

RMED Textbook: An Innovation in Interactive Multimedia Learning Tools for Sustainability Education in the RMED Study Program

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ABSTRACT (9 pt)

Keywords:

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This study aims to develop and validate an Interactive Digital Multimedia Textbook as an independent learning tool for students of the Diploma 4 Digital Education Multimedia Engineering (RMED) Study Program. The urgency of this research is based on the need for a cognitive bridge (scaffolding) for first-year students to master high-level digital skills amidst the limitations of physical laboratories. Using the Research and Development (R&D) method with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model, the main focus of this article is on the needs analysis stage through expert validation testing. The novelty of this tool lies in the integration of the "Embedded AI Tutorial-Sandbox" feature that allows AI-based content engineering practices directly within the textbook. The development stage involves validation by subject matter experts and media experts to ensure industry quality standards. The results of the needs analysis indicate high student demand for adaptive and interactive teaching media. Initial validation results indicate that this textbook is suitable for use with several technical revisions. The implementation of this textbook directly supports the achievement of Sustainable Development Goals (SDGs) number 4, namely ensuring inclusive and equitable quality education and increasing access to relevant digital skills for vocational students.

INTRODUCTION

Quality education is the fourth pillar of the Sustainable Development Goals (SDGs 4), which emphasizes equitable access to quality technical and vocational education (Adedoyin & Soykan, 2023). In the era of digital transformation, vocational education is required to produce graduates with high-end digital skills (Albana & Sujarwo, 2021). However, major challenges arise in new study programs, such as the Diploma 4 Digital Education Multimedia Engineering (RMED) at the Faculty of Vocational Studies, UNESA, where the progressive curriculum is often not accompanied by the availability of specific and adaptive teaching tools for the first batch of students.

New students in multimedia engineering often face a cognitive gap when trying to translate visual communication theory into complex multimedia programming practices. Reliance on face-to-face instruction in physical laboratories also hinders the creation of a flexible, self-paced learning environment. Therefore, innovative learning tools that provide interactive scaffolding are needed.

This research proposes the development of an interactive digital multimedia textbook using a "hybrid scaffolding-interactive" model. Unlike conventional textbooks or static e-books, this innovation integrates an "Embedded AI Tutorial-Sandbox" feature. This feature allows students to explore and practice artificial intelligence-based content engineering directly within a single digital platform.

Through a Research and Development (R&D) approach, this study aims to analyze user needs and validate the feasibility of this learning tool. It is hoped that this textbook will serve not only as a technical learning resource but also as a blueprint for the development of AI-based vocational learning tools that support digital literacy and sustainable quality education.

RESEARCH METHOD

Research method consist of participants, instrument and procedures, data analysis.

This research used the Research and Development (R&D) method with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model(Azwar Anas & Sondang sumbawati, 2020; Pratiwi et al., 2021) . This model was chosen based on its structured and highly effective workflow for producing precise instructional products.

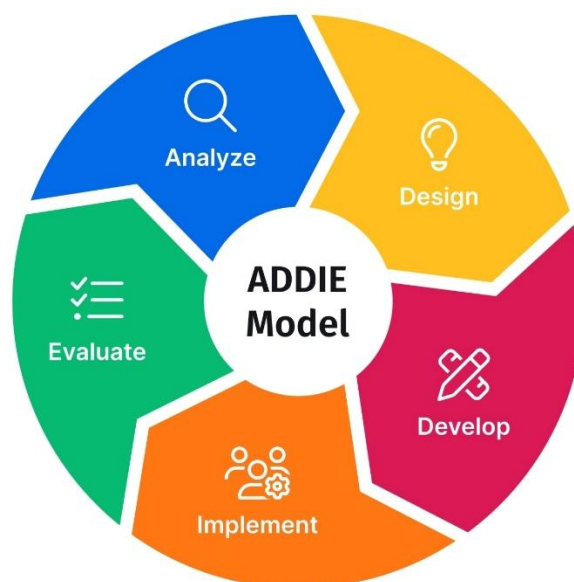


Figure 1. ADDIE Model

1. Analysis Stage (Analysis)

The initial stage is carried out to identify the gap between expected competencies and actual conditions in the field. The analysis includes:

- a. Student Needs Analysis :Through a questionnaire given to new RMED students who have passed the selection process for entering PTN, who will later become the first batch, to find out their learning style preferences.
- b. Curriculum Analysis :Reviewing learning outcomes of multimedia engineering courses to determine the material to be integrated into textbooks.

2. Design Stage (Design)

Based on the analysis results, a book outline, interactive multimedia UI/UX design, and Embedded AI Tutorial-Sandbox feature scenarios were developed (Polajnar, 2021; Sevchenko, 2023). At this stage, assessment instruments for validators were also developed.

3. Development Stage

This stage is the process of producing a textbook using multimedia development software. The primary focus is integrating interactive elements such as video tutorials, sandbox simulations, and AI-based APIs. Once the prototype is complete, validation testing is conducted by:

- a. **Subject Matter Expert:** Assess the accuracy and depth of multimedia engineering content (Munawaroh et al., 2023).
- b. **Media Expert:** Assess visual quality, interactivity, and digital usability (Kusuma et al., 2022).

4. Implementation and Evaluation Stage

A small-group trial phase was conducted to assess the product's acceptability among end-users before widespread implementation. Formative evaluations were conducted at each stage to revise the product based on input from experts and potential users (Yuningtyas, 2023)

5. Data Analysis Techniques

Data obtained from the validation questionnaire were analyzed using quantitative descriptive techniques. Validation scores were calculated using the percentage formula (Qodr et al., 2021):

$$P = \frac{\sum x}{\sum X} \times 100\%$$

RESULTS AND DISCUSSION

1. Results of Needs Analysis

Based on a questionnaire distributed to 30 students from the first batch of the RMED Study Program, it was found that:

- a. **85%** Students find it difficult to understand the logic of multimedia engineering through static text alone.
- b. **90%** Students want learning media that has direct simulation features without having to install heavy software at the initial stage.
- c. **Curriculum Analysis** shows that the "AI-Based Content Engineering" material is the core competency that most requires interactive scaffolding.

2. Interactive Digital Multimedia Textbook Prototype

The product developed is called "RMED Textbook v1.0". The superior features successfully developed are:

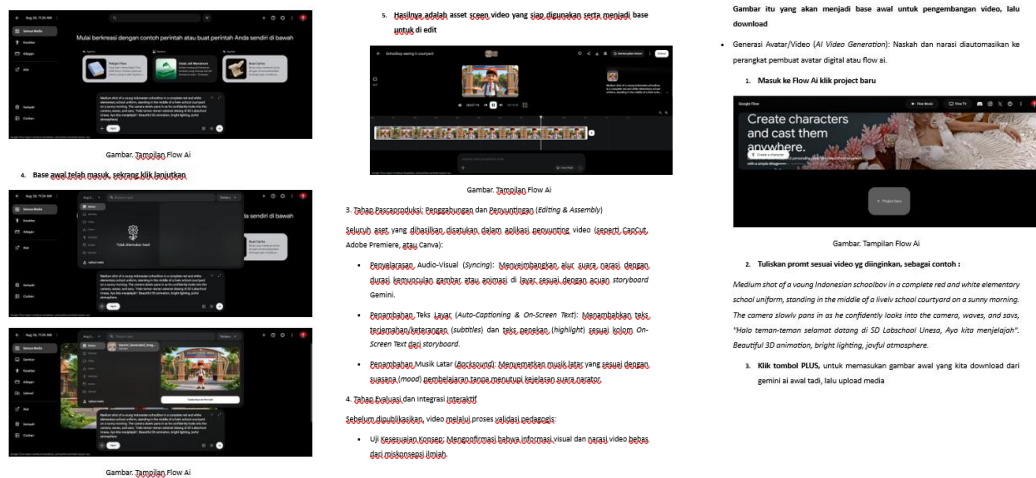


Figure 2.. The Product

- Interactive Scaffolding: The material is presented in a step-by-step format triggered by user interaction (click/swipe).
- Embedded AI Tutorial-Sandbox: A simulation window within the textbook where students can try out AI prompting to generate simple multimedia assets in real-time.

3. Expert Validation Results

Validation was conducted to measure the product's feasibility before testing it on students. The validation results are presented in Table 1.

Table 1. Validation Results of Material Experts and Media Experts

No	Assessment Aspects	Average Score (%)	Category
1	Subject Matter Expert	92%	Very Worthy
	- Curriculum Suitability	94%	
	- Depth of AI Material	90%	
2	Media Expert	88%	Very Worthy
	- UI/UX Design	85%	
	- Interactivity (Sandbox)	91%	
Combined Average		90%	Very Worthy

Validation results showed that the integration of the Embedded AI Tutorial-Sandbox feature achieved the highest score in the media aspect. Subject matter experts noted that the depth of the content engineering material aligned with industry standards (IKAPI). Although categorized as "Very Feasible," revisions were made to the UI/UX aspect, including the need to simplify the layout of the simulation window to make it more responsive when accessed via mobile devices.

4. Limited Trial Results

A trial on 30 students demonstrated an 87% practicality rate. Students reported that the interactive scaffolding helped them understand multimedia engineering concepts independently without the need for constant lecturer supervision. This confirms the product's effectiveness in reducing reliance on physical laboratory facilities in the early stages of learning (Douglas, 2021).

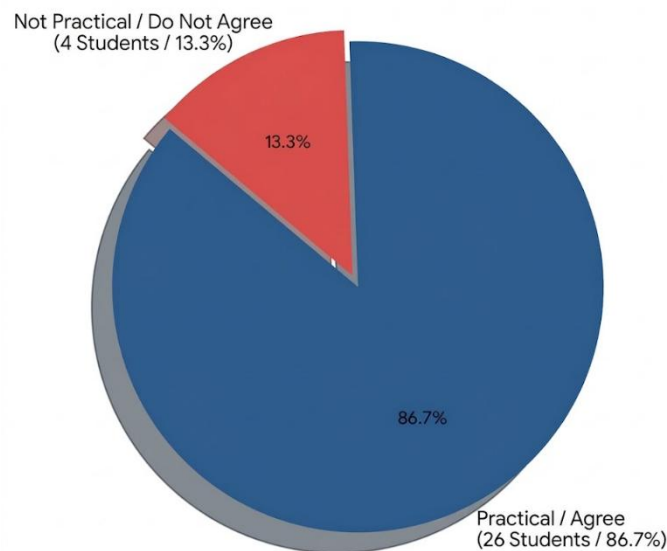


Figure 3. Students report

CONCLUSION

This research has successfully developed an Interactive Digital Multimedia Textbook as an independent learning solution for students of the D4 Digital Education Multimedia Engineering (RMED) Study Program at the Faculty of Vocational Studies, UNESA. Based on the research results, it can be concluded that:

- Needs Analysis confirms the urgent need for teaching media that can bridge students' cognitive gaps in AI-based content engineering materials through a scaffolding approach (Desa et al., 2021).
- Expert Validation Results shows that the "RMED Textbook " product is included in the Very Eligible category with an average score of 90%, where the Embedded AI Tutorial-Sandbox feature is the main innovation that supports high-level interactivity.
- Limited Trialproves that this textbook is effective in increasing student learning independence and reducing dependence on physical laboratory facilities in the early stages of lectures.

In practice, the development of this textbook significantly contributes to achieving SDG 4 (Quality Education) by providing access to inclusive and high-quality vocational education. The implication of this research is the creation of a blueprint for adaptive learning media that can be replicated in other digital study programs to strengthen national digital literacy.

DISCUSSION

The successful development of this interactive multimedia textbook has important implications for learning patterns in digital vocational education. Based on research findings, the application of the Hybrid Scaffolding model has proven to be an effective

cognitive bridge for first-year students in facing the complexity of multimedia engineering material. This is in line with the Zone of Proximal Development (ZPD) theory, which emphasizes the importance of systematic support to help learners achieve independence. The innovative Embedded AI Tutorial-Sandbox feature goes beyond the function of conventional textbooks by providing a responsive virtual practicum ecosystem. The integration of AI technology in the book not only facilitates the visualization of abstract concepts but also reduces technical barriers due to limited access to physical laboratories, thus making the learning process more flexible and inclusive. Furthermore, these findings demonstrate that the active involvement of industry partners in the validation process is a key factor in maintaining the relevance of the material to job market needs. This synergy ensures that the digital literacy developed through this textbook meets professionally recognized quality standards. Holistically, the development of this toolkit represents a concrete step toward realizing Sustainable Development Goals (SDG) target number 4, which is to ensure equitable quality education and improve relevant technical skills for young people. Thus, this study confirms that transforming learning media from static to interactive AI-based is an urgent need to create vocational graduates who are adaptive to future global technological changes.

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