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The Readability of a Project-Based Learning E-Module in Natural and Social Sciences for Grade 5 Students

Rahyu Setiani[1)], Rohmatus Syafi'ah*[2)]
1. Master of Mathematics Education, Postgraduate Program, Bhinneka PGRI University, Indonesia
Email address : rahyusetiani@gmail.com
2. Department of Science Education, Faculty of Social and Humanities, Bhinneka PGRI University, Indonesia
Email address : syafiahzainul@gmail.com

Abstract - This study addresses the scarcity of pedagogically robust and interactive digital materials by developing an innovative e-module for Natural and Social Sciences (IPAS) in Grade V elementary school, which is based on a Project-Based Learning (PBL) approach. Using a Research and Development (R&D) design with a modified ADDIE model, the e-module underwent validation by three experts in subject matter (90.97%), media (87.12%), and language (88.89%), confirming its high validity. A limited-scale readability test with 25 students further demonstrated its effectiveness, with a "very good" score of 93.15%. These results confirm the e-module is accurate, well-organized, visually engaging, and effective in promoting independent, deep learning through integrated interactive elements like videos, quizzes, and exploratory tasks. However, the study's limitation to a single school constrains the generalizability of these findings. Future research should therefore focus on testing the e-module's effectiveness in broader contexts and exploring the integration of adaptive technologies to enhance its personalization and sustainability.
Keywords: E-module, IPAS, Project Based Learning, Validation, Readability.

I. INTRODUCTION

Elementary education is a crucial foundation for fostering students' critical and scientific thinking abilities [1]. Within the context of the Merdeka Curriculum, the Natural and Social Sciences (IPAS) subject is designed to integrate conceptual understanding with real-life contexts, encouraging students to think analytically and holistically [2]. However, implementation often faces challenges in the field, where IPAS instruction remains predominantly theoretical and lacks contextual relevance, relying heavily on conventional media such as textbooks. This approach is frequently ineffective in sparking student interest, as they now demand more interactive and visual learning methods [3], leading to suboptimal deep understanding of IPAS concepts.

Various studies show the positive contribution of digital media to improved student learning outcomes. Recent studies, for instance, found that animated videos were effective in enhancing IPAS learning outcomes at the elementary level [4]. Similarly, other research has demonstrated that the development of interactive e-modules successfully increased the motivation and cognitive learning outcomes of fifth-grade students in science [5]. Although these media have a positive impact, their development is often limited to the digitalization of printed content, lacking a strong pedagogical framework to foster higher-order thinking skills (HOTS). This gap indicates the need for media innovation that goes beyond simple format conversion, instead facilitating a deeper and more meaningful thought process.

This study's novelty lies in integrating interactive online quizzes, such as Wordwall and Wizerme, into the e-module, which has been shown to significantly boost student motivation and engagement in learning. This integration addresses several limitations found in previous research. For example, studies by Rusni [6] and Pratiwi [7] developed effective and valid e-modules but did not specifically integrate interactive online quizzes linked directly to external reference sources, making the student learning experience less personalized and adaptive. Another study by Lestari [8] integrated videos but did not explicitly measure their effectiveness within a project-based learning context or assess student response to the module's overall readability. This e-module is equipped with links to articles and videos as supplementary reference sources, a strategy recognized for enriching the learning experience and promoting digital literacy [9].

To address this gap, this study develops an IPAS learning e-module that is both interactive and based on a Project-Based Learning (PBL) approach. The PBL concept, centered on real-world projects and problem-solving, is specifically designed to engage students in an inquiry process and connect IPAS concepts with practical challenges, encouraging them to construct their own understanding. While many studies have examined e-modules or PBL separately, no research has integrated these two components within a single development study. To date, there is no specific research that has developed an IPAS learning e-module by integrating a PBL pedagogical framework for fifth-grade elementary students. Therefore, this research is highly urgent and relevant.

The urgency of this research lies in the effort to fill the void of teaching media that is not only substantively valid but also capable of effectively implementing the Project-Based Learning (PBL) approach digitally. This is crucial given that digital media plays a central role in optimizing PBL and training 21st-century skills [10]. Thus, this study not only measures how readable this e-module is but also how well the module succeeds in creating a positive learning experience and supporting a deeper conceptual understanding for students.

II. METHODS

This study employed a Research and Development (R&D) design with a modified ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The

modification focused on the first three stages analysis, design, and development to produce an IPAS learning e-module integrated with a Project-Based Learning (PBL) approach.

The subjects of this study were fifth-grade students at SD Negeri 2 Mulyosari, Tulungagung Regency. Data collection was carried out using two main instruments: expert validation questionnaires and student readability questionnaires. The validation questionnaires were measured using a Likert scale and validated by three experts in the fields of material, media, and language, including a practicing teacher. The validation criteria covered material consistency, organization, writing systematics, and the module's ability to support independent learning and PBL. Media validity was evaluated based on layout, responsiveness, and visual appeal, while language validity was assessed based on spelling, grammar, and interactive style.

A quantitative descriptive analysis method was used to evaluate the validity and readability of the IPAS e-module. The research data was obtained through the percentage of assessment results derived from the Likert scale. This scale served to convert variables into indicators measured through a series of statements. Each item was given a quantitative score on a four-point scale (4=Strongly agree, 3=Agree, 2=Disagree, 1=Strongly disagree). Subsequently, the response percentage was calculated using the following formula:

$$percentage = \frac{\text{obtained score}}{\text{maximum score}} \text{x } 100\%$$

The resulting percentage was then interpreted based on established criteria. The e-module was categorized as very valid or very good according to the provided tables.

Table 1. Interpretation of IPAS E-Module Validity Assessment Scores

Percentage (%)	Criteria
81.26 – 100.00	Very valid
62.51 – 81.25	Valid
43.76 – 62.50	Moderately valid
25.00 – 43.75	Not valid

Source: Adapted from [11]

Table 2. Interpretation of IPAS E-Module Readability Assessment Scores

Percentage (%)	Criteria
76 – 100	Very good
51 – 75	Good
26 – 50	Not good
0-25	Very not good

Source: Adapted from [12]

III. RESULTS AND DISCUSSION

A. Results

The results of this IPAS e-module development study were validated by three expert validators (V1, V2, V3) and their readability was tested by 25 students. The data were analyzed using quantitative descriptive methods to determine the product's validity and readability levels.

Before the final assessment, the validators provided suggestions for improvement that served as the basis for the e-module's revisions. The material expert provided guidance on adhering to scientific writing rules, such as italicizing the foreign term Project Based Learning on the cover. They also suggested replacing a technical term like "bifocal" with a simpler word to be more easily understood by elementary school students. Meanwhile, the media expert suggested improvements to the visual and layout aspects, including using different font colors for keywords, adjusting image proportions, and arranging balanced spacing in the answer columns. Other suggestions from the media expert included changing the background color that could be visually distracting, varying cartoon images to avoid monotony, adding thin frames to images, and adjusting the format of broken tables and using dark fonts on light backgrounds. Furthermore, the language expert recommended simplifying overly complex sentences and replacing them with vocabulary more familiar to elementary school students. All these suggestions were implemented by the researcher to refine the product, ensuring the e-module is not only substantively valid but also appealing and easily accessible. After the revisions, the validators reassessed the developed product, with the results outlined as follows.

Table 3. Recapitulation of Validation Results from Material Experts

Aspect	Assessment Indicators	V1	V2	V3	Average((%)	Criteria
Consistency	Accuracy of scientific concepts aligned with IPAS learning outcomes.	4	3	4	91.67	Very Valid
	Consistency of scientific terms and symbols.	4	4	3	91.67	Very Valid
Organizatio n	Logical and systematic presentation flow.	3	4	4	91.67	Very valid
	Complete module structure	3	3	4	83.33	Very valid
	Illustrations reinforce understanding.	3	4	4	91.67	Very valid
Writing Systematics	Introduction contains background and description.	4	4	3	91.67	Very valid
	Discussion contains material competencies, etc.	3	4	3	83.33	Very valid
	Answer key & bibliography follow scientific principles.	3	4	4	91.67	Very valid
Support for Independent Learning	Material is designed for independent learning.	4	4	4	100.00	Very valid
Project-Based Learning Approach	Material supports elaboration, reflection, and conceptual links.	4	3	3	83.33	Very valid
	Contains open-ended questions and project-based exploratory	4	4	3	91.67	Very valid

Aspect	Assessment Indicators	V1	V2	V3	Average((%)	Criteria
	tasks to delve into deep understanding.					
	Equipped with interactive quizzes, videos, and animations that make learning meaningful and enjoyable.	4	4	4	100.00	Very valid
Overall Average					**90.97**	**Very valid**

Table 4. Recapitulation of Validation Results from Media Experts

Aspect	Assessment Indicators	V1	V2	V3	Average((%)	Criteria
Consistency	Consistency of layout, colors, icons, and images.	3	4	4	91.67	Very Valid
	Clear and easy e-module navigation.	3	3	4	83.33	Very Valid
Format	Responsiveness on various devices (gadgets, laptops).	3	3	4	83.33	Very valid
	Proportional page format.	3	4	3	83.33	Very valid
Appeal	Visually appealing suitable for elementary students' characteristics.	4	4	3	91.67	Very valid
	Multimedia supports learning engagement	4	3	4	91.67	Very valid
E-module Characteristics	Self-instructional	3	4	4	91.67	Very valid
	Stand-alone	3	3	3	75.00	Valid
	Adaptive	4	3	4	91.67	Very valid
Support for Project-Based Learning	Interactive and encourages exploration, discussion, and student thinking.	3	4	4	91.67	Very valid
	Visuals and project activities in the e-module support deep conceptual understanding.	3	4	4	91.67	Very valid
Overall Average					**87.12**	**Very valid**

Table 5. Recapitulation of Validation Results from Language Experts

Aspect	Assessment Indicators	V1	V2	V3	Average((%)	Criteria
Consistency	Spelling and grammar consistent with PUEBI guidelines	3	4	4	91.67	Very Valid
	Consistency in language style	3	4	3	83.33	Very Valid
Organization	Sentences and paragraphs are easy to understand	4	4	3	91.67	Very valid
	Logical flow between paragraphs and supports comprehension.	4	3	4	91.67	Very valid
Appeal	Communicative and motivating language	4	4	3	91.67	Very valid
	Simple word choice, suitable for elementary students' level	4	3	4	91.67	Very valid
Overall Average					**88.89**	**Very valid**

Table 6. Recapitulation of E-Module Readability Questionnaire Results

Aspect	Indicator	Total Score	Percentage (%)	Criteria
Material	The e-module helps students learn online	92	92.0	Very good
	The material is presented clearly and facilitates understanding	94	94.0	Very good
	Learning activities are arranged in a systematic step-by-step manner	90	90.0	Very good
	The sentences used are easy for students to understand	95	95.0	Very good
	Symbols or icons on the e-module are easy to understand	91	91.0	Very good
	The videos displayed facilitate understanding of material concepts	92	92.0	Very good
	Instructions for use are clear and easy to understand	94	94.0	Very good
	The e-module encourages students to learn independently according to their abilities	90	90.0	Very good
Benefit	The e-module facilitates understanding of concepts	95	95.0	Very good
	Learning using the e-module feels fun	96	96.0	Very good

Aspect	Indicator	Total Score	Percentage (%)	Criteria
	The e-module increases student interest in IPAS material	93	93.0	Very good
	The e-module makes students more enthusiastic about learning.	92	92.0	Very good
	The e-module facilitates students' independent learning at home	93	93.0	Very good
Presentation	The text or writing is easy to read and fits the page	90	90.0	Very good
	The images used in the e-module are clear and not blurry	93	93.0	Very good
	The videos displayed are visually appealing and relevant to the material	95	95.0	Very good
	The videos help in understanding concepts more concretely	95	95.0	Very good
	The e-module provides quizzes or practice questions for self-evaluation.	96	96.0	Very good
	The language used is communicative and easy for students to understand	94	94.0	Very good
Overall Average			**93.15**	**Very good**

B. Discussion

Based on the validation results, the IPAS e-module was rated as "very valid" and suitable for use as a learning medium, with high scores from material (90.97%), media (87.12%), and language (88.89%) experts. The high material validity confirms that the e-module content is accurate and logical, aligning with IPAS learning outcomes [13]. The accuracy of scientific concepts (91.67%) is crucial for preventing misconceptions [14], while the systematic organization and effective illustrations (91.67%) support students' information processing [15].

Specifically, this e-module effectively supports the Project-Based Learning (PBL) approach through interactive features like open-ended questions, exploratory tasks, and quizzes. This design is intended to encourage elaboration, reflection, and the connection between concepts, which are core to deep learning and PBL. The media validation also showed a consistent design quality (91.67%), responsiveness (83.33%), and visual appeal (91.67%), which are important for reducing cognitive load and increasing learning motivation [16]. The linguistic quality of the e-module is also very good with a score of 88.89%, ensuring readability and a communicative language style appropriate for the understanding level of elementary students [17].

The readability test conducted on 25 students yielded a very good average score (93.15%), proving that the module is easy to understand, enjoyable, and effective in facilitating conceptual understanding [18]. Overall, this e-module is proven to be very valid and effective within a limited context. Nevertheless, further research is needed to test its effectiveness on a broader scale and to explore the integration of adaptive technologies like artificial intelligence (AI) for personalized learning in the future.

IV. CONCLUSION

The PBL-based IPAS e-module is proven to be very valid and to have excellent readability in a limited context. Nevertheless, further research in various schools with diverse student characteristics is needed to test its long-term effectiveness, and to explore the integration of adaptive technologies like artificial intelligence (AI) for personalized learning in the future

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