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Development of Liveworksheet-Based E-Module on Energy and Business Materials for Class XI Vocational School Students

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Abstract: This research aims to develop, assess the validity, and determine student responses to a Liveworksheet-based e-module on Energy Efficiency in Small and Medium Enterprises as a learning resource for vocational students. The research and development (R&D) method employed the ADDIE model, which includes stages of Analysis, Design, Development, Implementation, and Evaluation. The e-module was developed using the Liveworksheet application to enhance interactivity and engagement. Data analysis of validity and student responses was conducted quantitatively using descriptive percentage techniques. The results show that the e-module achieved an average validity score of 92.62% from material experts, media experts, and education practitioners, categorized as very good and suitable for implementation. Student response tests conducted in two stages—small class trials with a score of 92.5% and large class trials with a score of 91.34%—both fall within the very good category. These results indicate that the developed e-module is valid, practical, and feasible to be used as an effective digital learning resource in vocational education.

Keywords: E-module media; Energy and effort; Learning teaching materials

Introduction

Technological advances in the twenty-first century, commonly referred to as "Industry 4.0", have given birth to new technological innovations that are closely related to digital elements such as the Internet of Things (IoT), artificial intelligence (AI), big data, mobile technology, and production facilities that facilitate data collection and analysis, both manual and automated. This research has significant implications for the evolution of education, especially in the 4.0 era, when effective teaching strategies are implemented through the use of appropriate technology, especially by utilizing various teaching media. The use of various learning media, such as audio, video, images, web-based media, and mobile-based, has increased in the context of the 4.0 era and can be integrated with blended learning models (Rusli et al., 2020). The application of learning media is very important to achieve learning goals, in accordance with a principle emphasized by previous researchers (Fatria, 2017; Nurhidayati et al., 2023). Therefore, adopting learning media technology is very important to ensure the effectiveness and suitability of learning in this era.

In the context of the learning process, it is important for educators to have the ability to develop digital-based teaching materials flexibly in line with the development of the industrial revolution (Oktaviara & Pahlevi, 2019; Darmawan et al., 2024; Muzijah et al., 2020). To meet these needs, innovations in electronic teaching materials are needed, such as the application of e-modules. E-modules are electronic modules that present learning materials that can be accessed by students independently, regardless time and place Similar to conventional teaching materials, e-modules have an introductory section that outlines the learning objectives and subject matter, including the presentation of materials and exercises. In electronic form, this module consists of attractive digital text and images. The

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advantage of e-modules lies in their ability to present images, audio, video, and animation, thus creating an interactive learning experience (Azkiya et al., 2022; Ekasari, 2024). One of the digital e-module media applications is Liveworksheet. The web-based application "Liveworksheet.com" is a student worksheet that can convert printed worksheets in the form of .doc, .pdf, .jgg into interactive worksheets that can be systematically corrected (Prabowo, 2021). Its accessibility through smartphones or computers makes Liveworksheet a practical choice for teachers, facilitating the design of teaching materials and efficient content delivery (Hapsari & Zulherman, 2021).

In the context of technology-based education, the focus shifts towards the use of more practical and effective media and teaching materials, so that it is easier for students to use (Murjainah et al., 2020). Technological advances have had a positive impact, especially in the development of digital learning environments. The use of modules as media and teaching materials can be more easily realized with the support of available technology. This approach positions the module as a student-oriented tool, encouraging independence and active participation of students in the learning process (Putra & Syarifuddin, 2019). As the times adopt technology, many modules are converted into e-modules to improve practicality, portability, and accessibility without the need for a larger physical space (Irkhamni et al., 2021). The use of the Liveworksheet application was identified as a solution to create interactive e-modules relevant to this context. This initiative is expected to be an innovative step in supporting technology-based education and creating more modern teaching materials.

The development of e-modules through Liveworksheet has become a major focus for researchers and education practitioners in various fields. The selection of Liveworksheet as an e-module development platform is based on several advantages, such as the availability of various input games, the addition of external media such as video and sound, easy accessibility of applications and websites, optimal image upload quality, and drag-and-drop features that facilitate the editing process (Tanjung & Faiza, 2019). Relevant previous research on the development of e-modules using Liveworksheet, such as those conducted by Pardede et al. (2023) shows that Liveworksheet-based electronic modules for regulatory system materials have been successfully developed and obtained a very valid and excellent category, so that they can be implemented in learning activities in schools. Sholihah et al. (2023) reported the results of their research, showing that the development of teaching materials in the form of e-modules was declared valid and practical through qualitative analysis. The validity of the teaching materials is obtained through expert reviews with comments and suggestions from validators, while Practicality is measured through one-to-one stages and small groups by analyzing comments and suggestions from students. Potential effects were found from student evaluation tests at the field test stage, where the e-module teaching materials developed showed potential effects with a problem-solving success rate of 81.8%. Focusing on the results of Sutomo et al. (2023), the validity of material experts was obtained of 78.4% (good category), the validity of media experts was 78.4% (feasible category), and the validity of instructional design experts was 82.41% (very feasible category). Thus, the average validity reached 79.73% in the valid category.

This study applies the ADDIE model formulated by Branch (2009) as a framework for the development of Liveworksheet-based interactive e-modules, with a focus on Energy and Business materials. The purpose of this study is to evaluate the validity and assess students' responses to the development of interactive e-modules based on the Liveworksheet application for learning Energy and Business materials in grade XI of SMK.

Method

This study employs a Research and Development (R&D) approach, which is a research method aimed at producing new products and testing their effectiveness (Marpaung et al., 2021). The R&D approach was applied to develop and validate Liveworksheet-based teaching materials on Energy Efficiency and Business for Grade XI vocational students.

The research was conducted at SMK Negeri 4 Payakumbuh City during the odd semester of the 2024/2025 academic year. The school was selected using the purposive sampling area method based on several criteria: the school has implemented the Merdeka Curriculum, teachers and students have access to digital devices and internet connectivity, and the subject of Energy and Business is part of the existing learning structure.

This development follows the ADDIE model, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The model emphasizes learner-centered instructional design, authentic tasks, and contextual learning that align with real-world vocational applications.

Analysis Stage

This stage is carried out to collect the data needed for the creation of e-modules. During the analysis process, the focus is to assess the needs of students during the learning process, Identify the causes of problems in learning and pre-planning thinking or

deciding about the subject or course to be given. The analysis stage was carried out by conducting a survey using a questionnaire given to students in grades XI-3 and XI-4. Data from the analysis of the student needs questionnaire were then analyzed using the formula (Nindiawati et al., 2021):

$$\text{Total overall percentage} = \frac{\text{Total overall percentage}}{\text{Number of Indicators}} \times 100 \quad (1)$$

Design Stage

This stage involves data acquisition and design planning. The details of the two steps include: data acquisition is carried out to collect materials that will be integrated into the e-module, and e-module design planning is carried out through the Liveworksheet application as software for product creation. Design planning includes elements from the front page, such as covers to bibliographies.

This design step is to verify the willingness to learn and the right exam method. In completing this design stage, teachers must be able to prepare a specific set of functions to close the gaps in learning implementation for lack of knowledge and skills. This design stage establishes a "line of sight" for the progress of the next ADDIE stage. The Monitoring Line leads to the line of shadow from the eye to the perception of the object. For example, the concept of the Monitoring Line in communication where the transmitter and receiver antenna are in visual contact with each other. It means for teachers that there is a bond between teachers to see students. Teachers must look at the lines seen by students so that students feel that they see the same bond of view with the teacher. This perspective presents a practical approach to maintain alignment of needs, goals, intentions, objectives, strategies and assessments through the ADDIE process (Branch, 2009).

Development Stage

This stage aims to generate and validate the selected learning resources. The resources needed in the implementation of planned learning must be identified by the teacher to complete this stage of Development. After that, for the planned teaching implementation, the selection or development of all necessary tools, then evaluate the learning output, and complete the remaining stages of the ADDIE teaching design series (Branch, 2009).

Implementation Stage

It aims for teachers to prepare a learning environment and involve students well in the learning process. This implementation has a general procedure, namely preparing teachers and preparing students. Teachers must adapt to the actual learning environment so that students can begin to build the new knowledge and skills necessary to close the student performance gap in learning. Development and evaluation activities signify the final stage of the implementation phase. Most of ADDIE's approach uses the implementation stage to transition to summative evaluation activities and other strategies that implement the teaching and learning process. The result of this stage is the implementation strategy. Common components of an implementation strategy are the student plan and the facilitator's plan (Branch, 2009). Teachers are required to really manage the study program in order to convey the implementation strategy properly.

Product Validation Test

The validation test stage is carried out by testing e-modules that have been created and evaluated by experts who have competence in their fields. Validation is carried out by asking validators to provide an assessment of the resulting product and provide suggestions or input related to Liveworksheet-based e-modules. This study uses instrument sheets, and data analysis is carried out by converting qualitative data into quantitative data. The scores set for the product assessment criteria by validators can be seen in Table 1.

Table 1. E-module validation continuation criteria e-module validation eligibility criteria

Score	Range	Criterion	Interpretation
5	81–100	Very good	No revision required
4	61–80	Good	Revise as necessary
3	41–60	Pretty good	Quite a lot of revisions
2	21–40	Bad	Many revisions
1	0–20	Very bad	Revisions

Student Response Test Stage

Response testing was carried out through small group and large group trials, where small group trials were carried out using a simple random sampling method with 12 respondents randomly selected from Class XI-3. Large group trials were carried out in Grades XI-4 involving all students of Grades XI-4. The product assessment criteria can be seen in Table 3. Large group testing is conducted in Grades X-2, involving all students in Grades X-2. The criteria for assessing products by students can be seen in Table 2.

Table 2. Student response assessment criteria

Score	Criterion
81–100	Very good
61–80	Good
41–60	Pretty good
21–40	Bad
0–20	Very bad

Evaluation Stage

The evaluation stage is the final stage in the E-Module development model, which involves assessing products based on the results of product trials in small and large groups. The goal is to be optimal.

This evaluation stage aims to assess the quality of the product and teaching process, both before and after the implementation stage (Branch, 2009). Determining evaluation criteria, selecting the right evaluation tools, and implementing the evaluation are common procedures related to the evaluation stage. Teachers should identify the success rate of learning, recommend improvements for next competencies of similar scope, stop all work, shift all responsibility for project implementation and evaluation to an administrator or designated manager, and focus on the evaluation stage.

Result and Discussion

The result of this development research is an e-module based on the Liveworksheet application which is specifically designed for Energy and Business materials in grade XI of SMK. This e-module serves as a learning resource for grade XI students of SMK Negeri 4 Payakumbuh City who are studying Energy and business material. The resulting e-module consists of various sections, including a cover page, a drafting page, a concept map, a glossary, a table of contents, and an introduction that includes the identity of the e-module, basic competencies and indicators, instructions for using the e-module, material descriptions, and learning materials.

In addition, this module also includes learning activities 1 and 2, which consist of learning objectives, material descriptions, summaries, learning video links, exercises, and practice answers. Finally, the e-module comes with a bibliography. Before being tested, this e-module went through a validation stage by three experts, namely learning material experts, content experts, and learning practitioners. The validation trial resulted in several revisions from each expert so that the e-module was ready for testing. The trial was carried out in stages, including small group trials and large group trials, to assess students' responses to the resulting e-modules. The results of student responses are the basis for improving the e-module so that it can be effectively integrated into the realm of Education.

Results of Student Needs Analysis

The analysis of student needs was carried out by distributing questionnaires to all grade XI students of SMK Negeri 4 Payakumbuh City. The school has four XI classes, with 36 students in each class. The questionnaire filling process will be carried out on September 12, 2024. The total respondents who took part in the student needs analysis reached 33 out of 36 students in grades XI-3 and 34 out of 36 students in grades XI-4. The results of the questionnaire given to all students of XI SMK Negeri 4 Payakumbuh City can be seen in Figure 1.

The Validation results from the learning material experts gave a validation score of 89.5%, categorized as very good, and suggested minor improvements by correcting incorrect words in the e- module to improve product quality. The manufacture of e-modules requires high accuracy and validation to produce products that are tested and ready to be tested (Nurdyansyah et al., 2021). Furthermore, the material expert gave an e-module assessment of 95.5% with excellent criteria and suggested the addition of references to strengthen the source. Accurate references support the accuracy of the content or points presented in the e-module, according to the material taught (Malahayati & Zunaidah, 2021). Learning practitioners gave a score of 94.3 with excellent criteria and suggested increasing the difficulty level of questions in the e- module to better train students' thinking skills. This opinion is in line with the views of Kurniawati et al. (2019) and Putra & Syarifuddin (2019) who emphasized that increasing the difficulty of questions can help students develop analytical thinking skills.

Validity is an important step in ensuring the acceptance of a work or product and is a guarantee that the product has passed a quality test (Hayashi, 2019). The average score of the three validators is 92.64%, with a very good category. These results confirm that the e-module as a teaching material product has met the standards and is suitable for testing. This is in line with other research, such as the research by Syahrizaldy et al. (2023), which created a Liveworksheet application-based teaching material with a validity level of 81.09%, with a very feasible category. Another study by Puspita & Dewi (2021) concluded that Liveworksheet-based e-modules are very feasible to be used as learning support. The e-module product has been improved according to the input and suggestions from each validator, following the principle that a good product must go through a revision stage to improve its quality based on the input provided by the validators (Himang, 2019).

Student Response Results

E-modules as teaching materials were tested on grade XI students of SMK Negeri 4 Payakumbuh City through two stages, namely small group trials and large group trials.

The results of the student response rate in the small class trial reached 92.5%, while in the large class trial it scored 91.3%. This score is included in the category of excellent student responses. This conclusion is reinforced by the positive response from students in the student response questionnaire, where they stated that

this e-module is interesting to read because it contains many images and the language used in this e- module is easy to understand. These results identify that this product has achieved a very high quality and can be developed for a wider range of uses. This statement is also in line with the view of Nurhairunnisah & Sujarwo (2018) that an effective e-module must meet the needs of students in the learning process and include complete and relevant materials to the curriculum. Products that meet these criteria are considered able to answer the needs of students in overcoming learning challenges. The findings of this study show that students show high enthusiasm for e-module literacy, as done in learning activities (Yulaika et al., 2020).

Conclusion

The interactive e-module based on the Liveworksheet application for Nanotechnology materials has been successfully developed using the ADDIE development model. This product can be used as an innovative teaching material for students. The validation process was carried out by learning experts with a score of 89.54%, material validation with a score of 95.53%, and validation of learning practitioners with a score of 94.34%. The average validation score of the three validators was 92.61% which was categorized as "excellent". This shows that the e-module has passed the validation stage well. The teaching materials of this e-module are then tested on students with some suggestions and input from validators to be revised. The student response test in the small class obtained a score of 92.5, while in the large class obtained a score of 91.34. The score shows that students give a positive response to the prepared e-module. With the results of the validation test and satisfactory student responses, this e-module can be developed for wider use, so that it can provide benefits for students in various learning contexts.

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