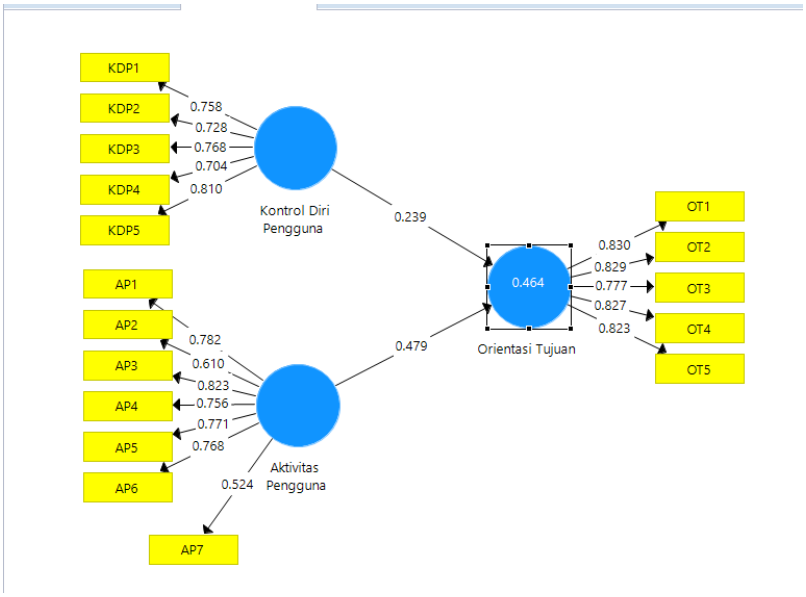
Characteristic	Quantity	Percentage
Learning Experience		
1-10	80	80%
11-20	15	15%
>20	5	5%
Employement Status		
ANS	65	65%
NON PNS	35	35%

Validity and reliability tests were conducted to ensure that the research instrument accurately and consistently measures the intended variables. Validity was tested using the Pearson Product Moment correlation to confirm that each item has a significant correlation with the total score. Reliability was assessed using Cronbach's Alpha, where an instrument is considered reliable if the value exceeds 0.7, indicating good internal consistency in measurement (Ghozali, 2018; Sugiyono, 2019).

Tabel 1. Validity Variabel

Variable	Indicator	Outher Loading
User Activity	AP1	0,782
	AP2	0,610
	AP3	0,823
	AP4	0,756
	AP5	0,771
	AP6	0,768
	AP7	0,524
User Self-Control	KDP1	0,758
	KDP2	0,728
	KDP3	0,768
	KDP4	0,704
	KDP5	0,810
goal orientation	OT1	0,830
	OT2	0,829
	OT3	0,777
	OT4	0,827
	OT5	0,823

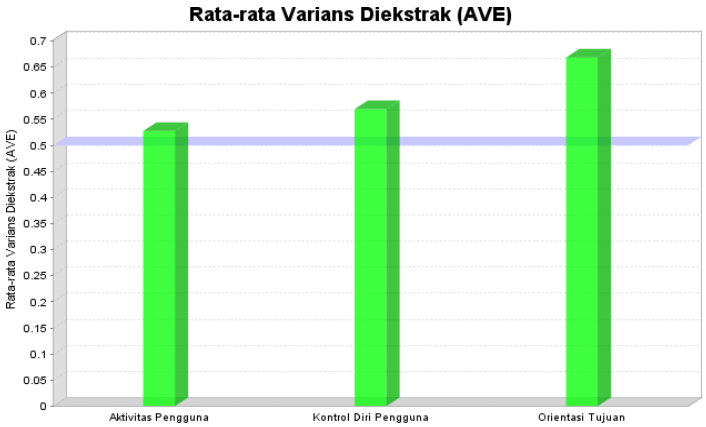
Picture.1 Boostraping Variabel



Based on Table 1 and Figure 1, the outer loading results indicate that two indicators have values below the threshold of 0.7. These indicators were removed because they did not meet the minimum validity criteria. After removal, only indicators with outer loading values greater than 0.7 were retained, ensuring that all remaining indicators are valid and suitable for further analysis. This process is consistent with the convergent validity guidelines in SEM-PLS analysis, where a minimum outer loading value of 0.7 is required to demonstrate indicator consistency in measuring its construct (Hair et al., 2021).

In addition, the indicator used to assess convergent validity in this research model is the Average Variance Extracted (AVE). A variable is considered to have good convergent validity if its AVE value exceeds 0.5, indicating that more than 50% of the construct variance can be explained by its indicators. Therefore, AVE values that meet this criterion are considered acceptable as they demonstrate adequate internal consistency of the construct (Hair et al., 2021).

Picture 2. Diagram Validty



tabel 2. Diagram Validty

Variable	*Average Variance Extracted* (AVE)	Description
User Activity	**0,527**	**Valid**
User Self-Control	**0,569**	**Valid**
Goal Orientation	**0,668**	**Valid**

tabel 2. Diagram Description

Variable	Cronbach's Alpha	Combatch's Alpha Reability	Description
User Activity	**0,845**	**0,885**	**Reliabel**
User Self-Control	**0,811**	**0,868**	**Reliabel**
Goal Orientation	**0,876**	**0,910**	**Reliabel**

The obtained Cronbach's alpha values indicate that the variables have adequate reliability, with each variable reaching a value of 0.7 or higher. This suggests that the use of learning media has a significant impact on the expected outcomes.

Based on the statistical analysis, hypothesis testing was conducted using a significance level (p-value) of 0.05 as the decision threshold. If the obtained p-value is less than 0.05 ($p < 0.05$), the null hypothesis (H_0) is rejected, indicating a significant effect of web-based learning media usage. Conversely, if the p-value is greater than 0.05 ($p > 0.05$), H_0 is accepted, indicating no significant effect. This analysis was performed using the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method, which allows simultaneous and in-depth analysis of relationships among variables. The SEM-PLS results are presented as follow.

Tabel.3. P Value

Variabel	P-Value
AP->OT	0,479
KDP->OT	0,239

Based on the results presented in the table, several key findings can be drawn from the data analysis. First, user activity shows a significant positive effect on goal orientation in the acceptance and use of the Project-Based Learning (PjBL)-based photosynthesis teaching module. Second, users' self-control also has a significant positive effect on goal orientation in the acceptance and use of the PjBL-based photosynthesis teaching module.

The data analysis indicates that both factors—user activity and users' self-control—have a significant influence on goal orientation in the acceptance and use of the PjBL-based photosynthesis teaching module. These findings suggest that students' active engagement in the learning process and their ability to regulate themselves contribute to better achievement of learning objective

Discussion

This study reveals that user activity has a significant positive effect on goal orientation in the acceptance and use of Project-Based Learning (PjBL) instructional modules. User activity refers to the extent to which students are engaged in exploration, investigation, and project completion, all of which are integral components of the module. The more actively students participate at each stage of the learning process, the higher their level of understanding and achievement of the intended learning objectives. This finding aligns with the core principles of project-based learning, in which students' active involvement in solving real-world problems enhances conceptual understanding and its application in everyday life.

User self-regulation is also proven to have a significant positive effect on goal orientation in the use of instructional modules. Self-regulation refers to students' ability to manage time, tasks, and challenges encountered during the learning process. In the context of PjBL-based modules, students with strong self-regulation are better able to complete tasks effectively, remain focused on

learning goals, and overcome obstacles that may arise during project implementation. The ability to self-manage is essential in project-based learning, which often requires flexible time management and independent organization.

The relationship between user activity and self-regulation in the PjBL context indicates that these two factors complement each other in achieving the desired goal orientation. High levels of activity become more effective when supported by strong self-regulation, as students with good self-management skills are more likely to maintain consistency in their activities, complete projects in a structured manner, and develop a deeper understanding of learning objectives. Therefore, the development of both factors in project-based learning is crucial for improving educational quality.

4. CONCLUSION

The findings of this study emphasize that active student engagement and self-regulation are key factors in achieving better learning outcomes, particularly in the acceptance and use of Project-Based Learning (PjBL) instructional modules. Active engagement enables students to participate directly in the exploration, investigation, and completion of real-world projects, which not only enhances their understanding of learning concepts but also promotes practical application in daily life.

On the other hand, self-regulation equips students with the ability to manage time, tasks, and challenges effectively throughout the learning process, ensuring that they remain focused on learning goals and are able to overcome potential obstacles. The combination of these two aspects not only supports the achievement of desired learning outcomes but also strengthens the development of 21st-century skills such as critical thinking, collaboration, creativity, and independence.

Therefore, efforts to foster active engagement and self-regulation among students should become a primary focus in the design of PjBL-based instruction. Educators and educational stakeholders need to design strategies that encourage active student participation while simultaneously helping learners build strong self-management skills. This approach ensures that PjBL not only delivers optimal academic outcomes but also equips students with essential skills to face future challenges.

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