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Physics Teaching Modules in the Merdeka Curriculum Framework Using the Guided Inquiry Model: A Validity Review

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Abstract

The lack of valid physics teaching modules in the Merdeka curriculum framework makes it difficult for educators to develop learning tools that meet classroom needs. This research uses the guided inquiry model to measure the validity of physics teaching modules in the Merdeka curriculum framework. This research is categorized as research and development using the ADDIE model. Data was obtained using a validation sheet instrument distributed to two expert validators and one practitioner validator. The data analysis technique used was descriptive quantitative. The results showed that the physics teaching module in the Merdeka curriculum framework using the guided inquiry model was valid and categorized as excellent. This research serves as a reference for developing similar teaching materials, and the module's validity contributes to improving the quality of physics learning in the classroom. The suggestion for future follow-up efforts is to conduct a practicality and effectiveness test.

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INTRODUCTION

21st-century learning is an approach where every individual is prepared to face global demands and challenges, which include rapid advances in technology and information, affecting all aspects of life (Arantika et al., 2019; Fitria et al., 2019; Haryandi et al., 2019; Husnaini & Chen, 2019; Zainuddin et al., 2021). As a result, 21st-century learning demands the development of 4C competencies, namely collaboration, critical thinking, creativity, and communication (Gholam, 2019; Kurniawan & Syafriani, 2021; Putri & Syafriani, 2020; Sutiani et al., 2021; Utami et al., 2020). To master the 4C competencies, it is essential to first master science process skills, as these serve as the methodological and analytical foundation for developing the 4C competencies when applied in learning (Aditomo & Klieme, 2020; Astuti et al., 2018; Effendi et al., 2019; Khairiyah, 2019; Margunayasa et al., 2019). One of the learning models that can support the development of 4C competencies is the guided inquiry model.

The guided inquiry-based learning model is one where the educator plays the role of a facilitator, providing guidance and open-ended questions, while students actively engage in exploring learning material through observation, questioning, research, and experiments (Arifuddin et al., 2021; Aumi & Mawardi, 2021; Cairns, 2019; Nia, 2021; Nurhuwaida et al., 2022; Ramadani et al., 2021; Wen et al., 2020; Yani et al., 2021). The guided inquiry model is necessary for the current curriculum, the Merdeka Curriculum, because the phases

of the guided inquiry model align with the principles of the Merdeka Curriculum, which emphasizes student-centered learning, competence development, and flexibility for students to become independent learners (Abdurrahman et al., 2019; Dama & Husain, 2022; Fahmi et al., 2021). According to Febrina & Qomariyah (2024), Palupi et al. (2020), and Yulika and Hardeli (2023), the guided inquiry model involves students in exploring knowledge, which supports the principles of the Merdeka Curriculum that place students as the main subjects of learning. Furthermore, the guided inquiry model encourages students to find answers on their own, motivating them to discover solutions through collaboration, communication, and independence (Sudarmanto et al., 2021; Tahrim et al., 2021). These are competencies that the Merdeka Curriculum aims to foster.

In practice, the Merdeka Curriculum focuses not only on classroom learning but also encourages exploration outside the classroom, making the learning experience more engaging and not entirely teacher-centered. The Merdeka Belajar (Independent Learning) approach emphasizes freedom and stimulates creative thinking (Rahayu et al., 2022; Rahmadayanti & Hartoyo, 2022). This learning system is expected to shape students' character, making them confident, independent, socially intelligent, and competitive (Irawati et al., 2022; Izzah & Jannah, 2023; Maulinda, 2022). In line with this principle, the Merdeka Curriculum also gives educators the freedom to develop teaching tools that suit students' needs (Jauhariyah et al., 2021; Purnawanto, 2022; Sakur et al., 2023).

To facilitate educators in developing teaching tools, the Ministry of Education, Culture, Research, and Technology of Indonesia provides the Merdeka Mengajar website, where verified teaching tools are available for educators to use as a guide. However, in reality, verified teaching modules for phase F in physics are still limited. Some research has been done to develop valid teaching modules, such as the study by Erlin et al., (2023) which developed a physics teaching module based on local wisdom with a Scaffolding method, Ulfa et al., (2024) which developed a Merdeka curriculum physics module for phase E on alternative energy, and Yiniar et al., (2024) which developed a Merdeka curriculum module on energy work integrating inquiry skills and collaboration.

Since the measurement of the validity of Merdeka Curriculum physics teaching modules has not been widely conducted and the results have not been clearly presented on the Merdeka Mengajar platform, the researchers are interested in developing a valid phase F physics teaching module using the guided inquiry model that can serve as a reference for educators. The novelty of the developed module lies in the inclusion of a special segment containing insights into science, technology, and engineering, drawn from applied technologies closely related to students' everyday lives.

METHODS

This study aims to measure the validity of physics teaching modules in the Merdeka curriculum framework using the guided inquiry model. The method used is the ADDIE model (analysis, design, development, implementation, and evaluation). The product produced is a physics teaching module using the guided inquiry-based learning model to enhance science process skills.

In the analysis stage, an analysis was conducted, including curriculum analysis, analysis of student characteristics, and teaching material analysis. The curriculum used in class XI at a high school in Banjarbaru is the Merdeka Belajar curriculum, so the school's learning objectives must refer to the learning outcomes and learning objective elements found in the Merdeka Belajar curriculum.

Then, in the design stage, learning activities and research instruments were designed. Learning activities were designed by breaking down the learning outcomes into learning

objectives and the learning objective flow (LOF). It was then decided that there would be four meetings, three for the learning process and one for the post-test.

In the development stage, the designed module was validated by academic and practitioner experts. The developed module consists of general information, core components, and appendices. The purpose of this process is to evaluate the appropriateness of the developed teaching module. The validation data were analyzed using the average score from the expert evaluations. The module validation categories were then adjusted according to the determined criteria. The criteria for validating the physics teaching module are shown in Table 1.

Table 1 Module validity criteria

No.	Interval	Category
1.	$\bar{x} > 3.4$	Very Good
2.	$2{,}8 < \bar{x} \leq 3.4$	Good
3.	$2.2 < \bar{x} \leq 2.8$	Fairly Good
4.	$1.6 < \bar{x} \leq 2.2$	Poor
5.	$\bar{x} \leq 1.6$	Very Good

(Widoyoko, 2016)

RESULTS AND DISCUSSION

This research aims to produce a valid physics teaching module using the guided inquiry model. The developed module includes general information, core components, and appendices. It covers the topics of temperature and heat. Below is the cover page of the physics teaching module, as shown in Figure 1.

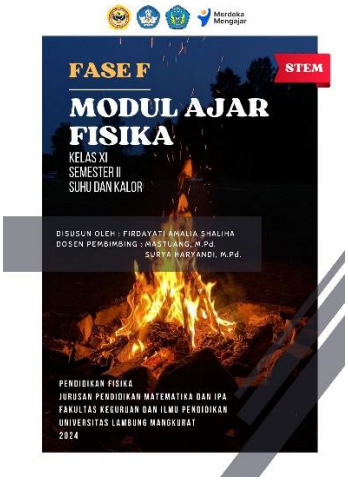

Figure 1 Cover of the developed module

The developed physics teaching module was created based on the students' needs and adjusted to the school's curriculum. It has also been validated by two academic validators and one practitioner validator. The module is based on the student's needs and is in line with the Merdeka curriculum. The validation results from the first validator are shown in Figure 2.

Based on Figure 2, all aspects received a "very good" category. The language aspect, general information, learning outcomes and learning objectives, module components, and meeting details received the highest ratings. This indicates that, according to Validator 1, the developed module uses communicative language and meets the aspects of the Merdeka curriculum. Validator 1's suggestion is to emphasize the development of the Pancasila Student Profile character.

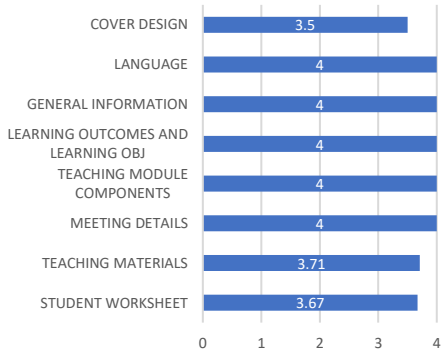

Figure 2 Evaluation results from validator 1

Next, Figure 3 shows the evaluation results from Validator 2. Based on Figure 3, all aspects received a "very good" category, with the highest ratings in language, general information, learning outcomes and learning objectives, module components, and meeting details. The lowest rating was given to the cover design. Validator 2's suggestion is to improve the post-test to ensure it aligns with the learning objectives and adjust its scoring.

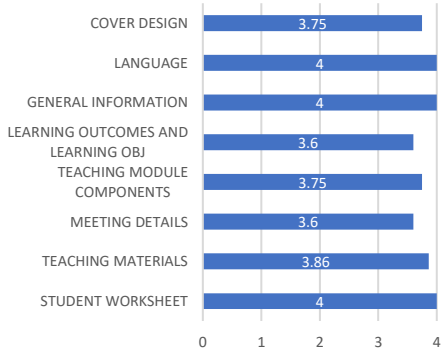

Figure 3 Evaluation results from validator 2

Then, in Figure 4, it can be seen that all aspects received a "good" category, with the cover design, language, learning outcomes, and learning objectives aspects receiving the highest ratings. The lowest rating was given to the teaching material aspect. Validator 3's suggestion for improvement is to align the post-test questions with the learning objectives for phase F.

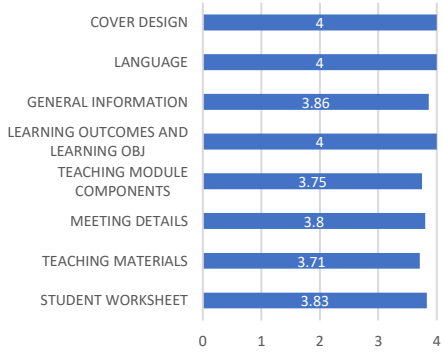

Figure 4 Evaluation results from validator 3

Overall, the teaching module's cover design received a very good rating, with the cover meeting all necessary criteria for teaching modules in the Merdeka curriculum. These include listing the module identity, such as the material title, author, institution logo, Merdeka curriculum logo, Tut Wuri Handayani logo, an image representing the module's content, the institution's name, and the year of creation.

The language aspect in the teaching module was also rated very good. This indicates that the language and sentence structure in the module are easily understood by students because they are adapted to their cognitive development level, follow PUEBI writing guidelines, maintain consistency in using symbols, and align illustrations with the intended messages, avoiding ambiguous meanings. According to Sagala & Naibaho (2023), and Iksan et al., (2023), the language in a teaching module is considered good if it is clear, easy to understand, consistent, and accurate in grammar and spelling.

The general information aspect received a very good rating. This part of the module, as per the Merdeka Curriculum, contains seven segments: 1) Module identity, including the name of the author, school, subject, phase, class/semester, key material, and allocated time; 2) Learning outcomes, including cognitive elements related to physics understanding and skills-related process skills, aimed at guiding the learning process and measuring its success; 3) Prerequisite knowledge, which students must have before starting the lesson; 4) Pancasila Student Profile, focusing on character development in line with the guided inquiry model; 5) Facilities and media, including tools and resources like the teaching module, student's worksheet, and technology; 6) Target students, aimed at regular students; 7) The teaching model/method, which is based on guided inquiry. According to Maulinda (2022), a good teaching module includes these general information segments in the Merdeka Curriculum.

The learning outcomes and objectives aspect also received a very good rating. This aspect was evaluated as good because it includes elements of learning outcomes, extracts from the learning outcome elements, the learning objectives of the entire module, the flow of learning objectives, and the dimensions of the Pancasila Student Profile to be achieved through the learning process.

The core components of the module received a very good rating, including 1) The learning objectives, which are developed into indicators of achievement applying the concepts and laws of heat as the learning outcomes; 2) Meaningful understanding, which includes learning points that focus not only on memorizing concepts but also on applying knowledge to everyday life; 3) Trigger questions, which provide brief narratives of contextual phenomena followed by questions to stimulate curiosity; 4) Learning preparation, including steps taken to prepare students for the material. The learning activities, part of the meeting details, were also rated very well. These activities follow the guided inquiry model's syntax and are systematically arranged to meet students' learning needs, with a time allocation of 2 hours or 90 minutes.

Assessment in this module includes formative and summative assessments. Formative assessments are conducted during the learning process using student worksheets and exercises, while summative assessments are performed at the end of the learning process as a learning achievement test. The module also includes a student reflection sheet to assess students' learning experiences.

The appendix details, including teaching materials and student worksheets, were rated very good. The teaching materials include concepts, formulas, examples, exercises, and solutions, which educators use during lessons. The materials also include segments on science, technology, and engineering, which can help educators and students deepen their understanding of the related topics. These segments include a Science Quiz, a Technology

column explaining the relationship between temperature and heat in technology applications, and Engineering, which provides insights into applying temperature and heat concepts in everyday object designs. Engaging teaching materials motivate students to be more actively involved in the learning process (Maulinda, 2022).

The developed student's worksheet uses clear and unambiguous command sentences and easy-to-understand language. It is relevant to the guided inquiry model's syntax and includes questions aligned with learning objectives and science process skills. However, elements that promote the Pancasila Student Profile are still lacking, so improvements were made by adding elements of the Pancasila Student Profile, as suggested by the validator.

Overall, the developed teaching module received excellent validity and reliability, with a percentage of agreement of 89.53%, indicating that the evaluations from the three validators consistently assessed the validity of the module's aspects.

CONCLUSION

Based on the data analysis results, the physics teaching module within the Merdeka curriculum framework using the guided inquiry model is declared valid, so the developed module can serve as a reference for developing similar teaching materials. Furthermore, the validity of the developed module contributes to improving the quality of physics education, which is expected to encourage critical thinking skills and student conceptual understanding.

However, this study has several limitations. First, the module's validity is based only on initial data analysis without further testing of its practicality and effectiveness in real classroom settings. Second, the validity testing was limited to content validity and was not conducted empirically. Third, this research is limited to physics and has not been tested on other subjects. Therefore, further research is needed to assess the practicality and effectiveness of the physics teaching module in the classroom to produce a practical and effective module.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest in this study.

AUTHOR CONTRIBUTIONS STATEMENT

FAS was responsible for drafting the research concept and background. FAS developed and implemented the methodology with supervision and review from M and SH. M and SH reviewed and examined the data analysis.

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