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Readability Analysis Of Physics Module Based On PBL For Vector And Newton Laws Material For X Grade Students In Senior High School

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Abstract. *Language validation aims to determine the accuracy of the use of language in the module. It is intended that the information to be conveyed by the module can be conveyed clearly to the reader. This research was conducted to determine the language validity of the PBL (Problem Based Learning) physics module on vector material to find out how appropriate it was for X grade students in high school. The method used in this research was a qualitative descriptive research method. By using a research procedure that was calculating the validation results obtained, then providing the criteria and categories of the percentage of the results of the assessment of the validity value. From the results of this study, the overall value of language validation was obtained, namely 81.25% with a very decent category.*

Keywords: *Validity, Module, PBL (Problem Based Learning), Vector*

Abstrak. Validasi bahasa bertujuan untuk mengetahui ketepatan penggunaan Bahasa pada modul. Hal tersebut bertujuan agar informasi yang akan disampaikan modul dapat tersampaikan dengan jelas kepada pembaca. Penelitan ini dilakukan untuk mengetahui validitas bahasa dari modul fisika berbasis PBL (Problem Based Learning) pada materi vektor untuk mengetahui bagaimana kelayakannya untuk siswa SMA kelas X. Metode yang digunakan dalam penelitian ini adalah metode penelitian deskriptif kualitatif. Dengan menggunakan prosedur penelitian yakni menghitung hasil validasi yang diperoleh, kemudian memberikan kriteria dan kategori persentase hasil penilaian dari nilai validitas. Dari hasil penelitian ini, diperoleh nilai keseluruhan validasi Bahasa yaitu 81,25% dengan kategori sangat layak.

Kata Kunci: Validitas, Modul, PBL (Problem Based Learning), Vektor

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INTRODUCTION

Because Indonesia is such a diverse country in terms of culture, ethnicity, and religion, people's lives in Indonesia are also diverse. It can be seen that Indonesia is a geographically unified country, so it becomes a country with various advantages. One of them is the dominant system in Indonesia, which goes through many changes in development, beginning with the economic, social, cultural, and even educational systems. (Agustin *et al,* 2020)

According to Haryadi *et al* (2021), every human being requires education because education allows a nation's quality to be built. Education can be defined as any human effort to understand something through the learning process. Education is a critical activity for humans. Because education allows humans to develop commendable behavior and noble character. As a result, education is one aspect that is inextricably linked to humans and cannot be separated. As a result, education is capable of guiding people in determining direction, goals, and a meaningful life. (Risdianto, 2019).

The Indonesian education system has faced numerous challenges over the years, ranging from home learning due to the Covid-19 pandemic to major issues due to numerous curriculum changes. It can be stated that education in Indonesia lags far behind that of other countries. Most students are only given material to study on their own; soft skills are inadequate and do not correspond to the school curriculum (Setiawan, 2020).

Physics is called "Fysikos" and "fysis" in Greek, which means "nature," and "physics" in English. Physics is a branch of science that deals with natural phenomena (Mukti *et al.,* 2020). Physics is a science that is intimately related to human life. There are numerous applications of physics in everyday life, such as the current form of technology. Because of the existence of heavy work, technology will benefit and become lighter. Some physics concepts are combined in one form or another of sophisticated equipment or technology. This technology is used in a variety of applications, including household appliances, industry, and transportation. (Nikat *et al,* 2021)

The impact/influence of ICT development has had a significant impact on the advancement of education in Indonesia. It is possible to facilitate teaching and learning activities with the advancement of current technology (Melanda *et al*, 2023). Along with these advancements, it may also bring about advancements in learning media (Affandi *et al*, 2020). Learning media can be used to help students understand abstract concepts in physics by concretizing them. (Wulandari and Mudinillah, 2022).

According to Wulandari *et al* (2023), learning media is a tool or intermediary used by educators to deliver learning material in a way that students can understand. Furthermore, learning media significantly improves the effectiveness of the learning process. The media is an important component in learning physics because learning physics appears abstract and can be easily understood with the help of the media. As a result, using instructional media to improve learning quality is highly recommended (Suhardiman *et al* 2022).

Individual learning using learning media in the form of teaching modules is a popular learning media today. Modules, like education, play an important role in learning. The module is a type of written or printed learning media that is organized in a systematic manner. It contains learning materials, learning methods, and learning objectives that are adapted to basic competencies or indicators of competency achievement. By completing the exercises in the module, students can learn independently about their abilities and interest in learning (Azka *et al.,* 2019).

A teacher or educator must consider the learning model in addition to the media required for learning. According to Sarumaha *et al* (2020), a teacher is said to have reflected the implementation of a quality learning process when students or students achieve satisfactory learning outcomes. As a result, teachers are expected to have diverse abilities in selecting appropriate and varied learning models. The learning model itself can be interpreted as a framework that provides a systematic description of how to implement learning in order to achieve learning objectives. Problem-based learning is one of the learning models. The Problem Based Learning (PBL) learning model is a problem-based learning model that is applicable in everyday life. This PBL learning model is a real-life learning model (Gulo, 2022).

Problem Based Learning (PBL) is a learning model that involves students in a learning activity (project) to produce a product, but in this case PBL focuses on using problems to increase knowledge, understanding, and student skills (Panggabean, 2022). The Problem Based Learning model is a relevant learning model for improving students' numeracy literacy skills (Masliah and Nirmala, 2023).

A vector, as we know, is a physics quantity that has both magnitude and direction. Force, velocity, acceleration, momentum, and other vector quantities are included in physical phenomena. The definition of vector itself is a digital image formed by a combination of points and lines that are mathematically connected to form polygons to form specific image objects with value and direction. Parallel vectors and opposite vectors are the two types of vectors. Many misconceptions arise in this vector quantity material, such as students adding up ordinary

numbers without considering the angle between the vector and the vector's direction. It is hoped that by conducting research that results in Problem Based Learning-based modules, students will gain a better understanding of vector material (Ilahi, 2021).

Validation is a metric that indicates the level of validity of an instrument, which can be defined as testing the truth, validation, accuracy, accuracy, or perfection. Validation comes in the form of data type checks, code checks, range checks, format checks, consistency checks, and uniqueness checks. Validation in a study is very good at avoiding errors in data entry, making data entry easier, and also providing accuracy and completeness, so it is very important to have validation in a study (MZ, 2021).

Language is the first communication tool that every human being acquires upon entering the world. As a result, language is extremely important in human life. Because language allows humans to easily socialize and interact. Language is a form of communication that uses pronunciation and writing to convey one's will so that others can understand it. Language serves as a communication tool through activities such as speaking, listening, reading, and writing (Arisandy, 2019). When developing teaching modules, linguistic elements related to readability must be considered. According to Nissa *et al* (2022), readability is defined as all the elements contained in the teaching module that will affect the reader's success in understanding the material presented in the module.

RESEARCH METHOD

The qualitative descriptive research method was used in this study. The qualitative descriptive research method aims to describe or describe a research subject using variable data obtained from specific subject groups.

The instrument object was used in the physics module to conduct language validation research using Problem Based Learning (PBL) vector material. In this language validation, the validator focused on the components that are the focus of his evaluation. These elements are: 1) Clarity of language use, 2) Readability of messages or information, 3) Ability to motivate learners, and 4) Compatibility with students' intellectual development. The validation results are then calculated using the following steps:

1. To calculate the validation results is obtained by using this formula:

$$V = \frac{T\ se}{T\ sm}\ x\ 100\ \%$$

Where:

V : Number of research levels

T se : The total of the empirical scores obtained

T sm : Maximum total score

Then, the score results were obtained from the analysis of validation formula results. In addition, the data obtained can be seen by examining the level of module validation.

2. Providing the criteria and categories of the percentage of the results of the validity value assessment using this formula:

Table 1. Criteria and Category of Validity Value

No	Criteria of validation value (%)	Category
1.	$76 < V \leq 100$	Valid
2.	$51 < V \leq 75$	Valid Enough
3.	$26 < V \leq 50$	Less Valid
4.	$0 < V \leq 25$	Invalid

FINDING AND DISCUSSION

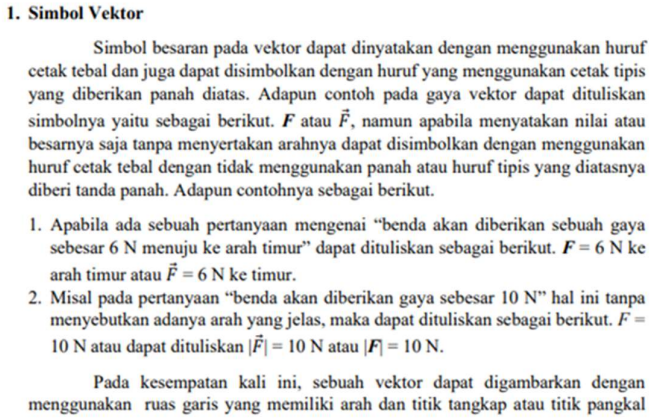
This language validation aimed to determine the accuracy of language use in this module; language components validated include: Communicative, Dialogical and interactive, and Appropriateness with students. The systematic language of a module ought to use language that was easy to understand; it was intended that the module's information be conveyed clearly to the reader. The language module used ought to also be interactive, which means that the language used to convey information should influenced the reader to think about and analyzed the information obtained. The terminology used in a module must also be appropriate for the level of education. Because students' intellectual levels differed at each level, a module ought to use language and terms that were simple and easy for readers to understand.

The validation carried out by two validators yielded the following results:

Table 2. Language Validation result data

Component	Item	Score			
		1	2	3	4
Communicative	The clarity of language use				√
	Readability of message or information			√	
Dialogic and Interactive	Ability to Motivate Students			√	
Compatibility with Student Development	Compatibility with Students' Intellectual Development			√	

Table 1 shows the results of language validation, where two sub-component items were assessed in the communicative component, namely the clarity of language use and the readability of messages or information. A score of 4 was obtained for language clarity, and a score of 3 was obtained for message or information readability. This is illustrated in Figure 1:



1. Simbol Vektor

Simbol besaran pada vektor dapat dinyatakan dengan menggunakan huruf cetak tebal dan juga dapat disimbolkan dengan huruf yang menggunakan cetak tipis yang diberikan panah diatas. Adapun contoh pada gaya vektor dapat dituliskan simbolnya yaitu sebagai berikut. $\boldsymbol{F}$ atau $\vec{F}$, namun apabila menyatakan nilai atau besarnya saja tanpa menyertakan arahnya dapat disimbolkan dengan menggunakan huruf cetak tebal dengan tidak menggunakan panah atau huruf tipis yang diatasnya diberi tanda panah. Adapun contohnya sebagai berikut.

1. Apabila ada sebuah pertanyaan mengenai "benda akan diberikan sebuah gaya sebesar 6 N menuju ke arah timur" dapat dituliskan sebagai berikut. $\boldsymbol{F}$ = 6 N ke arah timur atau $\vec{F}$ = 6 N ke timur.
2. Misal pada pertanyaan "benda akan diberikan gaya sebesar 10 N" hal ini tanpa menyebutkan adanya arah yang jelas, maka dapat dituliskan sebagai berikut. F = 10 N atau dapat dituliskan $|\vec{F}|$ = 10 N atau $|\boldsymbol{F}|$ = 10 N.

Pada kesempatan kali ini, sebuah vektor dapat digambarkan dengan menggunakan ruas garis yang memiliki arah dan titik tangkap atau titik pangkal

Figure 1. Communicative language

The language used to explain the material in the module was simple and easy to understand, as shown in the image above. The use of bold or italic letters and words helped readers remember terms, equations, and other important information. The module also included a glossary to help readers understood the terms covered.

There were sub-component items on the ability to motivate students in the dialogic and interactive components; a score of 3 was obtained in this sub-component. This is showed in Figure 2 below:

Figure 2. Dialogical and interactive language

According to Figure 2, the module has used dialogic language, with interrogative sentences that could elicit a reader's response, implying two-way communication. The module also included images that represented explanations of vector addition material. With these images, the reader has an idea or imagination about how vectors could be used.

Then, in the component of conformity with student development, there was an item of conformity with student intellectual development that received a score of 3. This is showed by the absence of scientific terms that were difficult for readers to understand, ensuring that the information contained in the module was easily digestible. The glossary explained the specific terms related to the material.

It is possible to analyze the results of the validator's validation using the following formula:

$$V = \frac{T_{se}}{T_{sm}} \times 100\%$$

If the total empirical score obtained (T_{se}) is 13 and the maximum total score is 16, then:

$$V = \frac{13}{16} \times 100\%$$

$$V = 81{,}25\ \%$$

Therefore, the overall score from language validation is 81.25%.

After obtaining the formula analysis score results, the data can be reviewed by considering the following language validity levels :

No	Criteria of validation value (%)	Category
1.	$76 < V \leq 100$	Valid
2.	$51 < V \leq 75$	Valid Enough
3.	$26 < V \leq 50$	Less Valid
4.	$0 < V \leq 25$	Invalid

According to table 2, the whole value of language validation is 81.25%, which is categorized as very good.

CONCLUSION

The descriptive qualitative research method was used in this article. The following were the research findings using this method. The goal of this language validation was to be able to determine the accuracy of language use in teaching modules with vector material. Language components that could be validated include communicative, dialogue, interactive, and student suitability. A score of 4 was obtained for the clarity of language item, and a score of 3 was obtained for the readability of messages or information. The ability to motivate students obtained a score of 3 on the dialogic and interactive components. A score of 3 was obtained on the item of student development suitability, on the item of student intellectual development conformity. The overall value of language validation was 81.25% with a very good category.

SUGGESTION

We only validate the data contained in our teaching modules in this research article because we only get information from the teaching materials we created. We apologize for the lack of research on language analysis in (PBL-based physics module for vector material).

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