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Design of Digital Teaching Material of Sustainable Lifestyle Theme Integrated Ethno-PjBL for Independent Curriculum Learning

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Abstract: This study aims to produce digital teaching materials on the theme of sustainable lifestyle integrated with Ethno-PjBL that are valid, practical, and effective for independent curriculum learning. The type of research used is design research with the Plomp model, which consists of a preliminary research stage, a prototype stage, and an assessment stage. The research is limited only to the practicality stage at the assessment stage, with a trial on 36 students of SMAN Kota Jambi in 2023/2024. The research instruments include teacher interview guidelines, needs analysis questionnaires, knowledge tests, creative thinking tests, validation instruments, and practicality. The data analysis technique used is descriptive analysis, namely describing the validity of Aiken's V and its practicality. The results of the study show that the digital teaching materials on the Theme of Sustainable Lifestyle Integrated with Ethno-PjBL for Independent Curriculum Learning have valid criteria and a very good level of practicality, according to teachers and students. Thus, this digital teaching material is valid and practical for use in learning.

Keywords: Digital teaching material; Ethno-PjBL; Practicality; Validity

Introduction

Twenty first century skills are needed by students to face various challenges. This century requires every individual to have comprehensive abilities, namely abilities that are balanced between knowledge, skills, attitudes, and values in their lives (Asrizal et al., 2022). To face the challenges of the 21st century, human resources are needed who are able to compete and make every aspect of life easy to do (Noorhapizah et al., 2020). Human resources must have important abilities, namely creative thinking skills (Asriadi & Istiyono, 2020; Busyairi et al., 2022). These skills are needed to develop new ideas, increase efficiency, and design solutions to complex problems related to science content. In addition, these skills are the basis for innovating and preparing superior human resources (Duong et al., 2020).

The ability to use technology is also seen as a core ability that must be possessed in the 21st century. The rapid development of technology in this century affects many aspects of life, one of which is education (Hidayatullah et al., 2021; Uygarer & Uzunboylu, 2017). 21st century education is driven by the rapid development of information and communication technology, which not only produces new teaching approaches but also paves the way for new generations to enter the higher education system (Sriboonruang et al., 2023). Technological development require educators to be able to integrate technology into learning. The goal is to create a dynamic learning environment (Dakhi et al., 2020).

The application of technology to learning can be done in various ways. One form is the development of digital teaching materials (Sariyatun et al., 2018). Digital teaching materials are one of the current educational

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trends, namely developing learning by reducing the use of paper in schools, so that the use of computers in learning becomes a necessity in schools, both for the benefit of the learning process and the evaluation of learning outcomes (Kustijono & Hakim, 2018). Digital teaching materials can help teachers increase students' enthusiasm for receiving learning materials so that it becomes an effort to help create more interactive learning and help students achieve learning goals (Suni & Ahmad, 2023). Previous research findings stated that digital teaching materials received a positive response from students (Kustijono & Hakim, 2018). Other researchers' findings also revealed the need to develop digital teaching materials so that learning becomes more interesting as an effort to prepare the future generation to fully master the challenges of the 21st century (Mardiana et al., 2021; Widya et al., 2021).

Learning in the Independent Curriculum is carried out through various project-based activities and can be implemented by adding local content according to the local wisdom of the region. The goal is to encourage students to become skilled in producing work, understanding concepts, and applying them to solve real problems (Intiana et al., 2023). Many research results state that the project-based learning model (PjBL) is a learning model that is suitable for improving 21st century skills. This is because this model emphasizes student activities to produce products as a form of applying research, analysis, creation, and presentation skills from concepts that have been learned with real experience (Ekawati et al., 2019; Panggabean et al., 2021; Undari et al., 2023). The PjBL model is based on learning that is in accordance with the needs in the field to develop problem-solving and technology-based skills (Asman et al., 2022). The PjBL model is an effective model for developing skills needed in the 21st century, including critical thinking, problem solving, interpersonal communication, information and media literacy, collaboration, leadership and teamwork, innovation, and creativity.

As a large and diverse nation, teachers have a role to play in introducing and instilling culture in students. For this reason, real efforts are needed to implement cultural knowledge in Indonesian educational institutions (Udiyana et al., 2022). The goal is for students to be aware of their culture and the surrounding environment, where this awareness is closely related to students' mindsets in solving problems (Lestari & Apsari, 2022). Integration of physics material with local wisdom that surrounds the student's place of residence not only makes it easier for students to understand physics material but also to be more familiar with physics material with the surrounding culture that may begin to be replaced by outside culture (Fauzana et al., 2019). Local wisdom-based learning reflects the ethnoscience of a particular cultural community (Batlolona et al., 2022).

The integration of local culture with science learning, especially physics, is still rarely applied. This is supported by the statement of Udiyana et al. (2022) and Walid et al. (2022) stated that currently the integration of local wisdom in learning is still lacking. Several contributing factors are the difficulty of time in making teaching materials, the cost of making teaching materials, determining learning materials that are relevant to local culture, and the lack of teacher understanding of local culture (Basuki et al., 2023). This statement is also in accordance with the results of observations conducted by researchers at two Senior High Schools (SMAN) in Jambi City. During classroom learning, teachers only refer to textbooks and do not link physics learning to local culture. This is due to the unavailability of teaching materials based on local culture.

Based on the results of observations at two SMAN in Jambi City, several problems were found in the learning process. First, schools have not utilized the potential of developing technology to support the learning process optimally. The second problem is that students' knowledge skills are still in the sufficient category with a percentage of 55%. The third problem is that students' creative thinking skills are still low. The fourth problem is that students do not yet have access to learning resources that are relevant to the context of local wisdom in the Jambi region.

The results of the initial study conducted showed that there was a gap between ideal conditions and real conditions. This gap indicates a significant difference between what should happen according to theory or expectations, and what actually happens in the field. The solution offered by previous researchers is to develop a digital teaching material containing Ethno-STEM material on force and motion (Juniawan et al., 2024). Other researchers also provide solutions in the form of developing digital physics teaching materials based on Malay ethnoscience (Irfandi et al., 2023). Previous researchers also developed an ethno-STEM e-module with a PjBL model based on local wisdom of Yogyakarta to improve students' creative thinking skills (Maryanti et al., 2023).

Although these solutions have been implemented, there are still limitations in their scope and effectiveness. These limitations include not yet including integrated alternative energy materials with the PjBL model and local wisdom of Jambi Province. Another limitation can also be seen from the dependent variable used, which is only limited to one dependent variable. To overcome these limitations, a more integrative and comprehensive solution is needed. The proposed solution is the

development of digital teaching materials integrated with the PjBL and ethnoscience learning models.

The PjBL model is an effective learning model to develop students' knowledge and creative thinking skills. The PjBL model will be packaged in digital teaching materials and integrated with ethnoscience. The goal is that along with the development of science and technology, students' awareness of local wisdom and culture will not decrease. Modernization has eroded the nation's cultural values due to the lack of application and understanding of the importance of culture in society. Integration between teaching materials and technology can facilitate a better learning experience, especially in 21st century learning (Thinnukool, 2018). The results of previous research show that by using the PjBL model, students' interest and motivation in learning can be increased because this model focuses on students (Padang et al., 2023). This model encourages students to be more active and understand concepts better when doing direct projects rather than receiving theory.

Based on the presentation of research data conducted by previous researchers, and the results of initial research on location regarding learning in schools, this research is important. This research is important because considering the current era is the digital era where learning requires digital-based learning. The importance of cultural integration into learning so that students are not carried away by the current of globalization and understand the culture around them so that the potential of students continues to develop. This reason made researchers interested in developing an integrated digital teaching material for the PjBL and ethnoscience models. The goal is to produce valid, practical, and effective digital teaching materials for alternative energy for learning in the independent curriculum.

Method

The research method used in this study is design research. The research procedure used in this study refers to the PLOMP model. The PLOMP model was chosen because it has analysis priorities in each stage of research, each syntax can be adjusted to research needs, and the development or prototype-making phase is the main one in this development model to formulate and determine answers to research problems (Harahap et al., 2020). This model consists of three phases, the first is preliminary research (needs analysis and literature review), the second is the development or prototyping phase (prototype design stage, formative evaluation, and prototype revision), and the third is the assessment phase (assessment stage) (Plomp & Nieveen, 2010). The prototype creation stage is carried out in steps that refer to the Tessmer diagram in Figure 1.

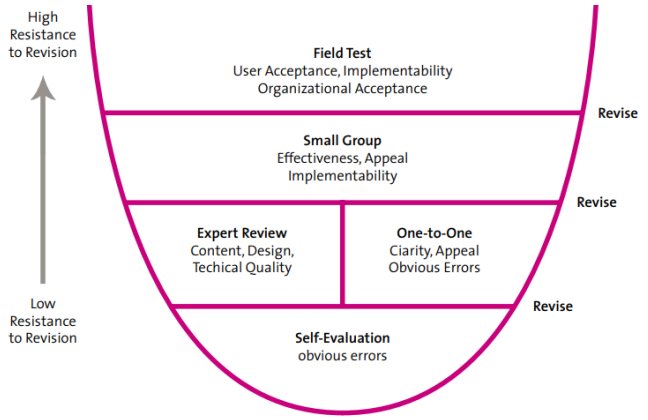

Figure 1. Tessmer diagram

Subjects testing to investigate to see the validity of the product consisted of five validators of physics lecturers at FMIPA UNP. The trial subjects to see the practicality of the product were teachers and students at one of the SMAN in Jambi City. Practicality in this study consists of three stages, namely the individual evaluation stage, the small group evaluation stage, and the field test stage. The object of this study is digital teaching materials on the theme of integrated sustainable lifestyles (Ethno-PjBL. This research was only conducted up to the practicality stage at the assessment phase, namely the development trial tested on 36 students at one of the SMAN in Jambi City in the 2023–2024 academic year.

The instruments used in this study consisted of teacher interview guidelines, student needs analysis questionnaires, student characteristics analysis instruments, validation instruments, practicality instruments, and written test instruments consisting of 10 multiple-choice questions to see students' knowledge abilities and 4 essay questions to see students' creative thinking skills. The data analysis technique used is descriptive analysis that describes validity and practicality. The final value data for the validity results were obtained using the formula (Aiken, 1985).

$$V = \frac{\sum s}{n(c-1)} \quad (1)$$

Information regarding the product validation result assessment criteria is as follows: S = r – l0, where l0 is the lowest validity assessment value (score = 1), c is the highest validity assessment value (score = 5), and r is the value given by an expert. This assessment aims to measure how valid a product is based on expert evaluation. By using this scale, we can determine the

quality and reliability of the product objectively. These assessment criteria can be seen in Table 1.

Table 1. Interpretation of Product Validity (Aiken, 1985)

Criteria	Criteria Interval
< 0.80	Valid
> 0.80	Invalid

Table 2. Interpretation of Product Practicality

Criteria	Criteria interval
Very well	81 – 100
Good	61 – 80
Enough	41 – 60
Less	21 – 40
Very good	< 21

The practicality of a product is an important aspect in evaluation, as it reflects the ease of use and benefits for users. The assessment score (f) is usually collected through surveys or product trials by users. The total score (N) represents the maximum value that can be achieved in the assessment. The final percentage (P) is calculated to determine the extent to which the product is practical in its use. Table 2 contains details of the assessment categories that help in interpreting the final score, ensuring that the product meets the expected practicality standards.

Result and Discussion

Preliminary Research

This research begins with a preliminary research stage. This stage is carried out to obtain information about problems in schools and possible solutions. The results of this stage are also used to obtain the temporary characteristics of the product to be developed. At this stage, needs and context analysis, literature studies, and conceptual framework development have been carried out. Based on the results of interviews and the distribution of questionnaires and questions on knowledge and creative thinking, several problems were found in the learning process.

The first problem is based on the results of interviews with teachers, it was obtained that students' knowledge and creative thinking skills were still low. To strengthen this statement, student analysis was carried out. Student analysis was carried out by distributing questions to measure knowledge and creative thinking skills. The results of the analysis of creative thinking skills data on each indicator can be seen in Figure 2. In addition, the results of the analysis of student knowledge data on each indicator can be seen in Figure 3, which provides an overview of the level of student knowledge in various aspects relevant to learning.

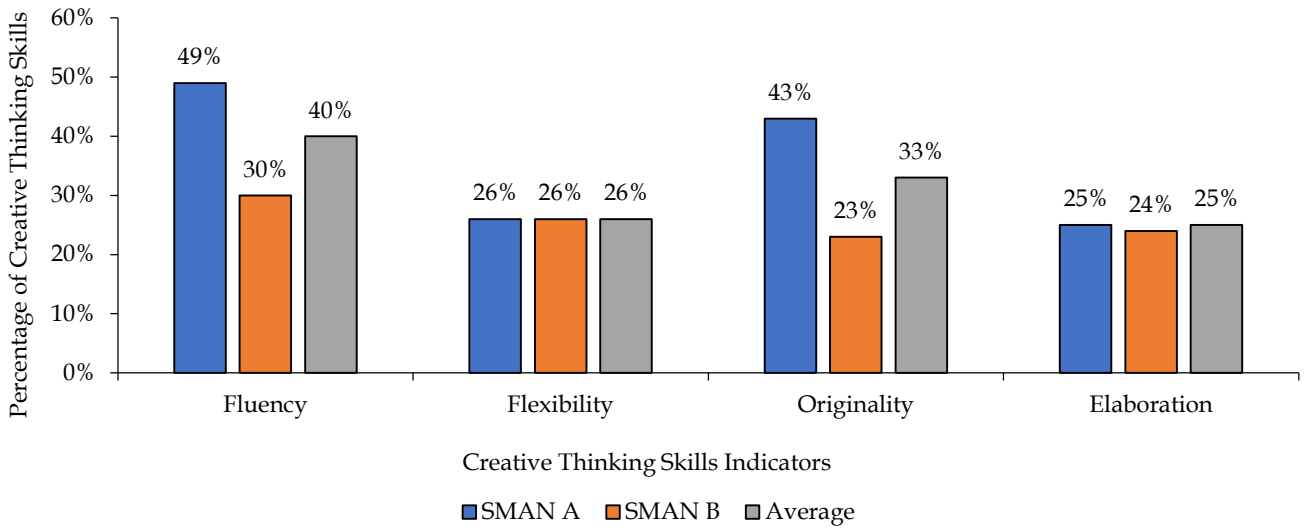

Figure 2. Results of creative thinking skills data analysis

On the fluency indicator, the average percentage obtained was 40%, with a low category. In the flexibility indicator, the average percentage obtained was 26%, with a low category. The originality and elaboration indicators, respectively, had percentages of 33% and 25% with a low category. Based on these data, it can be concluded that the highest percentage of creative thinking skills indicators is fluency, and the lowest indicator is elaboration. Furthermore, an analysis of students' initial knowledge was carried out on each indicator, consisting of C1 (remembering), C2 (understanding), C3 (applying), C4 (analyzing), C5 (evaluating), and C6 (creating). The results of the analysis of students' initial knowledge can be seen in Figure 3.

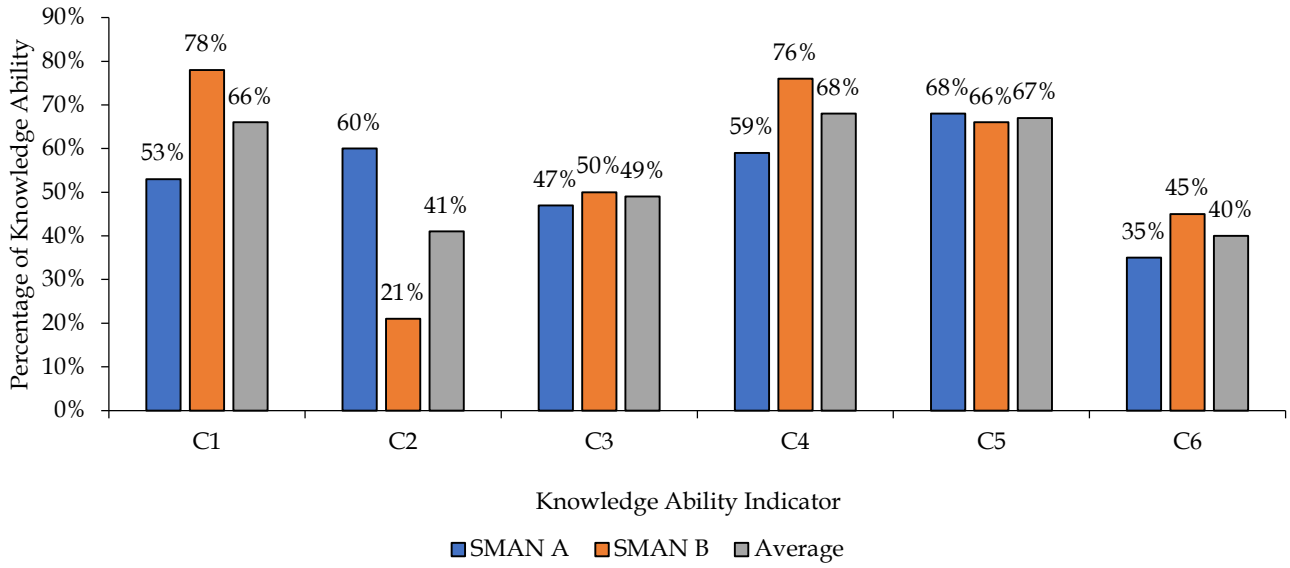

Figure 3. Knowledge ability data analysis results

Based on Figure 3, it can be seen that the highest indicator is indicator C4 with a percentage of 68% in the high category, while the lowest indicator is indicator C6 (creating) with a percentage of 40% in the low category. Indicator C2 (understanding) obtained a percentage of 41% with a sufficient category. Indicator C3 (applying) obtained a percentage of 49% with a sufficient category. Indicator C5 (evaluating) obtained a percentage of 67% with a high category.

The second problem is that schools have not utilized the potential of developing technology to support the learning process optimally. Although technology is increasingly advanced, its application in learning is still limited. For example, currently, teachers are using digital teaching materials in the form of PDF files that are shared with students. However, the use of this technology is still far from optimal because it is only limited to the distribution of learning materials without any interactivity or additional features that can improve student understanding.

The third problem is that students do not yet have access to learning resources that are relevant to the context of local wisdom in the Jambi region. Conventional teaching materials often do not cover aspects of local wisdom, and as a result, students are less familiar with the culture and traditional knowledge of their region. Integration between science and local wisdom is often overlooked. In fact, combining scientific knowledge with local wisdom can make learning more meaningful and easier for students to understand because it is in accordance with their daily lives. the fourth problem is that teachers have never used digital teaching materials that they have developed themselves in accordance with the demands of independent curriculum learning.

Based on the results of the student needs questionnaire, information was obtained regarding the learning resources used. As many as 88% of students use printed books, 12% use the internet, and 4% use LKS (student worksheets). Printed books are still the main learning resource used by most students. This shows that conventional learning methods are still dominant in their educational environment. The use of the internet as a learning resource shows that some students have started to utilize technology to obtain additional information other than printed books. Meanwhile, no students use e-modules, as evidenced by the percentage of use of 0%. The results of the questionnaire also showed that 100% of students felt the need for other learning resources that were easier to understand and learn independently. In addition, as many as 84% of students stated that they were interested in using digital teaching materials on the theme of sustainable lifestyles integrated with Ethno-PjBL.

Various studies have shown that students' creative thinking skills in physics learning are low (Wibowo & Ahmad, 2023; Muchsin & Mariati, 2020; Auliyah et al., 2021; Praptama et al., 2023; Sarah et al., 2023; Suciati et al., 2023). The reason is that in general creative thinking is not trained by teachers. Most students only pay attention and take notes on what the teacher says. Teachers still think that creative thinking is not important in the learning process. This can be seen from the frequency of teachers giving tests using routine questions rather than questions that contain problem solving (Purwati & Alberida, 2022).

Various studies have also shown that students' knowledge in physics learning is still low (Amelia et al., 2021; Astra, 2023; Namira et al., 2024; Susilawati et al., 2022). This happens because so far physics learning has

implemented conventional learning. Students are often asked to answer questions on worksheets whose answers are available in books, which does not facilitate in-depth thinking. The use of traditional learning models with whiteboards and student handbooks does not make students more active and enthusiastic in participating in learning. Teachers also tend to dominate the learning process, so that students listen more than actively participate. This condition indicates the need for a learning model that is more relevant to the current conditions of students and adequate facilities to empower students' thinking abilities (Ilma et al., 2022; Malik et al., 2022; Samputri, 2020).

Literature studies also reveal that the factors causing low knowledge and creative thinking abilities are due to the lack of access to technology by most students, which hinders students' learning abilities (Dewi et al., 2019; Fideli & Vincent, 2022). In line with that, Saputro et al. (2020) also argue that the use of digital technology in learning can provide opportunities for a more effective learning process. In general, digital-based learning aims to encourage student-oriented learning, so that the student learning process is mostly shifted from teacher to student (Saarinen et al., 2021). The use of digital technologies in learning provides an opportunity to develop one's knowledge from basic ideas and theories that form the structure of construction and thinking to intuitive mechanisms that regulate life, providing an opportunity to participate and discuss the ideas they have (Beisenbayeva et al., 2024).

Prototyping Phase

Based on the results of the initial needs analysis, a digital teaching material was designed on the theme of sustainable lifestyle integrated with Ethno-PjBL so that it can be used by students and teachers as one of the teaching materials in the physics learning process. This stage consists of two stages, namely designing a product in the form of digital teaching materials and conducting formative evaluations. Students are expected to understand the importance of a sustainable lifestyle through interactive and contextual learning. The material presented in this digital teaching material includes basic physics concepts that are related to sustainable lifestyle issues. The cover display and objectives of the digital teaching materials on the theme of sustainable lifestyle can be seen in Figure 4, the design of the digital teaching materials can be seen in Figure 5, and the design of the student worksheets can be seen in Figure 6.

Figure 4 shows the appearance of the cover design of digital teaching materials. The cover of digital teaching materials is designed to attract the attention of readers and introduce the contents of the learning materials clearly. The front page of the digital teaching materials presents important information such as the title of the digital teaching materials, learning topics, classes, authors, logos, and images that can represent the contents of the digital teaching materials created. The design of learning objectives in digital teaching materials is very important because it functions to attract the attention of readers, provide clear information, and reflect the contents of the teaching materials. Visual elements such as attractive images and colors can help attract readers' interest, while information such as the title, topic, class, and author help readers understand the content to be learned and who created the material. Learned.

Figure 5 shows the appearance of the material design in digital teaching materials. The material description contains a detailed explanation of the learning material. In this section there are also several videos to make it easier for students to understand the material, as well as questions that can increase students' knowledge and creative thinking skills.

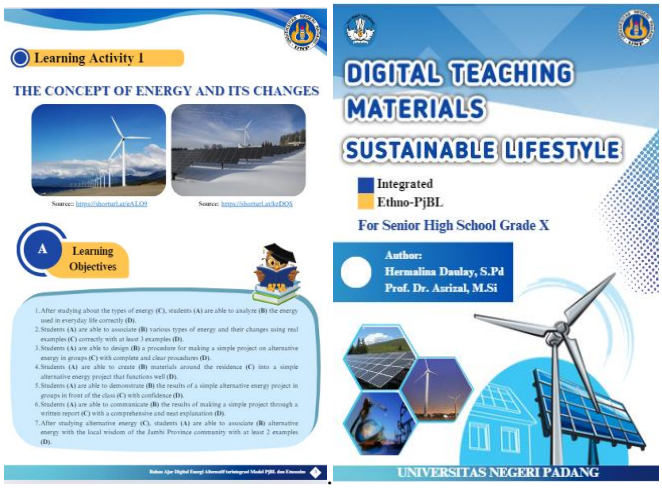

Figure 4. Cover design

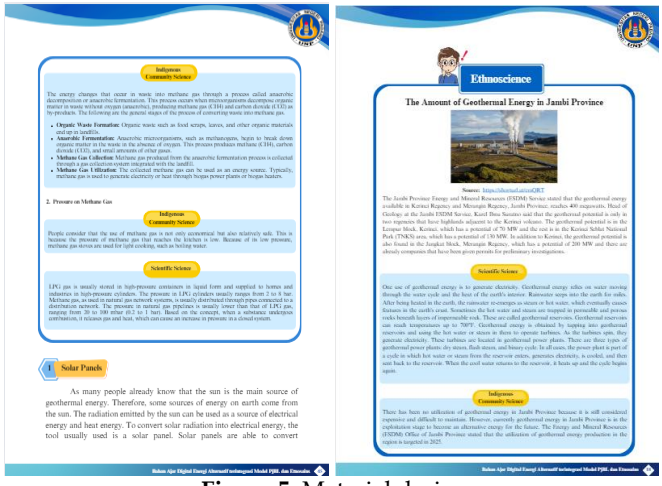

Figure 5. Material design

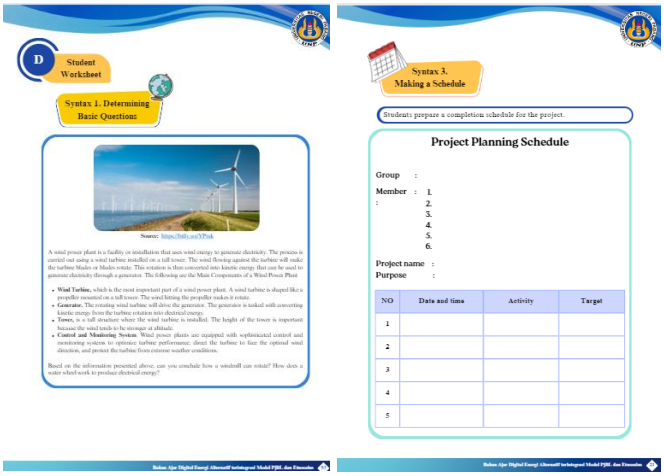

Figure 6. Worksheet design

Figure 6 shows the design of the student worksheet on digital teaching materials. In this section, there is a syntax for the project-based learning model. The syntax of the project-based learning model begins with the first phase, namely determining basic questions in the form of questions that can be assigned to students to determine activities. The second phase is to prepare a project plan that is carried out collaboratively between teachers and students and contains a selection of activities that can support answering basic questions and knowing the tools and materials used to help complete project activities. The third phase is to prepare a schedule, namely to create a timeline for completing the project and a deadline for completing the project. The fourth phase is project monitoring, in which the teacher is responsible for monitoring student activities while completing the project. The fifth phase is to test the results and presentations made to help teachers measure the achievement of standards, play a role in evaluating the progress of each student, and provide feedback on the level of understanding that has been achieved. The sixth phase is evaluation, in which educators and students reflect on project activities and results.

After the prototype is completed, before being validated by the expert team, each prototype is re-examined by the researcher. At this stage, the researcher reads and checks the completeness of each prototype, corrects any errors, and adds any parts that are deemed lacking. In digital teaching materials, each prototype is checked in terms of the suitability of the teaching material structure, the suitability of the application of the PjBL learning model syntax in digital teaching materials, the suitability of the application of ethnoscience in digital teaching materials, and the use of language, writing images, punctuation, and correct equations. Based on self-evaluation, the structure of the digital teaching materials is in accordance with the guidelines used, the application of the PjBL learning model has been implemented in digital teaching materials, ethnoscience has been applied in digital teaching materials, and the use of language, writing, images, and punctuation is correct.

The designed digital teaching materials were then validated by five validators. The assessment of the integrated Ethno-PjBL sustainable lifestyle-themed digital teaching materials was carried out using a validation instrument. The validation instrument consists of four assessment aspects, namely the material substance aspect, learning design, appearance, and software utilization (Depdiknas, 2010). Based on the validation results carried out by five validators, several comments and suggestions were obtained, which will then be used to improve the integrated Ethno-PjBL sustainable lifestyle-themed digital teaching materials that have been created to be better.

Based on comments and suggestions from expert validators on digital teaching material products, the next step is to make revisions by improving the product according to the input and suggestions given by the validators. After going through the revision process and the digital teaching material being declared valid by the validators, the digital teaching material is ready to be tested in the school environment. The results of the validation assessment by expert validators on digital teaching materials can be seen in detail in Table 3.

Table 3. Expert Validation Results

Assessment aspects	Validation value	Category
Substance of material	0.89	Valid
Learning design	0.89	Valid
Appearance	0.92	Valid
Software	0.86	Valid
Average	0.89	Valid

Based on Table 3, it can be explained that the digital teaching materials developed have an average Aiken's V value of 0.89, which is a valid category. Based on these data, digital teaching materials with the theme of sustainable lifestyles integrated with Ethno-PjBL can be used in learning activities. The high validity value indicates that the materials are well-received by the evaluators. This integration of sustainable lifestyles and Ethno-PjBL offers a unique approach to engaging students. Moreover, the practical application of these materials in a real classroom setting can enhance learning experiences. Therefore, educators are encouraged to adopt these materials to promote effective and meaningful learning.

In developing teaching materials, validation by several experts is required so that the development can produce teaching materials that are in accordance with the needs, concepts, and characteristics of students (Desyandri et al., 2021). The purpose of validation is to obtain recognition and approval of the suitability of the

product to the needs so that it is feasible and suitable for use in learning. Product validity testing will produce better products because validity testing provides an opportunity for validators to provide input and suggestions on the product being developed (Sawitri & Asrizal, 2024). A teaching material will be declared valid if it is measured with a tool that is capable of measuring the teaching material; in this case, the teaching material is validated using inter-rater analysis techniques (Sukardi et al., 2020).

The assessment aspects of the validity test in this study consist of four components, namely the material substance aspect, learning design, appearance, and software utilization. The assessment of digital teaching materials on the theme of sustainable lifestyle integrated with Ethno-PjBL was carried out by five experts, namely lecturers in physics education at Padang State University. The results of the data analysis from the validity test on the material substance aspect, which includes truth, depth, contemporary, and readability in digital teaching materials, obtained a valid category. The learning design aspect, which includes the title, learning outcomes (CP), learning objectives, materials, sample questions, exercises, summaries, self-assessments, evaluations, compilers, and references in digital teaching materials, obtained a valid category.

The appearance aspect, which includes navigation, letters, media, colors, and layout in digital teaching materials, obtained a valid category. The accuracy in selecting the appearance aspect is also considered in the development of this teaching material by creating a cover design, background color, and selection of images in the teaching module, as well as the layout of images or text, so that this teaching module has very good qualifications and is worthy of being implemented (Pratiwi & Jayanta, 2023). The software utilization aspect, which includes interactiveness and authenticity in digital teaching materials, obtained a valid category. The overall results of the validation of digital teaching materials on the theme of integrated sustainable lifestyle (Ethno-PjBL) obtained a valid category.

The development of materials through teaching is very important. The results of research by Mudiartana et al. (2021) how that digital teaching materials developed based on local wisdom can provide a better learning experience. The development of project-based teaching materials (PjBL) is an effort to design teaching materials that are appropriate to students' needs using a project-based approach. This requires attention to time constraints, the availability of resources such as equipment, materials, and experts, as well as strong support from teachers, parents, and schools, so that the learning experience is optimal. Teachers must consider resource and time factors for optimal implementation of teaching materials. The development of project-based teaching materials provides significant benefits for students in improving their understanding and skills by getting them used to solving problems, finding solutions, and producing project assignments based on the problems given, so that learning becomes more active through group discussions to achieve learning goals (Muslim et al., 2023).

After the digital teaching materials are declared valid by the validator, a practicality test is carried out. The practicality test aims to determine the extent of the practicality of the developed digital teaching materials. Practicality tests were conducted by teachers and students. The results of the data analysis from the practicality test were obtained from an assessment of ease of use, time efficiency, and the benefits of digital teaching materials in learning activities. The average results of the practicality test by teachers were in the very good category. Furthermore, the results of the practicality test by students were also in the very good category. The next stage was a one-on-one evaluation stage with representatives of students who would be the targets of the study. The students selected were three students with different abilities, ranging from low to medium to high. The instrument used was a practical instrument for students. The results of the practicality of the one-on-one evaluation can be seen in Table 4.

Table 4. One-on-One Evaluation Results

Rated aspect	Mark (%)	Criteria
Ease of use	0.94	Very good
Learning time efficiency	0.96	Very good
Benefit	0.89	Very good
Total	0.93	Very good

Table 4 shows that the average value of the practicality of digital teaching materials based on one-on-one evaluation is 0.87 with a very good category. One-on-one evaluation consists of three students with different abilities, namely low ability, medium ability, and high ability. This grouping is done so that the practicality results obtained can be stated to apply to various levels of student cognition. By involving students of various levels of ability, this evaluation ensures that digital teaching materials can be used effectively by all students, regardless of their cognitive abilities. The practicality results from the individual evaluation stage are described based on the abilities of each student, thus providing a more comprehensive picture of the effectiveness of these digital teaching materials. This approach ensures that teaching materials are not only suitable for students with high abilities but also inclusive and beneficial for students with medium and low abilities. The results of the individual evaluation stage can be seen in Figure 6.

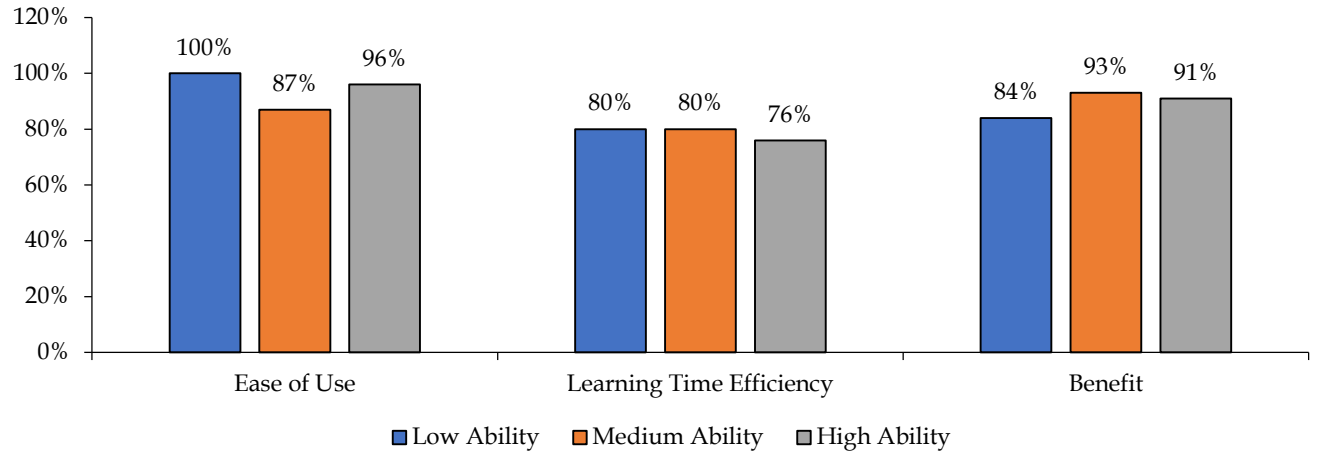

Figure 7. Result of one to one evaluation

Based on Figure 7, it is known that from the results of the one-on-one evaluation, the digital teaching materials are overall easy to use, efficient to use, and useful in learning for students with low abilities, medium abilities, and high abilities. The results of the one-on-one evaluation are then analyzed, and improvements are made if there are components that need to be improved. If nothing needs to be improved, the next stage is a small group evaluation.

Table 5. Results of Small Group Evaluation Practicality

Rated aspect	Mark (%)	Criteria
Ease of use	0.87	Very good
Learning time efficiency	0.88	Very good
benefit	0.89	Very good
Total	0.88	Very good

Small group evaluation is a step that aims to determine the practicality of the product based on small groups. Sample selection at this stage is carried out randomly on nine class X students with different levels of ability. The instrument used is the student practicality instrument. The results of small group practicality can be seen in Table 5.

Table 5 shows that the average practicality value of digital teaching materials based on small group evaluations obtained a value of 0.88, which is included in the very good category. The practicality results from the small group evaluation stage are described based on groups with low, medium, and high abilities. The purpose of this grouping is so that the practicality results obtained can be stated as applicable to various levels of student cognition. With this grouping, it can be ensured that the digital teaching materials are effective and can be well received by students with various levels of ability. The results of the small group evaluation show that these digital teaching materials are not only easy to use by students with high abilities but can also be applied effectively to students with medium and low abilities, thus ensuring inclusivity in the learning process. The results of the small group evaluation can be seen in Figure 8.

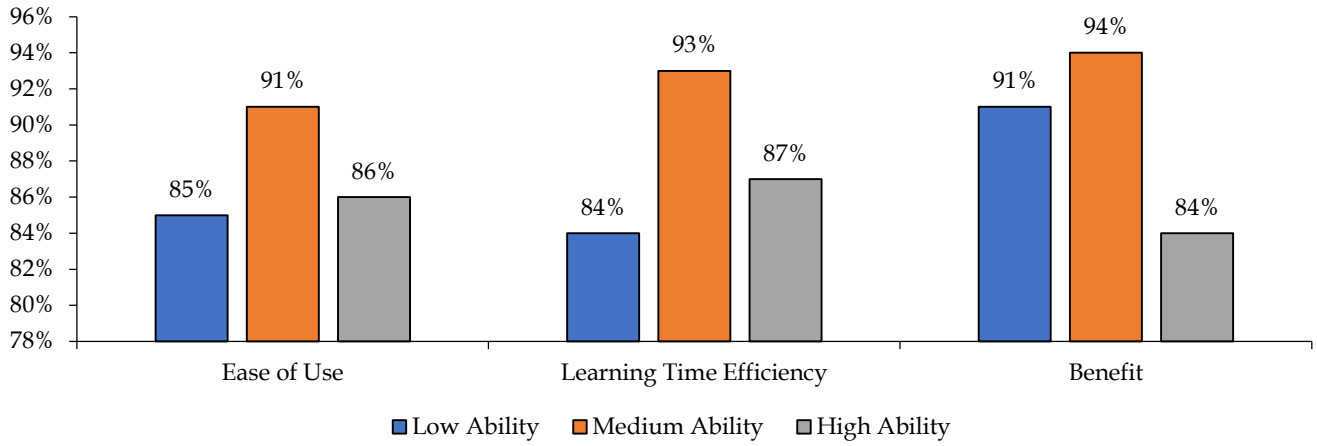

Figure 8. Small group evaluation results

Based on Figure 8, it is known that, based on the results of the small group evaluation, the digital teaching materials are overall easy to use, efficient to use in learning, and useful in learning for students with low, medium, and high ability groups. Thus, it can be concluded that the digital teaching materials produced in this study are worthy of being tested on a large scale with students.

Assessment Phase

At this stage, the practicality questionnaire was given to class X physics teachers and class X students to see the responses in the use of integrated digital teaching materials PjBL and ethnoscience learning models. First, for the practicality questionnaire by the teacher, it was distributed to one class X physics teacher. The results of the practicality test at the field test stage based on the responses by the teacher can be seen in Table 6.

Table 6. Teacher Practicality Results

Rated aspect	Mark (%)	Criteria
Ease of use	0.9	Very good
Learning time efficiency	0.86	Very good
Benefit	0.94	Very good
Total	0.90	Very good

Based on Table 6, it is known that the average value of the practicality of digital teaching materials based on teacher responses obtained a value of 0.90 with a very good category. Based on these data, the digital teaching materials on the theme of sustainable lifestyle integrated with Ethno-PjBL are very good to use in learning activities. Second, for the student practicality questionnaire, the class used was class X E6 with 36 students. The results of the practicality test at the field test stage based on student responses can be seen in Table 7.

Table 7. Student Practical Results

Rated aspect	Mark (%)	Criteria
Ease of use	0.88	Very good
Learning time efficiency	0.87	Very good
Benefit	0.89	Very good
Total	0.88	Very good

Based on Table 7, it is known that the average practicality value of digital teaching materials on the theme of sustainable lifestyle based on responses from students is 0.88, which is in the very good category. Based on these data, digital teaching materials on the theme of sustainable lifestyles integrated with Ethno-PjBL are very good to use in learning.

The practicality test was carried out in three stages, namely a one-to-one test, a small group test, and a limited field test (Plomp & Nieveen, 2010). The results of the one-to-one trial analysis were in a very good category. The results of the small group test analysis obtained a very good category. After carrying out the one-to-one test and small group test stages, a limited field test was carried out. The results of the limited field test on students obtained a very good category, and the results the results on teachers also obtained a very good category. Based on the results obtained, it can be stated that the digital teaching materials on the theme of sustainable lifestyle integrated with Ethno-PjBL are very good in terms of ease of use, efficient learning time, and benefits.

Teachers in schools must be able to integrate technology into learning because technology greatly helps teachers and students in the learning and teaching process (Rokhayati & Widiyanti, 2022; Nuryantini & Yudhiantara, 2019). The integration of advanced technological devices in physics education will revolutionize the learning environment, offering various opportunities for students and educators to improve educational outcomes (Faresta et al., 2024). The results of previous studies have shown that there are significant differences between students who are taught using PjBL learning and those taught with conventional learning, both in terms of learning outcome parameters and creative thinking skills (Saputra & Kuswanto, 2019). This is reinforced by the opinion of Asrizal et al. (2020), who stated that electronic teaching materials can provide opportunities for students to study learning materials at home or other places.

Conclusion

The results of the study show that digital teaching materials of Sustainable Lifestyle Theme Integrated Ethno-PjBL for Independent Curriculum Learning have valid criteria and a very good level of practicality, according to teachers and students. In conclusion, this digital teaching material is valid and practical for use in learning.

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Author Contributions

Conceptualization; S. B.; methodology.; E.; validation; formal analysis; S. B.; investigation.; E; resources; S. B.; data curation: E.; writing—original draft preparation. S. B.; writing—review and editing: E.; visualization: S. B. All authors have read and agreed to the published version of the manuscript.

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