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Practicality of E-Modules Based on Contextual Teaching and Learning Models on Renewable Energy Material for Phase E Students

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ABSTRACT

This study was driven by the need for teaching materials that aligned with the Merdeka Curriculum, particularly in context-based learning that connected subject matter to real-life situations. However, the limited availability of relevant teaching materials and the inadequate use of technology in the learning process remained obstacles in enhancing students' understanding of renewable energy concepts. Therefore, this study aimed to develop a practical e-module based on a contextual learning model for Phase E students. The e-module development followed the ADDIE model, which consisted of analysis, design, development, implementation, and evaluation stages. The practicality test involved three high school physics teachers using a teacher practicality instrument questionnaire and 69 Phase E students using a student practicality instrument questionnaire. The results indicate that the developed e-module falls into the "highly practical" category, with an average score of 96% from teachers and 82% from students. Based on these findings, it is concluded that the e-module meets practicality standards and is suitable for supporting students' understanding of renewable energy concepts in school learning.

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INTRODUCTION

The advancement of time and technological progress serve as the primary foundation for curriculum renewal in education. Since 2022, Indonesia has implemented the Independent Curriculum in accordance with the Regulation of the Minister of Education, Culture, Research, and Technology No. 56/M/2022 (Menteri Pendidikan, Kebudayaan, Riset, 2022). This policy is expected to provide solutions for the increasingly dynamic challenges of modern education. The curriculum grants teachers the flexibility to adjust their teaching approaches and learning models to better align with current educational needs (Nugroho & Narawaty, 2022). Furthermore, the Independent Curriculum is designed to equip students with essential competencies needed to face future challenges. These competencies include

critical thinking, creativity, and problem-solving skills (Amalia, 2022). By emphasizing these core skills, the curriculum aims to produce graduates who are adaptive, innovative, and capable of responding to global challenges.

The implementation of Independent Curriculum requires instructional materials that align with the characteristics of flexible and student-centered learning. Appropriate teaching materials are necessary to support learning models that effectively achieve educational objectives (Hanazahra et al., 2025). Teaching materials encompass all resources (including information, tools, and texts) systematically arranged to present a comprehensive depiction of the competencies students need to master and are used in the learning process for planning and evaluating instructional implementation (Choiriyah et al., 2022). One form of teaching material is the E-Module. An E-Module is an electronic learning module that can be accessed via devices such as smartphones or laptops and is designed using specialized software (Asyshifa Astri et al., 2024). In addition to assisting teachers in delivering lessons, E-Modules also benefit students by enabling them to apply acquired knowledge to solve problems, both individually and within their communities (Hufri, Dwiridal, & Yulia Sari, 2021). The accessibility of E-Modules makes learning more flexible, allowing students to study at their own pace and revisit material whenever necessary.

The contextual learning model is one of the approaches that can be implemented in Independent Curriculum with the support of appropriate instructional materials. Learning that meets contemporary demands involves the development of 4C skills: critical thinking, creativity, communication, and collaboration (Ardiansyah et al., 2022). These demands align with the advantages of the contextual learning model, which presents material more relevant to real-life experiences and applies experiential learning methods. Additionally, this approach is student-centered, fostering an active and interactive learning environment, providing students with the freedom to express their ideas, and allowing flexible application across various subjects and learning settings (Simeru et al., 2023). The contextual learning model incorporates steps for applying physics concepts based on students' environmental situations (Annisa Wudda et al., 2024). This model enables students to understand the material more easily as it relates to real-life experiences around them. The use of context-based instructional tools has been proven to improve student learning outcomes (Hufri, Dwiridal, & Amir, 2021). Furthermore, this learning approach encourages students to develop problem-solving abilities through direct engagement with relevant real-world scenarios.

Observations conducted at SMAN 1 Banuhampu indicate that teachers and students rely on government-issued textbooks and publisher-provided worksheets during lessons. However, students still struggle to understand the material because the content in these textbooks and worksheets lacks relevance to their daily experiences. Therefore, developing a context-based E-Module for renewable energy topics tailored to Phase E students is essential. This development is expected to enhance student engagement and comprehension by presenting material that is more relatable and applicable to their everyday lives. Accordingly, this study sought to develop a practical e-module based on a contextual teaching and learning model for Phase E students

METHODS

The research model used in this study is a development research approach that follows the ADDIE model. This model consists of five main stages: analysis, design, development, implementation, and evaluation (Pribadi, 2009). Each stage is systematically structured to serve

as a guideline for developing instructional products while ensuring continuous improvements in learning effectiveness (Cahyadi, 2019). The structured nature of the model allows researchers to systematically refine and enhance educational materials based on iterative evaluations. This model is widely applied in educational research as it provides a clear framework, enabling researchers to develop products that align with learners' needs and improve the quality of learning experiences.

The analysis stage focuses on identifying existing problems and exploring applicable solutions that can be implemented to overcome them. This stage involves gathering relevant data through various methods, such as literature reviews, observations, and interviews, to obtain a comprehensive understanding of learning difficulties and gaps that need to be addressed. The results of this stage serve as the foundation for the subsequent design phase. The design stage involves the development of a blueprint for the product, which serves as a solution to the problems identified earlier. In this study, the developed product is an E-Module consisting of several structured sections, including the cover, introduction, table of contents, glossary, preface, core learning material, and a closing section. The design of the E-Module is carefully structured to ensure that it is engaging, interactive, and easy to navigate, making it suitable for independent learning as well as guided instruction.

The development stage aims to bring the initial design to life by producing a functional version of the product. At this stage, the content is refined, multimedia elements may be integrated, and the overall presentation of the E-Module is enhanced to maximize its effectiveness. After the development phase, the implementation stage is carried out to test the feasibility, usability, and practicality of the developed product. This process typically involves a trial phase where the E-Module is introduced to a selected group of users to evaluate its effectiveness in real classroom settings. The findings from this stage help identify any potential issues that may arise during its broader application. The final stage, evaluation, is conducted after all previous stages are completed. The primary goal of this stage is to assess the overall quality of the E-Module, incorporating feedback from teachers and students to refine and optimize the instructional material. Evaluation ensures that the product aligns with learning objectives and effectively enhances students' understanding of the subject matter.

The practicality assessment in this study involved three physics teachers who evaluated the E-Module using a teacher practicality instrument, along with 69 Phase E students who assessed it using a student practicality instrument. The practicality instrument for teachers evaluated several key components, including the quality of content, clarity of presentation, ease of use, and overall benefits of the E-Module in supporting the teaching process. Meanwhile, the student practicality instrument assessed various aspects, such as ease of learning, attractiveness, accessibility, and the overall usefulness of the E-Module in helping them understand the material more effectively. The collected responses were analyzed using a Likert scale, which categorizes responses into five levels: very poor, poor, adequate, good, and very good. The use of a Likert scale allows for a systematic and quantitative assessment of the practicality of the E-Module, ensuring that the findings are objective and reliable.

By implementing a structured development process, this study aims to produce an E-Module that not only meets the needs of students but also serves as an effective instructional aid for educators. Each stage of development is systematically carried out to ensure the quality and relevance of the final product. Practicality testing is conducted based on data collected during implementation. The collected data provides insights into the usability and

effectiveness of the E-Module in real learning environments. The practicality of the developed product is measured using the following formula:

$$Final\ Score = \frac{Total\ Score}{Maximum\ Score} \times 100\%$$

Next, calculations were conducted to assess the level of product practicality based on criteria modified by (Retnawati, 2016). The developed E-Module should fall within the interval of 41%, categorized as moderately practical, up to an interval of 100%, categorized as highly practical, to ensure its effective use in learning. This classification serves as a reference to assess the extent to which the product meets the expected practicality standards. If the practicality score falls below 41%, further improvements are needed to enhance its usability and effectiveness. This range is used as a benchmark for evaluating the practicality of the E-Module in the learning process.

RESULTS AND DISCUSSION

Results

The objective of this study was to develop an e-module based on the contextual teaching and learning model, focusing on instructional materials related to renewable energy for Phase E students. It comprehensively explains each stage of the ADDIE development model, from analysis to implementation. Strong emphasis is placed on integrating the learning model with students' real-life experiences to enhance their understanding and engagement. This approach seeks to bridge the gap between theoretical knowledge and practical application, allowing students to connect their learning to real-world contexts. Consequently, this study strives to improve students' motivation and comprehension of renewable energy concepts.

During the analysis phase, an initial assessment was conducted to identify learning gaps. The results revealed that students continued to struggle with understanding renewable energy concepts. This issue primarily stemmed from their reliance on government-issued textbooks and publisher-provided worksheets, which were often perceived as less relevant to their daily lives. Additionally, the existing learning media lacked interactivity and accessibility, making them less effective in promoting student engagement. These findings highlighted the urgent need for contextualized instructional materials aligned with the independent curriculum to create a more meaningful and impactful learning experience.

The e-module was systematically designed as an instructional material product during the design phase, incorporating multimedia elements such as videos, images, and hands-on experiments to enhance students' engagement and comprehension. The e-module structure consisted of several key components, including an introduction, content sections, conclusions, a preface, a table of contents, and a glossary to support student understanding. Following this stage, the development phase was carried out, during which the e-module was created using Canva, an intuitive design platform that allowed for visually appealing and well-structured educational content. After the design was finalized, the e-module was converted into an interactive flipbook using Heyzine, further enhancing its accessibility and usability for students. By integrating these technological tools, the e-module aimed to provide an engaging, practical, and effective learning resource that supported independent learning. The assessment using a practicality instrument by teachers covered several components, including the content of the e-module, its presentation, ease of use, and benefits. The results of the

practicality assessment by teachers regarding the content component of the e-module were shown in Figure 1.

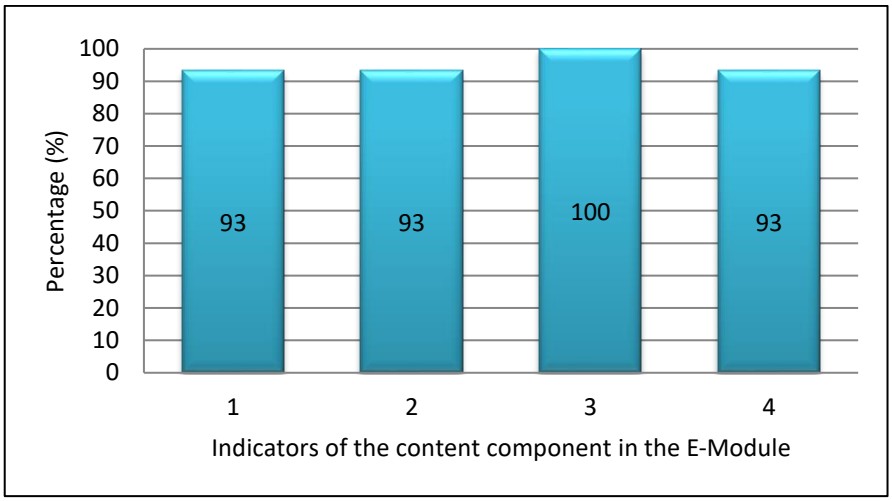

Figure 1. The Practical Value of the Content Component in E-Modules

Based on the results in Figure 1, the content component of the E-Module attains all four indicators within the "Highly Practical" category. The obtained score range falls between 93% and 100%. An average score of 95% is achieved, placing it within the same category. These findings indicate that the content component meets high practicality standards. The practicality assessment results for the presentation component in the E-Module are displayed in Figure 2.

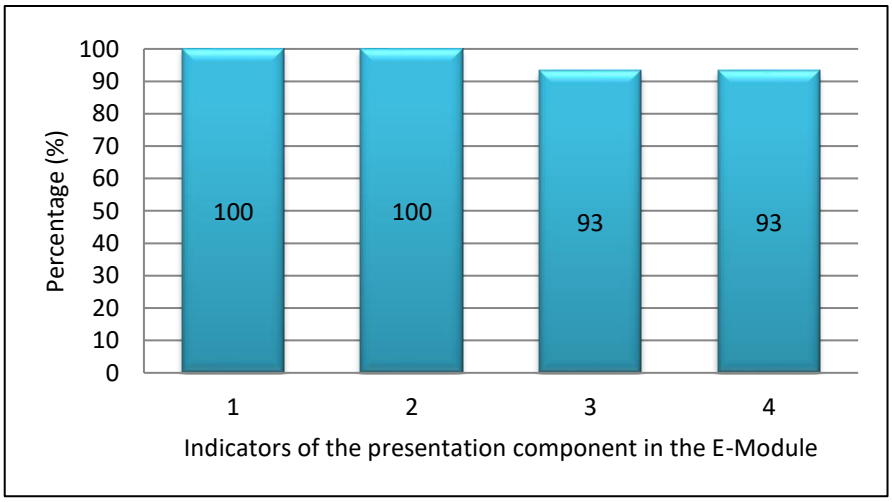

Figure 2. The Practical Value of the Presentation Component in E-Modules

Based on the results in Figure 2, the presentation component of the E-Module includes four indicators classified as Highly Practical, with scores ranging from 93% to 100%. Each indicator demonstrates a high level of practicality, reflecting optimal presentation quality. The average score obtained is 97%, which falls into the Highly Practical category. These results indicate that the presentation in the E-Module has a very high level of practicality. The practicality assessment results for the ease-of-use component in the E-Module are presented in Figure 3.

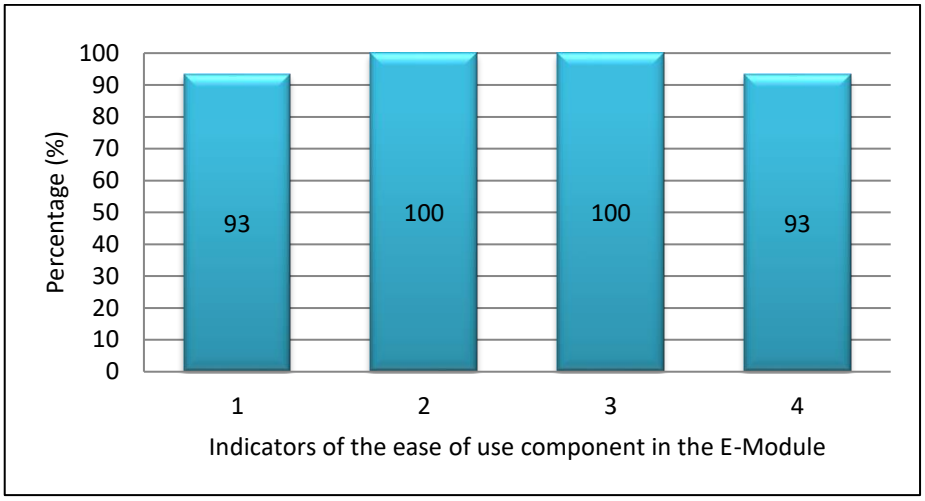

Figure 3. The Practical Value of the Ease-of-Use Component in E-Modules

Based on the results shown in Figure 3, the ease-of-use component in the E-Module includes four indicators categorized as Highly Practical. The obtained scores range from 93% to 100%, indicating a high level of practicality. The average score achieved is 97%, placing it in the Highly Practical category. These results demonstrate that the E-Module has excellent ease of use. Furthermore, the practicality assessment of the benefits component in the E-Module is presented in Figure 4.

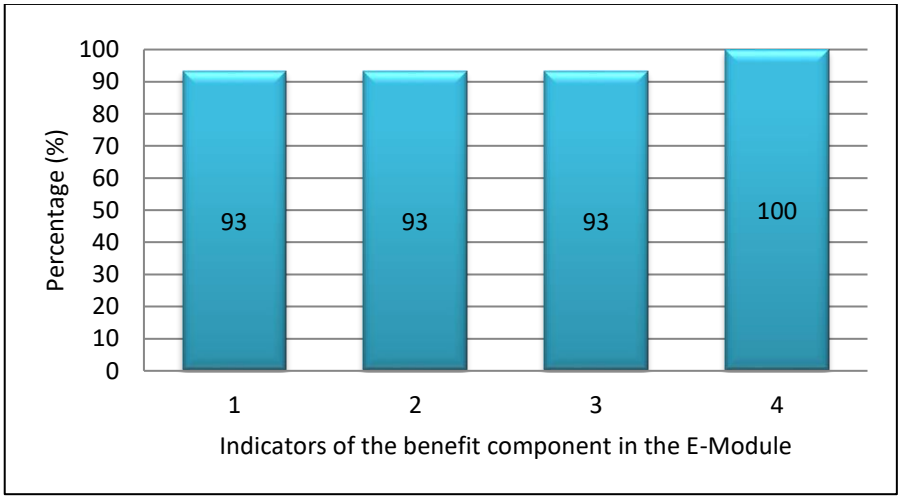

Figure 4. The Practical Value of the Benefits Component in E-Modules

Based on the results shown in Figure 4, the benefits component in the E-Module includes all indicators categorized as Highly Practical. The obtained values range from 93% to 100%, indicating a high level of practicality. Each indicator reflects the effectiveness and usefulness of the E-Module in supporting learning. The average score achieved is 95%, placing it in the Highly Practical category. These findings confirm that the benefits component of the E-Module meets high practicality standards.

The practicality test of the E-Module was also conducted with 69 students in Phase E to evaluate its effectiveness in facilitating learning. This test focused on three key components: learning ease, attractiveness, and usefulness, which are essential aspects in determining the overall practicality of the E-Module in a real classroom setting. The assessment aimed to measure how well students could engage with the module, navigate its content, and benefit

from its features. By analyzing these components, the study provides valuable insights into the extent to which the E-Module supports the learning process, enhances student interest, and contributes to knowledge acquisition. The results obtained from the practicality evaluation serve as a benchmark for identifying strengths and potential areas for improvement in the E-Module's design and implementation. The practicality assessment results for the learning ease component are presented in Figure 5.

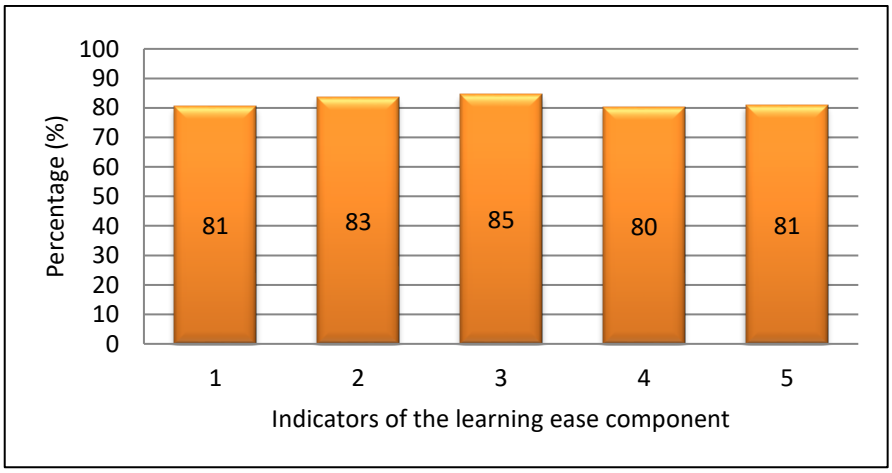

Figure 5. The Practical Value of the Learning Ease Component

Based on the results shown in Figure 5, the learning ease component includes one indicator in the Highly Practical category with a value of 80%. Additionally, four other indicators fall into the Highly Practical category, with values ranging from 81% to 85%. The obtained scores indicate a consistently high level of practicality across all indicators. The average score achieved is 82%, placing it in the Highly Practical category. Furthermore, the practicality assessment for the attractiveness component is presented in Figure 6.

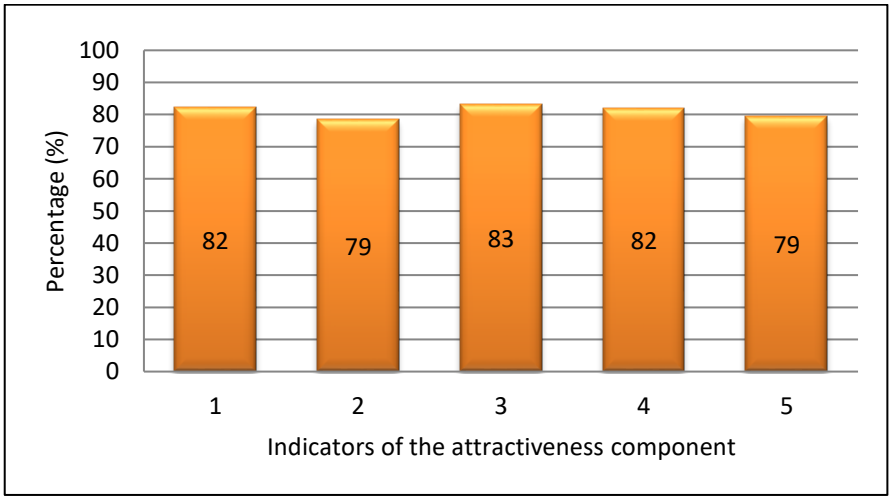

Figure 6. The Practical Value of the Attractiveness Component

Based on the results shown in Figure 6, the attractiveness component in the E-Module includes two indicators categorized as Practical, with values around 79%, and three indicators categorized as Highly Practical, with values ranging from 82% to 83%. This results in an average score of 81%, placing it within the Highly Practical category. These findings indicate that the E-Module is visually and structurally appealing, making it engaging for students. The

combination of practical and highly practical indicators suggests that while the module is generally attractive, certain aspects may still have room for improvement to further enhance user engagement. Furthermore, the practicality assessment for the usefulness component of the E-Module is presented in Figure 7.

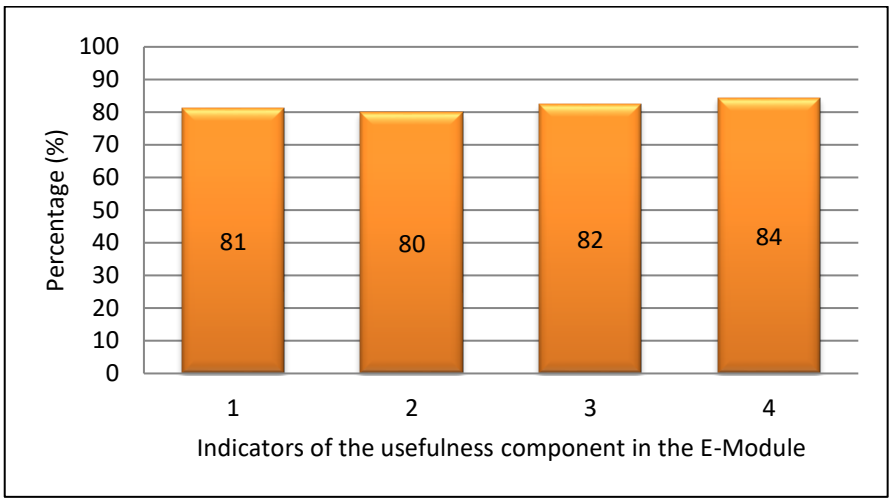

Figure 7. The Practical Value of the Usefulness Component in E-Modules

Based on the results shown in Figure 7, the usefulness component in the E-Module includes one indicator in the Practical category with a value of 80%. Additionally, three other indicators fall into the Highly Practical, with values ranging from 81% to 84%. These values indicate a high level of practicality across most indicators. The average score achieved is 82%, placing it in the Highly Practical. These results confirm that the usefulness component of the E-Module meets the standards of the Highly Practical category.

Discussion

This study aims to develop an E-Module based on the contextual learning model, specifically designed for teaching renewable energy concepts to Phase E students. The practicality of the E-Module was assessed through evaluations by three physics teachers and 69 Phase E students, focusing on multiple aspects, including content, presentation, ease of use, benefits, learning ease, attractiveness, and overall usefulness. The assessment employed a Likert scale, categorizing responses from highly practical to not practical (Sukmadinata, 2010). The evaluation process was structured to ensure that the developed E-Module meets the necessary standards for effective teaching materials, particularly in providing a more interactive and meaningful learning experience.

The teachers' assessment of the E-Module's practicality was conducted using a structured evaluation instrument that covered four critical aspects: content, presentation, ease of use, and benefits. The results indicated that the developed E-Module falls within the Highly Practical category, signifying its effectiveness and suitability for classroom use. The ease of use component was particularly noteworthy, as the E-Module was found to be accessible and user-friendly, allowing seamless integration into the teaching and learning process. Even teachers and students with minimal technological proficiency could navigate and utilize the module effectively (Agustin & Razi, 2023). This ease of access ensures that the E-Module can be widely adopted in various educational settings, promoting inclusivity in digital learning.

The contextual learning-based approach implemented in the E-Module aligns with the criteria for practical teaching materials, which range from practical to highly practical. This classification suggests that the E-Module is not only feasible for implementation but also capable of enhancing student engagement and comprehension. Research conducted by (Hufri et al., 2019) supports this finding, emphasizing that E-Modules designed with real-life relevance significantly contribute to improving student learning outcomes. When students can relate lesson content to their everyday experiences, their motivation and understanding increase, making learning more effective. Additionally, the Highly Practical classification of the developed E-Module indicates that teachers can efficiently use it as a teaching aid, allowing them to facilitate learning more effectively while reducing the reliance on conventional textbooks and worksheets (Okta Vernanda & Zulyusri, 2023)

Beyond the teachers' evaluations, students also provided valuable feedback on the E-Module's practicality, specifically regarding its ease of learning, attractiveness, and overall usefulness. The assessment results from students further confirmed that the developed E-Module belongs to the Highly Practical category. This positive response highlights that students find the module engaging, easy to understand, and beneficial for their learning process. The interactive features, such as videos, images, and experiments embedded in the E-Module, contribute to making learning more enjoyable and dynamic. These findings further reinforce the idea that using a contextual learning-based E-Module can lead to better learning outcomes, as students are more likely to retain and apply the knowledge gained through interactive and real-world applications (Hufri et al., 2019).

The study's findings strongly indicate that the contextual learning-based E-Module on renewable energy for Phase E students successfully meets the practicality criteria required for effective classroom implementation. By providing students with opportunities to learn independently and at their own pace, the E-Module supports a more flexible and student-centered learning approach. The integration of contextual learning principles encourages students to actively engage with the material, allowing them to connect theoretical concepts with real-world applications. This approach not only enhances conceptual understanding but also fosters critical thinking and problem-solving skills. At the same time, teachers benefit from a more structured and adaptable teaching resource, making it easier for them to deliver complex material in an accessible and engaging manner.

The relevance of renewable energy as a subject matter further strengthens the importance of this E-Module in modern education. In an era where environmental sustainability and energy conservation are critical global issues, equipping students with knowledge about renewable energy sources becomes essential. Integrating this topic into a practical and interactive E-Module helps students develop an awareness of contemporary global challenges. At the same time, it enables them to acquire scientific knowledge that is applicable in real-world contexts (Puspaningsih et al., 2021) emphasize that curriculum materials aligned with real-world issues encourage students to think critically about solutions, fostering a sense of responsibility toward sustainable development.

CONCLUSION

The research findings indicate that the contextual learning-based E-Module developed for Phase E students has met the practicality criteria. The average practicality score obtained is 96% from teachers and 82% from students, demonstrating a high level of usability. These

results serve as strong evidence that the E-Module aligns with the required practicality standards, making it suitable and effective for use in the learning process. The high level of practicality suggests that both teachers and students find the E-Module accessible, easy to use, and beneficial for improving learning experiences. Consequently, the contextual learning-based E-Module can be considered a viable instructional tool that enhances student engagement and comprehension while supporting teachers in delivering more interactive and meaningful lessons.

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