International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.ijmoe.com

GLOBAL ACADEMIC EXCELLENCE

DEVELOPMENT OF AN INTERACTIVE LEARNING MODULE BASED ON THE ADDIE MODEL FOR THE TOPIC OF MECHANICAL PROPERTIES IN STEEL AT VOCATIONAL COLLEGE

Che Mohammad Fattihi Ekhmal Che Mut[1], Mohd Erfy Ismail[1*], Rosmawati Abd. Hamid[1], Khairul Amin Ishak[1], Ahmad Zaki Mohamad Amin[2], Irwan Mahazir Ismail[3]

[1] Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, Malaysia
Email: fattihiekhmal@gmail.com, erfy@uthm.edu.my, rosmawati.sn@gmail.com, cb210030@student.uthm.edu.my
[2] Centre for Foundation Studies in Science, Universiti Malaya, Malaysia
Email: azaki@um.edu.my
[3] School of Education, Universiti Utara Malaysia, Malaysia
Email: irwanm@uum.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 30.06.2025
Revised date: 21.07.2025
Accepted date: 15.08.2025
Published date: 01.09.2025

To cite this document:

Mut, C. M. F. E. C, Ismail, M. E., Hamid, R. A., Ishak, K. A., Amin, A. Z. M., & Ismail, I. M. (2025). Development of an Interactive Learning Module Based on the Addie Model for the Topic of Mechanical Properties in Steel at Vocational College. *International Journal of Modern Education, 7* (26), 141-156.

DOI: 10.35631/IJMOE.726010

Abstract:

The use of interactive learning modules has the potential to enhance the understanding of mechanical concepts in steel while providing a highly engaging and interactive learning experience for students. However, traditional learning approaches that are less effective make it challenging for students to understand and apply knowledge in practical situations. This study aims to develop an interactive learning module using the FlipHTML5 application, based on suitable learning theories for the Diploma in Welding Technology subject, according to the vocational college syllabus. Additionally, it seeks to assess the impact of FlipHTML5 in improving usability in terms of design, functionality, and content relevance for learning the mechanical properties of steel, while addressing the lack of teaching learning materials (TLM) in the subject of Metallurgy and Corrosion Control. The research methodology involves product development through a quantitative approach. The quantitative research design was employed to ensure systematic data collection and analysis in evaluating the effectiveness of the developed module. In addition, the study instrument uses a questionnaire based on a 5-level Likert scale, namely, strongly disagree, disagree, neutral, agree, and strongly agree. It also follows the product design and development framework using the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) model as a guide for developing the interactive learning module. The pilot study involved

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

30 fourth- and fifth-semester students at Batu Pahat Vocational College, while the main study was conducted on 40 fourth- and fifth-semester students at Muar Vocational College using a simple random sampling method. Data collected were analyzed using descriptive statistics through Statistical Package for the Social Sciences (SPSS) version 30, with a Cronbach's Alpha value of 0.942 in the pilot study, indicating a high level of instrument reliability. The analysis results reported mean values for usability in terms of design (mean = 4.47), module functionality (mean = 4.36), and content relevance (mean = 4.40). This reflects a positive impact on the use of the interactive learning module for the topic of mechanical properties of steel. The discussion revealed that the interactive learning module developed based on the ADDIE model could enhance students' understanding. This includes interactive elements such as videos, infographics, and interactive quizzes, helping students grasp complex concepts effectively. In conclusion, this study has a positive impact by providing an innovative learning approach that improves students' understanding. It also has the potential to serve as a reference model for developing interactive learning materials for technical subjects.

Keywords:

ADDIE Model, E-Learning, Interactive Learning Module, Mechanical Properties of Steel, Vocational Education

Introduction

Vocational education in the field of materials and steel engineering plays a crucial role in shaping a competent workforce ready to face increasingly complex industrial challenges. In this context, vocational education at secondary schools (SMK) and vocational colleges is highly relevant, particularly in enhancing students' technical understanding and critical thinking skills. According to Rahmadani (2023), vocational education should integrate vocational literacy to develop critical abilities. Moreover, the transformation of vocational education has become a key focus in supporting national development agendas. Ariffin et al. highlighted that the Teaching and Learning (T&L) process in vocational education needs to be more engaging and aligned with current technological advancements to capture students' interest.

Additionally, vocational education plays a vital role in improving career opportunities and reducing recidivism rates among youths. Teaching the topic of mechanical properties in steel often faces various challenges, particularly when conventional teaching methods, which are less effective, are employed. Thus, understanding the mechanical properties of steel requires a profound grasp of physics and chemistry concepts. However, students may struggle to relate theoretical concepts to practical applications. According to Li and Maat (2022), more innovative approaches, such as problem-based or collaborative learning, must be adopted to enhance students' understanding of this topic.

Therefore, the use of technology in teaching can be a decisive factor in improving teaching effectiveness. Smith (2020) explained that the use of technology in education can help deliver complex concepts in a more engaging and accessible manner. The significance of developing interactive learning modules to improve the quality of T&L in vocational colleges is highly significant. Meanwhile, Gracia (2021) emphasized that the use of e-modules integrating Information and Communication Technology (ICT) can create a more active and engaging classroom environment.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

Problem Statement

Vocational education plays a crucial role in preparing a highly skilled workforce, especially in the fields of engineering and industry. Beyond merely imparting technical skills, it also serves as a platform to foster critical thinking and problem-solving abilities essential for modern industries (Rahmadani, 2023). However, research on digital learning, particularly interactive learning modules for mechanical properties of steel in Metallurgy and Corrosion Control courses, remains limited. Existing studies primarily focus on different subjects to highlight the effectiveness of interactive e-modules in enhancing student engagement, learning outcomes, and practical training (Aulia & Hardeli, 2022). The lack of research in this niche area presents an opportunity to develop interactive learning modules tailored to these courses, thereby enhancing students' comprehension and knowledge (Adnan et al., 2022).

One key design issue in interactive learning modules is the confusing interface and poor engagement structure (Chu & Ramírez, 2012). Proper design must encompass content and construct validity to ensure learning material effectiveness and engagement (Anggoro et al., 2023). Note that poorly structured courses may lead to information overload, disorientation, and cognitive strain for students, especially when dealing with dense and disorganized module content (Zheng & Chen, 2020; Riani et al., 2024).

Another concern involves text displays in interactive modules. While exposure to "textisms" does not significantly impair spelling ability (Charlina et al., 2022), students often prefer innovative and interactive content presentation (Affan Lubis et al., 2022). Additionally, the use of animations in learning modules presents challenges in cognitive acquisition and knowledge processing. Although animations can enhance visualization, they may hinder detailed encoding and mental simulations, leading to cognitive overload (Hubing et al., 2002; Schnotz et al., 1999).

The usability of graphics and images is another critical aspect affecting user experience in interactive modules. Challenges in expressing interactive dynamics can undermine interface effectiveness (Drumeva, 2022). Accordingly, interactive graphics have the potential to evoke emotional responses and improve communication (Ancker et al., 2009). On the other hand, issues with audio integration can hinder interactive learning experiences (Waters, 1997). Proper hardware and software considerations are necessary to maximize the benefits of audio systems for interactive learning (Nurjanah et al., 2021).

Furthermore, interactive learning modules often face technical challenges, including non-user-friendly interfaces, technical difficulties, and poor student motivation due to complex designs (Mcquaigue et al., 2018). Students often struggle with traditional textbooks and face difficulty visualizing complex subjects without engaging interactive modules (Hendra et al., 2022). Other obstacles include difficulties in searching for credible digital content, managing unclear terminologies, and limited exploration opportunities (Kapidakis, 2011; Ma et al., 2018).

Lastly, issues such as unsuitable training exercises and poorly aligned video content in interactive learning modules negatively impact student engagement and knowledge acquisition (Ibrahim, 2015; Kim et al., 2011). Limited interactive elements in existing Learning Management Systems (LMS) and the absence of structured interactive modules affect learning outcomes (Martin & Moore, 2008). Therefore, developing high-quality, interactive, and well-

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

structured learning modules is critical to enhancing learning experiences and achieving effective educational outcomes (Amini & Usmeldi, 2022).

Research Question

The research questions for developing an interactive learning module based on the ADDIE model for the topic of mechanical properties of steel in vocational colleges are as follows:

1. How does the design aspect of the interactive learning module influence the learning outcomes of students in vocational colleges?
2. How does the usability of the interactive learning module help improve students' understanding in vocational colleges?
3. How is the suitability of the interactive learning module content accepted by students in vocational colleges?

Research Method

The research methodology involves product development through a quantitative approach. The quantitative research design was employed to ensure systematic data collection and analysis in evaluating the effectiveness of the developed module. This quantitative approach involves the use of research instruments such as questionnaires, which enable objective measurement of students' understanding of the developed module. In addition, the study instrument uses a questionnaire based on a 5-level Likert scale, namely, strongly disagree, disagree, moderate, agree, and strongly agree. This study also follows the product design and development using the ADDIE model as a guide for developing an interactive learning module. The ADDIE model was selected as the instructional design framework for developing an interactive learning module on FlipHTML5 due to its systematic and structured phases: analysis, design, development, implementation, and evaluation (Ali et al., 2023). Each phase plays a pivotal role in ensuring the effectiveness and quality of the developed learning content. Figure 4.1 visually represents the ADDIE stages and their sequential process.

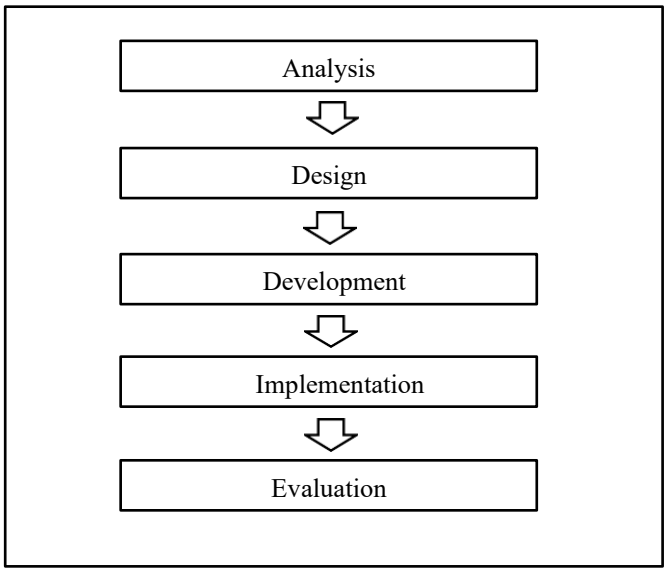

Figure 4.1: Stage in the Development of the ADDIE Model

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

Analysis Phase

The analysis phase focuses on identifying problems and gathering information to address them. The researcher conducted observational analyses to understand challenges faced by students in learning the topic of mechanical properties in the Metallurgy and Corrosion Control course. This phase serves as the foundation for instructional design, aimed at defining objectives, identifying problems, and ensuring the suitability of learning targets. The researcher analyzed student knowledge and classroom use of e-modules to assess their effectiveness compared to traditional learning methods. A literature review was also conducted on the technical design and appropriate content for developing the interactive learning module.

Design Phase

The design phase involves developing an interactive learning module for the topic of mechanical properties of steel, presented as an interactive storyboard. The design focuses on key criteria of the ADDIE model, ensuring ease of use and effective application by students. Key elements considered include media integration, content structure, language, and display design, aligning with instructional strategies used by educators during T&L (Rahayu & Sukardi, 2021). The module was specifically designed for the DMB 3323 Metallurgy and Corrosion Control course to enhance student engagement and understanding.

Table 4.1: Design Criteria For Interactive Learning Module Products

Criteria	Explanation
Media	The interactive learning module is suitable for use by students and lecturers Variety of functions User-friendly
Content	Based on the prescribed Vocational College Standard Curriculum
Language	Simple and easy-to-understand language Vocabulary aligned with the Vocational College Standard Curriculum
Display	Must include images, videos, animations, and audio

Development Phase

The development phase involves creating and assembling all content and components based on the design phase, translating the instructional structure into a functional interactive learning module (Bakhrun, 2021). Initially, the module interface was designed using Canva and later integrated into FlipHTML5 to enhance interactivity. The researcher incorporated videos, quizzes, concise notes, and explanations related to the topic of mechanical properties of steel. This phase followed the previously developed storyboard, ensuring alignment with the instructional design. Subsequently, an alpha test was conducted to obtain expert validation and confirm compliance with the specified requirements.

International Journal of Modern Education
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

(a) (b)

Figure 4.2: (a) Interactive Learning Module & (b) QR Code for Access to E-Learning

Implementation Phase

The implementation phase is a critical stage in the ADDIE model, where the developed interactive learning module is tested in a real learning environment. This study began with an alpha test using Statistical Package for the Social Sciences (SPSS) version 30 to obtain Cronbach's Alpha values for assessing the reliability of the questionnaire and the interactive module. The test involved two expert lecturers from University Tun Hussein Onn Malaysia specializing in multimedia and mechanical fields, and 30 diploma students in Welding Technology from Batu Pahat Vocational College who had enrolled in the Metallurgy and Corrosion Control course. Feedback from experts and students helped identify improvements in the module's content, design, and technical functions. This phase ensured that the module met usability and effectiveness standards, supporting optimal learning experiences for vocational college students (Hidayat & Nizar, 2021).

(a) (b)

Figure 4.3: (a) & (b) Uses of the Interactive Learning Module by Target User

Evaluation Phase

The evaluation phase, as the final stage of the ADDIE model, plays a crucial role in assessing the effectiveness, functionality, and acceptance of the developed interactive learning module. This study conducted a comprehensive beta test involving 43 Diploma Vocational Malaysia (DVM) students from the Welding Technology course at Muar Vocational College, who were

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

studying Metallurgy and Corrosion Control. The module was evaluated based on usability, appeal, and pedagogical effectiveness. A questionnaire measured key aspects such as content effectiveness, interactive design, usability, and its contribution to learning outcomes. Descriptive statistical analysis was performed to determine mean scores, which were interpreted within low, moderate, or high categories. At the same time, direct observation provided additional insights into the module's real-world application. Concurrently, the feedback and data collected guided improvements, ensuring the module met student needs and supported learning effectively (Asrial et al., 2020).

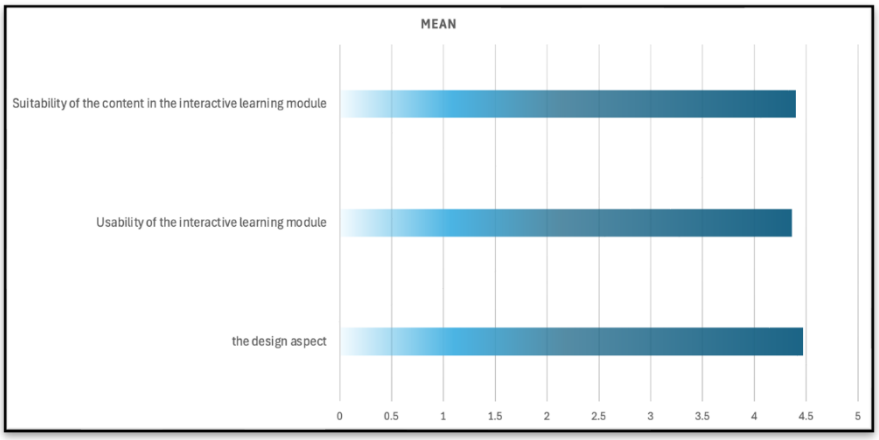

Figure 4.4: Result and Analysis

Population and Sampling Study

The population in this study refers to the entire group of individuals relevant to the research, comprising students from the Welding Technology program at a vocational college. According to Weeks and Atlas (2015), a population encompasses a set of individuals, objects, or events that are the subject of inquiry for a research study. To determine the sample size, the researcher adopted the sample size determination table developed by Krejcie and Morgan (1970). It provides a structured approach to selecting an appropriate sample size based on the total population. In this study, out of a population of 43 students enrolled in the Metallurgical and Corrosion Control course (DMB 3323), 40 students were selected as the final sample. This selection ensures adequate representation and reflects the population's key characteristics relevant to the research objectives.

To select respondents, the researcher employed a combination of purposive random sampling and simple random sampling techniques. Purposive sampling ensured that participants met specific criteria relevant to the research focus, such as enrollment in the Welding Technology program and participation in the course under investigation. Meanwhile, simple random sampling, which provides an equal probability of selection for each student in the population, further enhances the validity and reliability of the sample selection process. Kaviza (2020) highlighted that simple random sampling is instrumental in enabling researchers to make statistically sound inferences about a population while minimizing bias. This rigorous sampling strategy ensures that the findings generated from this study can be generalized appropriately to similar educational contexts.

International Journal of Modern Education
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

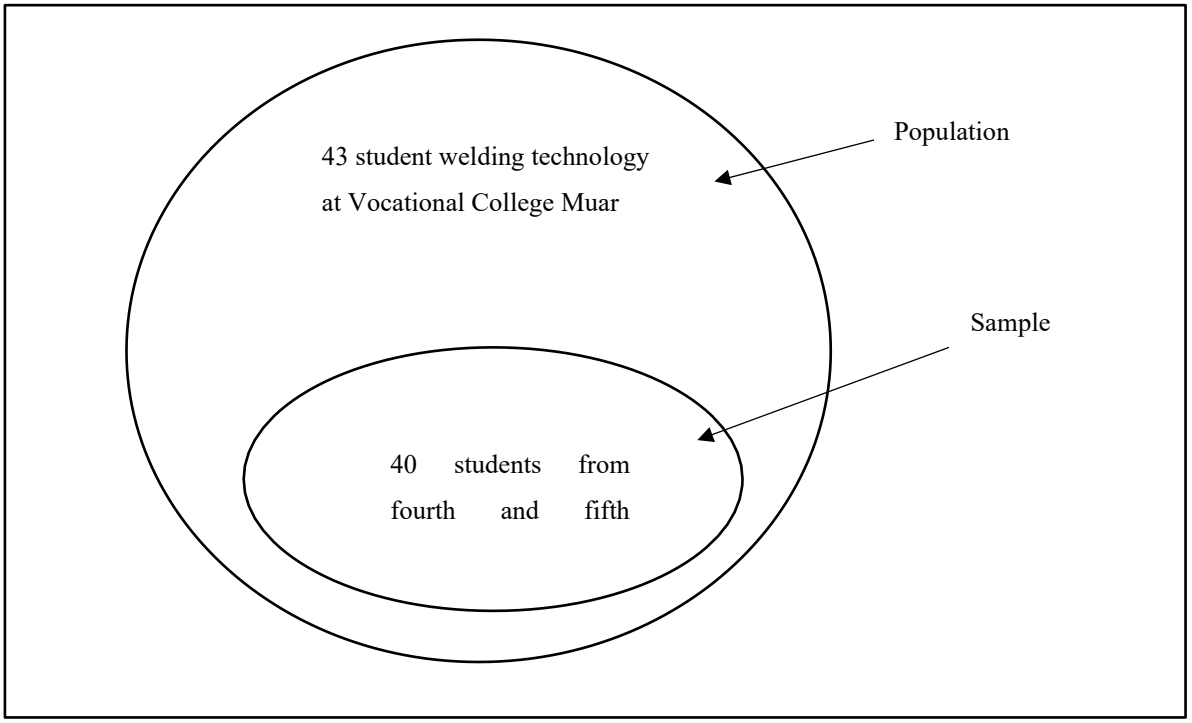

Figure 4.5: Population and Sampling Study

Reliability and Validity

Reliability in this study refers to the consistency and stability of the questionnaire items across time, ensuring accurate and dependable data collection. The researcher employed Cronbach's Alpha coefficient to assess the internal consistency of the questionnaire items. According to Shojima and Toyoda (2002), a Cronbach's Alpha value of 0.942 or higher indicates excellent internal consistency. The pilot study conducted prior to the full implementation of the interactive learning module aimed to evaluate its functionality and suitability while identifying potential issues during its application. This process also provided insights into the reliability of the questionnaire items, as suggested by Rebhi et al. (2023). The pilot study findings allowed for adjustments to be made to the questionnaire to ensure data consistency and reliability.

To ensure the validity of the interactive learning module and questionnaire, the researcher adopted content and internal validity assessments. Content validity was obtained through expert reviews involving experienced professionals in the field. These experts were consulted to evaluate the appropriateness of the module content, activity design, and learning objectives. Additionally, internal validity was assessed through alpha testing by measuring the usability and accuracy of the module, as recommended by McKim (2022). The findings from the expert validation process guided refinements to the module to enhance user experience, functionality, and educational relevance.

Findings

The questionnaire utilized in this study was designed to gather data from respondents to address the research questions. Each item within the questionnaire was assessed by calculating the mean scores, which were based on a 5-level Likert scale: strongly disagree, disagree, neutral, agree, and strongly agree. The interpretation of responses was guided by the range of mean scores presented in Table 6.1, which helped determine the respondents' perspectives on the research questions.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

Table 5.1: Score Mean Analysis

Score	Score Mean Mark	Level
1	1.00 – 1.80	Very Low
2	1.81 – 2.60	Low
3	2.61 – 3.40	Moderate
4	3.41 – 4.20	High
5	4.21 – 5.00	Very High

Part A: Demographics of Respondents

Tables 5.2 and 5.3 present the demographic distribution of 40 respondents. Most were male (85%), while females comprised 15%. All respondents were Malay (100%).

Table 5.2: Frequency Distribution of Respondents by Gender

Gender	Frequency (f)	Percentage (%)
Male	34	85
Female	6	15
Amount	40	100

Table 5.3: Frequency Distribution of Respondents by Nation

Nation	Frequency (f)	Percentage (%)
Malay	40	100
Indian	0	0
Chinese	0	0
Other races	0	0
Amount	40	100

Part B: The Usability of an Interactive Learning Module from the Design Aspect

The objective of the first research question is to determine how far the usability of interactive learning modules from the design aspect will affect the students' understanding of how to use the modules. The results are summarized in Table 5.1. In particular, Table 5.1 provides the results of the respondents involved in the survey according to items and suggests that the result (mean) obtained is at a very high level. It also indicated that respondents very strongly agreed with the presented items. Moreover, it implied that the respondents strongly agreed that the usability from a design aspect makes the learning process more efficient.

Table 5.4: Score Mean and Standard Deviation of Items B1 to B13

No	Item	Mean	Standard Deviation
B1	Interactive learning modules use appropriate text sizes.	4.46	0.596
B2	The interactive learning module uses the type of text that suits the student's learning level.	4.32	0.567
B3	The choice of background color in the learning module does not disturb the reader's focus.	4.46	0.596
B4	The animation displayed in the learning module corresponds to the teaching topic.	4.59	0.591

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

B5	The size of the graphics in the learning module is appropriate.	4.41	0.547
B6	The graphics used are appropriate to the teaching topic.	4.49	0.597
B7	The graphics used are related to the content of the lesson.	4.44	0.634
B8	The audio display used in the interactive learning module can be played and stopped at any time.	4.32	0.610
B9	The video quality displayed in the module is clear.	4.54	0.552
B10	The audio quality displayed in the module is clear.	4.56	0.550
B11	Smooth module interface when switching pages.	4.44	0.550
B12	QR codes work well when scanned using a smartphone.	4.56	0.594
B13	The FlipHTML5 platform works well.	4.46	0.596

The high score mean on item B4 (min = 4.56) clearly indicates that respondents strongly agree that the animation display in the learning module corresponds to the teaching topic.

Part C: The Functional Ability of an Interactive Learning Module

The objective of the second research question is to assess the functional ability of an interactive learning module. The survey findings are outlined in Table 5.5, namely the analysis of item C. There are six items reported in this section. Referring to the results in Figure 5.1, most respondents very strongly agreed that the usability of interactive learning modules will assist students in improving their understanding of the learning process about the topics of mechanical properties in steel.

Table 5.5: Score Mean and Standard Deviation of Items C1 to C6

No	Item	Mean	Standard Deviation
C1	User-friendly interactive learning module.	4.47	0.623
C2	Interactive learning modules are easy to handle.	4.44	0.634
C3	Interactive learning modules are easily accessible anywhere.	4.27	0.593
C4	Interactive learning modules can be accessed at any time.	4.37	0.536
C5	Interactive learning modules can be explored without any problems.	4.32	0.567
C6	The interactive learning module has links that work well.	4.41	0.591

The high score mean on item C1 (mean = 4.47) clearly indicates that respondents strongly agree that the usability of the interactive learning modules is user-friendly.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

Part D: The Appropriateness Of An Interactive Learning Module

The objective of the third research question is to observe how far the appropriateness of the content of an interactive learning module helps students understand the topic of mechanical properties in steel. The findings of the survey are tabulated in Table 5.6. There are eight items in this section, and have been proposed to respondents to obtain their feedback on the appropriateness of the content of the interactive learning module. The results suggest that the highest mean score is for item D4 (mean = 4.56) and the lowest mean score is for item D3 (mean = 4.32). Meanwhile, the value of the mean item score for B4 was the highest, and respondents agreed that the content of the interactive learning module uses easy-to-understand language.

Table 5.6: Score Mean and Standard Deviation of Items D1 to D8

No	Item	Mean	Standard Deviation
D1	The content of the interactive learning module is clear in terms of delivery.	4.34	0.656
D2	The content of the interactive learning module is in line with the content of the topic syllabus.	4.46	0.596
D3	The content of the interactive learning module is organized in an orderly manner based on the topic of mechanical properties in steel.	4.32	0.650
D4	The content of the interactive learning module uses easy-to-understand language.	4.56	0.550
D5	The content of the interactive learning module provides independent quizzes/exercises that are parallel to the learning topic.	4.34	0.575
D6	The content of the interactive learning module contains videos that parallel the content of the topic of mechanical properties in steel.	4.46	0.636
D7	The content of the interactive learning module is in accordance with the student's learning level.	4.34	0.617
D8	The content of the interactive learning module is presented from easy to difficult.	4.34	0.693

Discussion

The study demonstrated that interactive learning modules significantly enhance students' comprehension and engagement in the topic of mechanical properties of steel. Developed using the ADDIE model and FlipHTML5, the module effectively integrated multimedia elements such as quizzes, videos, and infographics to support active learning (Farooqui et al., 2023). Furthermore, positive feedback highlighted the usability and design, with intuitive navigation reducing cognitive load. However, challenges like mobile compatibility were noted, emphasizing the need for multi-platform optimization (Rahim et al., 2021). Despite that, the module's alignment with curriculum objectives was well-received, although participants suggested including real-life examples for practical understanding (Musolin et al., 2023). Nonetheless, continued improvements are recommended to maintain its relevance and effectiveness.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

Usability of Interactive Learning Modules from the Design Aspect

The design aspect of interactive learning modules plays a critical role in enhancing user experience and engagement. A well-structured and visually appealing design facilitates ease of navigation and aids in information retention. This study reported that the design of the developed module adhered to key usability principles, such as simplicity, intuitive layout, and effective use of multimedia elements. The positive feedback from participants regarding the layout and user interface highlights the significance of clear and logical navigation pathways. As suggested by Jais et al. (2022), user-friendly interfaces significantly reduce cognitive load and promote better learning outcomes. The integration of visual aids, such as infographics and videos, provided multiple representations of the content, catering to diverse learning styles. This is consistent with Najuah et al. (2021), who emphasized the dual-channel processing capabilities of learners in digital environments.

Future improvements can include more adaptive design features that tailor content display based on user interactions. Additionally, enhancing the aesthetic appeal by incorporating modern design elements such as micro-interactions may further boost user engagement.

Usability of Interactive Learning Modules

The usability of interactive learning modules was assessed based on three key factors: functionality, user satisfaction, and ease of use. The findings indicate that the module demonstrated high usability, with participants rating the module positively across these dimensions. The smooth functionality of the module contributed to a seamless learning experience. In addition, the use of FlipHTML5 as the development platform enabled interactive features such as clickable elements, embedded quizzes, and hyperlinked sections, which facilitated learner autonomy and engagement. According to Ranuharja et al. (2021), responsive systems and user feedback loops are essential for effective digital learning tools.

User satisfaction was another critical factor, with respondents appreciating the interactive features and the immediate feedback provided during quizzes. This aligns with the findings of Dilaines et al. (2024), who highlighted the significance of feedback in sustaining learner motivation. Despite these positive outcomes, certain usability challenges were noted. For instance, a few users reported difficulties accessing some interactive elements on mobile devices. Accordingly, future iterations should focus on optimizing the module for mobile compatibility and ensuring platform-agnostic functionality.

Suitability of Content in Interactive Learning Modules

The content suitability of the interactive learning module was evaluated in terms of relevance, accuracy, and alignment with the curriculum objectives for the topic of mechanical properties of steel. The findings revealed that the content was well-structured and comprehensively covered the intended learning outcomes. Concurrently, participants reported that the inclusion of multimedia elements, such as videos and interactive quizzes, enhanced their understanding of complex concepts. This observation is supported by Kasi and Zaharudin (2023), who asserted that multimedia elements can facilitate deeper comprehension.

Moreover, the interactive quizzes allowed learners to assess their understanding in real-time, fostering self-directed learning. The alignment of the content with the vocational college syllabus ensured that the module remained contextually relevant and practically applicable. According to Adnan et al. (2022), contextual relevance is essential for meaningful learning

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010
experiences. However, minor content gaps were identified, such as the need for additional examples and case studies to illustrate the practical application of theoretical concepts. Therefore, addressing these gaps in future versions of the module will likely enhance its educational effectiveness.

Suggestions for Study Improvement

This study successfully developed an interactive learning module based on the ADDIE model for the topic of mechanical properties in steel, focusing on its effectiveness for vocational college students. While the findings highlight its potential as an innovative teaching tool, further exploration is needed to evaluate its adaptability and impact across diverse vocational education settings. Notably, expanding the research to different institutions would generate valuable empirical data on the module's effectiveness in varying contexts, considering demographic factors, student backgrounds, and institutional specializations. One expert recommended positioning this research at the undergraduate level, emphasizing test analysis to refine the module's interactive elements and syllabus alignment. Thus, future efforts should integrate advanced technologies and enhance interactive components to develop a more comprehensive and adaptable learning model tailored to vocational education needs.

Conclusion

In conclusion, developing an interactive learning module based on the ADDIE model for mechanical properties in steel at Muar Vocational College demonstrated notable effectiveness in enhancing learner engagement and comprehension. The module's design, functionality, and content suitability collectively contributed to a positive learning experience, as reflected by the high percentage of achievement and favorable feedback from students. Analysis of the module's context in terms of design, usability, and content suitability indicated its appropriateness and effectiveness for the T&L, particularly for welding students. At the same time, teachers recognized its potential as an innovative learning medium, further validating its pedagogical value. Despite these positive outcomes, suggestions for improvement were identified, particularly in mobile compatibility and content enrichment. Continued iteration and refinement will ensure its sustained relevance and effectiveness in vocational education, supporting students in improving their academic performance and mastery of topics.

Acknowledgements

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through Tier 1 (vot Q527).

References

Adnan, S. N., Omar, A. Z., & Mohtar, L. E. (2022, July). The Development of an Interactive Learning Module in The Topic of Transistor and Its Usability among Physics Trainee Teachers. In Journal of Physics: Conference Series (Vol. 2309, No. 1, p. 012053). IOP Publishing.

Affan Lubis, Azhary Tambusai, & Ahmad Laut Hasibuan. (2022). The Implementation on Genre Approach on Students' Skill in Writing Anecdote Text at Senior High School. International Journal of Educational Research Excellence (IJERE), 1(1), 13–18. https://doi.org/10.55299/ijere.v1i1.19

Ali, W. N. A. W., & Yahaya, W. A. J. W. (2023). Waterfall-Addie Model: An Integration of software development model and Instructional Systems Design in developing a digital

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

video learning application. *Asean Journal of Teaching and Learning in Higher Education*, *15*(1), 1-28.

Amini, R., & Usmeldi. (2022). Developing the Interactive e-Module Based on Integrated Learning for Primary School Students. International Journal of Information and Education Technology, 12(4), 272–279. https://doi.org/10.18178/ijiet.2022.12.4.1615

Ariffin, A., Hasnan, N., Zakaria, N., Rubani, S., Hamzah, N., & Juasseh, S. (2020). Pembangunan bahan e- pembelajaran berasaskan model needham lima fasa bagi topik konkrit. Online Journal for Tvet Practitioners, 5(2). https://doi.org/10.30880/ojtp.2020.05.02.008

Aulia, A., & Hardeli, H. (2022). Validity of E-Module Based on Problem Based Learning Integrated Demonstration Video and Science Literacy. IJIS Edu: Indonesian Journal of Integrated Science Education, 4(1), 45. https://doi.org/10.29300/ijisedu.v4i1.5871

Bakhrun, A. (2021). Perancangan Sistem Pembelajaran Daring Menggunakan Model ADDIE. Journal of Education and Instruction (JOEAI), 4(2), 633–650. https://doi.org/10.31539/joeai.v4i2.2887

Charlina, C., Septyanti, E., Mustika, T. P., & Rahmi, A. (2022). Electronic module as learning needs to write exposition texts for junior high school students. Journal of Education and Learning (EduLearn), 16(2), 219–225. https://doi.org/10.11591/edulearn.v16i2.20402

Chu, S., & Ramírez, G. M. ejía. (2012). Interactive learning for graphic design foundations. E-Learning and Digital Media, 9(4). https://doi.org/10.2304/elea.2012.9.4.345

Dilaines, L. E., Astuti, E., & Yusdita, E. E. (2024). Improving Student Learning Outcomes Through Accurate Online Modules with the ADDIE Model. Journal of Education Technology, 8(2), 275-286.

Drumeva, K. (2022). Graphic design of interactive interfaces. 040017. https://doi.org/10.1063/5.0099608

Farooqui, Y. S., Latif, M., Khokhar, A. S., Rahim, A., & Shabbir, T. (2023). Harnessing Interactive Media for Transformative Education In Pakistan: A Case Study Of Virtual Reality Integration. Journal of Positive School Psychology, 7(6), 165-179.

Garcia, M. L. (2021). *Enhancing classroom interaction through ICT-based e-modules*. Journal of Educational Innovation, 12(3), 45–58.

Hendra, N., Lapisa, R., Ambiyar, A., & Purwanto, W. (2022). Development of E-Interactive Module Starter System Maintenance with Discovery Learning Model. EDUTEC: Journal of Education And Technology, 6(1), 171–178. https://doi.org/10.29062/edu.v6i1.535

Hidayat, F. and Nizar, M. (2021). Model addie (analysis, design, development, implementation and evaluation) dalam pembelajaran pendidikan agama islam. Jurnal Inovasi Pendidikan Agama Islam (Jipai), 1(1), 28-38.

Hubing, N., Oglesby, D. B., Philpot, T. A., Yellamraju, V., Hall, R. H., & Flori, R. E. (2002). Session 2368 Interactive Learning Tools: Animating Statics.

Jais, N. F. M., Ishak, S. A., & Yunus, M. M. (2022). Developing the self-learning interactive module using ADDIE model for year 5 primary school students. International Journal of Academic Research in Progressive Education and Development, 11(1), 615-630.

Kasi, V., & Zaharudin, R. (2023). The Design and Development of the 'Grid and Game'Module Using the Addie Model for Remedial Pupils. KUPAS SENI, 11(2), 23-31.

Kaviza, M. (2020). Kesediaan Murid Terhadap Penggunaan Aplikasi Google Classroom Sebagai Platform Pembelajaran Sejarah. Malaysian Journal of Social Sciences and Humanities (MJSSH), 5(4), 108–115. https://doi.org/10.47405/mjssh.v5i4.397

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010
McKim, C. (2022). Validity: Criterion, Concurrent, Ecological, and Predictive. In Validity: Criterion, Concurrent, Ecological, and Predictive. Routledge. https://doi.org/10.4324/9780367198459-REPRW156-

Mcquaigue, M., Burlinson, D., Subramanian, K., Saule, E., & Payton, J. (2018). Visualization, Assessment and Analytics in Data Structures Learning Modules. Proceedings of the 49th ACM Technical Symposium on Computer Science Education, 864–869. https://doi.org/10.1145/3159450.3159460

Megat Abdul Rahim, P. R., Idris, S. L., Abdul Rahman, Z. I., Ya Shaq, M. S., & Nasir, N. F. (2021). Approaching listening and speaking skills using online to facilitate interactive learning from students' perspectives. Asian Journal of University Education (AJUE), 7(2), 203-214.

Musolin, M. H., Serour, R. O. H., Siregar, M., Hamid, S. A., Ismail, A., Huda, M., & Rohim, M. A. (2024, February). Developing personalised Islamic learning in digital age: pedagogical and technological integration for open learning resources (olr). In International Congress on Information and Communication Technology (pp. 11-25). Singapore: Springer Nature Singapore.

Najuah, N., Sidiq, R., & Lukitoyo, P. S. (2021). The development electronic module of history using ADDIE model. International Journal of Educational Research & Social Sciences, 2(6), 1658-1663.

Nurjanah, R. L., Saptanto, D. D., & Dewi, M. K. (2021). Using Modelling-Based Speaking Module for Informal Interaction Class to Support Self-Regulated Learning. Language Circle: Journal of Language and Literature, 15(2), 305–316. https://doi.org/10.15294/lc.v15i2.28656

Rahayu, I., & Sukardi, S. (2021). The Development Of E-Modules Project Based Learning for Students of Computer and Basic Networks at Vocational School. Journal of Education Technology, 4(4), 398. https://doi.org/10.23887/jet.v4i4.29230

Ramadhani, R. and Fitri, Y. (2021). Epub3 based mathematical e-modules using the sigil application as a solution in teaching and learning process through covid-19 pandemic. Formatif Jurnal Ilmiah Pendidikan Mipa, 11(1). https://doi.org/10.30998/formatif.v11i1.6826

Ranuharja, F., Ganefri, G., Fajri, B. R., Prasetya, F., & Samala, A. D. (2021). Development of interactive learning media edugame using ADDIE model. Jurnal Teknologi Informasi Dan Pendidikan, 14(1), 53-59.

Rebhi, M., Ben Aissa, M., Tannoubi, A., Saidane, M., Guelmami, N., Puce, L., Chen, W., Chalghaf, N., Azaiez, F., Zghibi, M., & Bragazzi, N. L. (2023). Reliability and Validity of the Arabic Version of the Game Experience Questionnaire: Pilot Questionnaire Study. JMIR Formative Research, 7, e42584. https://doi.org/10.2196/42584

Riani, E., Rejekiningsih, T., & Santosa, E. B. (2024). Video Interaktif untuk Optimalisasi Kemampuan Bernalar Kritis Mewujudkan Profil Pelajar Pancasila. JIIP - Jurnal Ilmiah Ilmu Pendidikan, 7(2), 1249–1257. https://doi.org/10.54371/jiip.v7i2.3345

Shojima, K., & Toyoda, H. (2002). Estimation of Cronbach's alpha coefficient in the context of item response theory. The Japanese Journal of Psychology, 73(3), 227–233. https://doi.org/10.4992/jjpsy.73.227

Smith, J. (2020). *Innovative teaching with technology*. Academic Press.

Zeleke, W. A., Hughes, T. L., & Drozda, N. (2020). Home–school collaboration to promote mind–body health. In C. Maykel & M. A. Bray (Eds.), Promoting mind–body health in schools: Interventions for mental health professionals (pp. 11–26). American Psychological Association.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 26 (September 2025) PP. 141-156
DOI: 10.35631/IJMOE.726010

Zheng, D., & Chen, H. (2020). Issues on the Construction and Implementation of Interactions Design Curriculum*. Proceedings of the 4th International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2020). https://doi.org/10.2991/assehr.k.200316.150