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Measuring the Usability and Appeal of an E-Module Using the User Experience Questionnaire

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ABSTRACT

This study aims to assess the readability level of an interactive e-module developed specifically for the Basic Electrical Engineering subject. The research sample consisted of students from three vocational schools in Jakarta. Prior to field implementation, the e-module underwent a validation phase involving six experts: two subject matter experts in electrical engineering, two experts in educational media technology, and two language experts specializing in Indonesian for secondary education. The study employed a Research and Development (R&D) methodology using the DDD-E model developed by Ivers & Barron. The validation results demonstrated that all assessed aspects were rated as “valid” by material, media, and language experts. Furthermore, the results of the User Experience Questionnaire (UEQ) revealed the following mean scores: Attractiveness (2.15), Perspicuity (1.94), Efficiency (2.14), Dependability (2.16), Stimulation (2.05), and Novelty (2.11). Based on the responses from 87 participants, the developed interactive e-module was rated in the “Excellent” category across all six aspects, indicating its strong potential and readiness for use in instructional settings.

1. Introduction

Directorate General of Informatics Applications in 2022 indicate that the literacy level of Jakarta residents, across all demographic groups and age cohorts, does not place within the top fifteen nationwide. This finding is corroborated by the 2022 Programme for International Student Assessment (PISA), in which Indonesia ranked 68th with a reading score of 371. This score reveals a disparity, as data on digital information access show that Western Indonesia particularly DKI Jakarta, has the highest level of access at 62%, along with the highest internet usage duration. However, in contrast, public interest in digital literacy remains notably low. In the education sector, internet use is predominantly focused on information searching for 36.5%, while other activities such as online learning processes and the use of multimedia for instruction comprise 27.6% and 17.1%, respectively.

During the observation process conducted by the researcher in several schools with Electrical Power Installation Engineering programs in Jakarta, several relevant challenges were identified concerning the effectiveness of teaching Basic Electricity. Students were found to remain relatively passive during the learning process, primarily due to the teachers' use of instructional media that remains teacher-centered. This teacher-dominated approach has contributed to a lack of active student engagement throughout the lessons. In addition, the limited variation in instructional media was also identified as a key finding during the observation process in four schools, where students were only provided with learning materials prepared by the teacher and accessible solely within the school environment (Kusumaningrum et al., 2024). This has resulted in restricted access to learning resources outside the classroom. Therefore, one proposed solution is the development of an electronic learning medium. This digital medium will be designed with clear learning objectives, similar to a traditional physical module, but enhanced through digitalization to include a variety of engaging features aimed at increasing students' interest in digital reading and learning.

Digitalization in education sector is one of the best innovation there is, in order to improvise the education system and the outcome . In this process, there is naturally a transformation of educational facilities and infrastructure from physical to digital forms, aimed at supporting a new learning paradigm. This shift is intended to enhance the learning experience and equip students with essential digital skills and employability talents for the future workforce (Kustono, 2022). From these problems, researchers conclude that it is needed to develop a digital learning media such as interactive electronic module. These electronic modules had an interactive aspects that allowed the student to interact more into the learning and the module itself, these aspects such as displaying images, videos, audio, and animation that equipped with informative test that allowed instant automatic result and feedback (Wirawati et al., 2023).

With the help from e-module, it is hoped that this new learning system can develop a better outcomes from pulling the student interest in learning and reading, because the learning materials in the module are well structured, specially designed to be more interesting and attractive by adding animations, learning videos, and audio to support the student (Safitri & Andromeda, 2023). Modules were originally designed in printed form in the beginning, it is now more advanced presented in electronic form which is more flexible and efficient. Not only that, e-module are also could enrich the learning experience and learning skills of the students (Wahyuni et al., 2025). According to Majri et al. (2024), understanding the digital paradigm is essential for educators aiming to design impactful and effective learning experiences. Learners in the digital era expect more than just relevant content, they require learning that is interactive, engaging, and adaptable. Moreover, incorporating technology into education should not be seen as the ultimate goal, but rather as a deliberate response to the changing demands and expectations of today's learners (Salsabila et al., 2023). This statement is further supported by a needs analysis conducted among 10th-grade students at SMKN 55 Jakarta, where the majority of learners expressed agreement with the development of an interactive e-module. They perceived the e-module as a suitable medium for learning in the

digital era, one that is more engaging, accessible, and effective in helping them understand the subject matter independently and flexibly (Suparmin et al., 2024).

The objective of this study is to develop an interactive e-module for the subject of Basic Electrical Engineering that is both feasible and effective for use in vocational high schools. Specifically, the research aims to ensure that the e-module meets content, media, and language validity criteria, demonstrates significant improvement in students' learning outcomes through experimental testing, and provides a positive user experience based on student perceptions.

2. Methodology

This study employs a Research and Development (R&D) methodology using the DDD-E model developed by Ivers and Barron (2002) in their book "Multimedia Projects in Education: Designing, Producing, and Assessing.". The model consists of three development stages and one evaluation stage, in which the first three stages serve as the foundation for refining the product in the final phase (Ivers & Barron, 2002). This model consists of four stages, Decide, which involves setting objectives and selecting materials. The steps include (1) formulating learning objectives; (2) determining the media scope; (3) conducting a literature review. Design, which focuses on structuring the product. It includes (1) creating a content outline; (2) developing a flowchart; (3) designing the product layout; (4) creating a storyboard. Develop, which refers to developing and producing the product, including designing the user interface to ensure it is ready for implementation. Evaluate, which involves assessing the completed product by reviewing the entire design and development process to ensure its quality and effectiveness. Figure 1 below illustrates the scope of the DDD-E model according to Barron, with detailed explanations provided for each aspect.

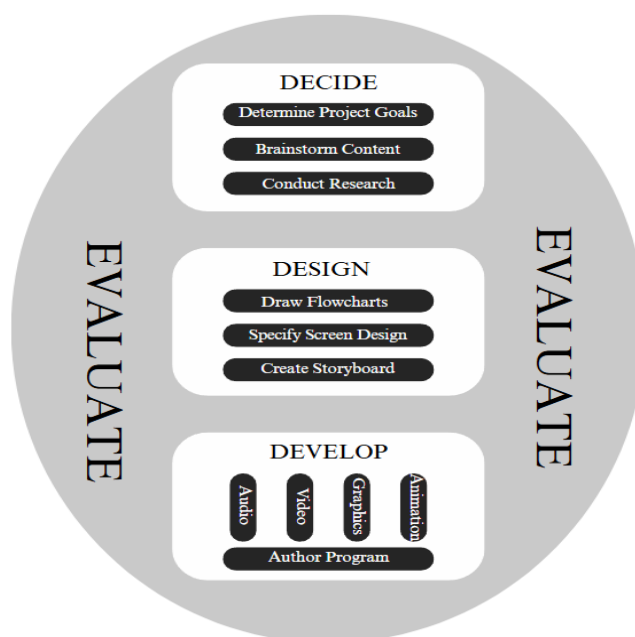


Figure 1. DDD-E Research Model

The data collection methods used in this study included questionnaires for expert judgment, as well as observation, UEQ's method, and one-on-one interviews with students, which served as supporting data to strengthen the findings. The data collected from the students were obtained using the User Experience Questionnaire (UEQ) method. This method was conducted to assess the level of readability and user experience of the developed media. The User Experience Questionnaire (UEQ) is calculated by converting each respondent's answer on the bipolar scale (−3 to +3) into numerical scores. Each item corresponds to one of the six UEQ dimensions, and the values are averaged to obtain a score per dimension for each respondent.

These scores are then averaged across all respondents to produce the final score for each dimension, such as attractiveness, clarity, efficiency, dependability, stimulation, and novelty. The results are interpreted using the standardized UEQ benchmark, where values above +1.5 indicate “excellent,” +0.8 to +1.5 “good,” −0.8 to +0.8 “neutral,” and below −0.8 “poor.” In this way, the UEQ scores provide an overview of the readability and user experience of the developed media. The data were then categorized using a classification table, as shown on Table 2, to determine the level of success and readability of the developed product. As for the product validation was conducted by 4 validators, consist 2 media expert lecturer and 2 subject matter expert lecturer. The validation instrument use Likert scale ranging from 1 to 5. The results of the validation were analyzed using Aiken V formula as the basis for assessment. After the validation score had been analyzed, then it will be categorized using validity category as it shown down below in Table 1.

Table 1. Validity Category

Indeks Validitas	Kriteria Validitas
$0,81 < V < 1,00$	Very Valid
$0,61 < V < 0,80$	Valid
$0,41 < V < 0,60$	Average
$0,21 < V < 0,40$	Not Valid
$0,00 < V < 0,20$	Very Not Valid

Arikunto modification (2012)

Table 2. Benchmark Interval For The UEQ Scale

	Att.	Eff.	Per.	Dep.	Stim.	Nov.
Excellent	> 1.75	> 1.78	> 1.9	> 1.65	> 1.55	>1.4
Good	> 1.52	> 1.47	> 1.56	> 1.48	> 1.31	> 1.05
	<1.75	<1.78	<1.9	<1.65	<1.55	<1.4
Above average	> 1.17	> 0.98	> 1.08	> 1.14	> 0.99	> 0.71
	<1.52	<1.47	<1.56	<1.48	<1.31	<1.05
Below average	> 0.7	> 0.54	> 0.64	> 0.78	> 0.5	> 0.3
	1.17	< 0.98	< 1.08	< 1.14	< 0.99	< 0.71
Bad	< 0.7	< 0.54	< 0.64	< 0.78	< 0.5	< 0.71

Schrepp & Hinderks, 2014

3. Results and Discussion

Define

The needs analysis was conducted by interviewing teachers of the *Basic Electricity and Electronics* subject to identify gaps in both the learning process and instructional media used in SMK Negeri 55 Jakarta, SMK Negeri 35 Jakarta, SMKN Negeri 1 Jakarta, and SMK Negeri 26 Jakarta. The result of the interview can be seen in Table 3 down below.

Table 3. Data From Interviews

No	Question	Answer
1.	What curriculum is currently used in the Basic Electrical Engineering subject (Dasar-Dasar Ketenagalistrikan / DDK)?	The Merdeka Curriculum
2.	What learning tools do you use during the DDK learning process?	Teaching modules, Learning Objective Pathway (ATP), Student Worksheets (LKPD), and government-issued textbooks (in hardcopy format).
3.	What teaching materials do you usually use to teach DDK?	Government-provided teaching modules that include components such as Learning Objective Pathways (ATP), Competency Standards (CP), etc.
4.	Apart from that, have you ever used teaching materials that utilize technology?	Yes, I've used media sourced from YouTube, social media, and PowerPoint presentations.
5.	What is your opinion about teaching materials that incorporate technology?	
6.	Have you experienced any obstacles while using technology-based teaching materials?	Not really. The students are quite active in searching for learning resources online and are already familiar with various technologies such as Zoom meetings, Google Classroom, Google Forms, etc.
7.	With the use of such teaching materials, has student-centered learning been implemented effectively? If not, how do you address the issues?	It has been quite effective, as the Merdeka Curriculum emphasizes the role of the teacher as a facilitator and encourages students to be expressive and more active.
8.	In your opinion, are there any materials that are difficult to teach or hard for students to understand in the DDK subject?	Yes, particularly materials that focus on the use of practical tools that, unfortunately, are not yet available in schools, and materials that limit students from exploring further.
9.	What kind of teaching materials do you use to teach those challenging topics?	I mostly use PowerPoint presentations and videos from the internet.
10.	In your opinion, how important is the role of teaching materials in supporting student-centered learning?	It is important, as they serve as a guide for students to achieve the learning objectives and outcomes.
11.	What type of teaching materials do you use that students tend to enjoy?	Students prefer media that combine audio and visual content in a balanced way, rather than just using textbooks. They also enjoy interactive videos.
12.	If an interactive electronic module were developed for the DDK subject, do you think it would help students better	It would be very helpful, but most modules currently available are paid. A freely accessible, engaging, and complete interactive module would greatly assist

understand the material and increase their learning interest?

students in understanding the material and increasing their motivation to learn.

The interview findings revealed that the learning process for *Basic Electricity and Electronics* remains teacher-centered, which is considered less effective for implementing Project-Based Learning. Although the teacher has incorporated technology into instructional media, the use of technology remains monotonous, as it mainly relies on PowerPoint presentations. As a result, students tend to feel disengaged due to the lack of variation in learning methods. Given that students possess smartphones and have access to internet connectivity, the development of an electronic learning module can be implemented with minimal obstacles. The presence of an *electronic learning module* for *Basic Electricity and Electronics* is expected to encourage students to be more active and innovative throughout the learning process.

Design

At this stage, it is necessary to design the product to be developed, beginning with the selection of an appropriate development platform. The application chosen for designing the module is Canva, which allows the final product to be downloaded in various file formats suitable for both print and digital distribution. The user-friendly and efficient design process ensures that the final product is not only visually appealing but also effective in delivering the intended message. By utilizing Canva as the development and design tool, various features and advantages can be leveraged to produce a professional and engaging product without incurring high costs or requiring advanced technical skills.

Develop

At this stage, the researcher developed the product based on the previously formulated design plan, using Canva as the design platform to arrange elements such as theme, background color, concept, supporting images, dimensions, and font types. All components were adjusted to enhance the effectiveness of information delivery within the learning media. Below, Figure 2 is the cover page of the electronic module as displayed in the Canva interface.

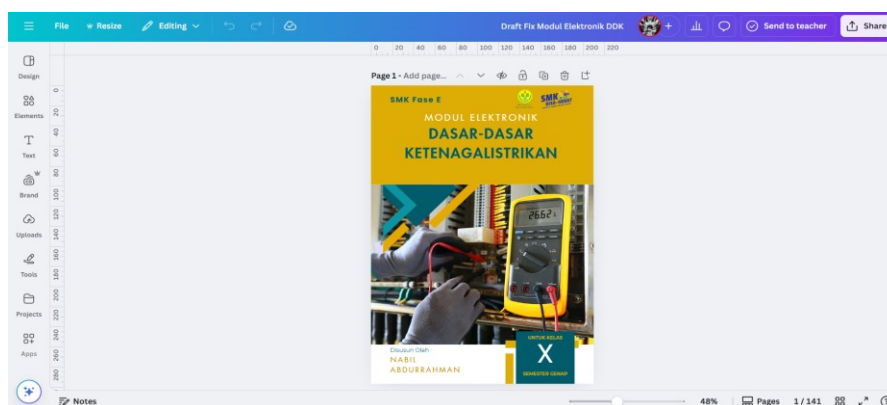


Figure 2. E-Module Cover from Canva Platform

During the initial operation of the module, the opening screen displays the title as shown in Figure 3. To navigate between pages, users can simply click the arrow icons to move forward or backward. Alternatively, users may also turn pages by swiping, simulating the experience of reading a physical book.



Figure 3. Final Product

In terms of interactivity, the product emphasizes the inclusion of hyperlink features embedded in several terms that are potentially difficult for students to understand. When these terms are clicked, users are directed to external references to enhance their literacy and comprehension. Additionally, the product is equipped with a Frequently Asked Questions (FAQ) feature, which presents a set of common questions related to the material and also provides links to relevant external literature for further exploration.

Evaluate

The evaluation stage consisted of two phases of data collection. In the first phase, data were gathered through the validation of the developed product by six experts. These experts included two subject matter experts in the field of basic electrical engineering comprising a university lecturer and a vocational school teacher who specialize in electrical subjects; two media experts with professional experience in educational media technology and digital learning tools; and two language experts with academic expertise in the use of Indonesian language within the context of higher education. Each expert contributed feedback according to their respective areas of specialization to ensure the quality, relevance, and clarity of the e-module.

1. Validity Test

The content expert conducted a validation process focusing on 4 critical aspects that relate to the quality and relevance of the information presented in the e-module. These aspects include content quality, instructional quality and supporting aspects quality, and the module's capacity to stimulate students' curiosity and engagement

with the subject matter. The results showed in Table 5 which is the Content Quality Aspect.

Table 5. Content Expert Validation

Aspects	Validator		s1	s2	Σs	V	Criteria
	1	2					
Content Quality	18	14	14	10	24	0,75	VALID
Instructional Quality	22	20	17	15	32	0,80	VALID
Supporting Aspects Quality	19	14	15	10	25	0,78	VALID
Curiosity Stimulate	14	11	11	8	18	0,75	VALID

Based on the calculation using Aiken's V formula, it is obtained a validated score of 0,75, which can be categorized as "valid". As for the Instructional Quality obtained a validated score of 0,80, which can be categorized as "valid". For Supporting Aspects Quality obtained a validated score of 0,78, which can be categorized as "valid". And for the Curiosity Stimulate aspect obtained a validated score of 0,75, which can be categorized as "valid". This indicates that the aspect meets the required standards and is considered appropriate for use within the context of the developed e-module.

The media expert evaluated the e-module from the perspective of its overall feasibility and effectiveness as a digital learning medium for students. This evaluation covered 3 main components the visual presentation quality, including visual quality, graphic standards, and interactivity provided by the module, which supports active user engagement and enhances the learning experience. The results showed in Table 6 which is the Visual Quality Aspect.

Table 6. Media Expert Validation

Aspects	Validator		s1	s2	Σs	V	Criteria
	1	2					
Visual Quality	44	44	33	33	24	0,75	VALID
Graphic Standards	17	16	13	12	16	0,67	AVERAGE
Interactivity	12	12	9	9	12	0,75	VALID

Based on the calculation using Aiken's V formula, it is obtained a validated score of 0,75, which can be categorized as "valid". As for the Graphic Standards obtained a validated score of 0,67, which can be categorized as "valid". And for the Curiosity Stimulate aspect obtained a validated score of 0,75, which can be categorized as "valid". This indicates that the aspect meets the required standards and is considered appropriate for use within the context of the developed e-module. The language expert carried out a validation that addressed 3 aspects closely related to the use of language and the clarity of information delivery within the module. These aspects comprise the communicative effectiveness of the text, communicativeness, clarity, dialogical style and interactivity elements that contribute to a more engaging and

student-centered learning environment. The results showed in Table 7 which is the Communicativeness aspect.

Table 7. Media Expert Validation

Aspects	Validator		s1	s2	Σs	V	Criteria
	1	2					
Communicativeness	20	18	15	13	22	0,61	VALID
Clarity	32	28	25	21	33	0,73	AVERAGE
Dialogical Style And Interactivity	18	14	14	10	24	0,67	VALID

Based on the calculation using Aiken's V formula, it is obtained a validated score of 0,61, which can be categorized as "valid". As for the Clarity aspect obtained a validated score of 0,73, which can be categorized as "valid". And for the Dialogical Style And Interactivity aspect obtained a validated score of 0,67, which can be categorized as "valid". This indicates that the aspect meets the required standards and is considered appropriate for use within the context of the developed e-module.

2. User Experience Questionnaire

Based on the six aspects evaluated using the User Experience Questionnaire (UEQ), the average scores were obtained as presented below in Figure 4. The data were collected from three vocational schools: SMKN 55 Jakarta, SMKN 26 Jakarta, and SMKN 1 Jakarta, with a total of 87 student respondents participating in the assessment. For the Attractiveness aspect, a mean score of 2,15 was recorded, which, according to the categorization by Schrepp & Hinderks (2014), falls under the "Excellent" category. The Perspicuity aspect received a mean score of 1,94, also categorized as "Excellent". For the Efficiency aspect, the mean score was 2,14, which is likewise considered "Excellent". The Dependability aspect yielded a mean score of 2.16, classified as "Excellent". The Stimulation aspect achieved a mean score of 2.05, also falling into the "Excellent" category. Lastly, the Novelty aspect obtained a mean score of 2.11, which, in accordance with Schrepp & Hinderks (2014), is categorized as "Excellent".

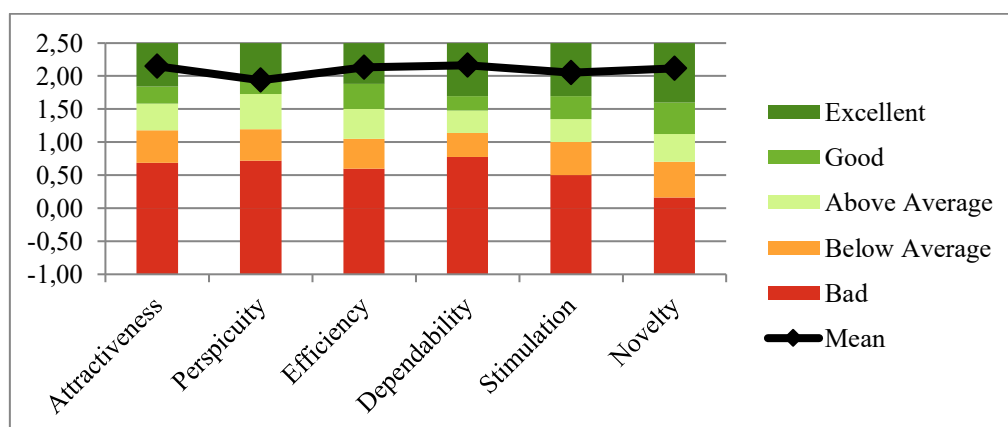


Figure 4. User Experience Measurement

The findings from the expert validations and User Experience Questionnaire (UEQ) reveal the feasibility and appropriateness of the developed interactive e-module for the *Basic Electrical Engineering* subject. Each validation phase provides insight into the module's strengths and areas for further refinement, particularly in terms of content accuracy, media quality, language clarity, and user experience. The high score in Novelty indicates the module's potential to provide fresh, modern learning experiences that depart from traditional textbook formats. Similarly, the strong performance in Stimulation and Efficiency reflects the module's capacity to motivate students while facilitating efficient learning processes.

Overall, the validation and user experience findings highlight that the developed e-module is both instructionally sound and user-friendly. The integration of interactivity, clarity in language, and alignment with digital learning expectations supports the implementation of student-centered learning as promoted by the Merdeka Curriculum (Emirzaki et al., 2022). Minor improvements in graphical standards and language communicativeness could further enhance usability and engagement. Thus, the module holds strong potential as an alternative digital resource for vocational students in electrical engineering education. Digital literacy refers to an individual's capacity to utilize various forms of media to obtain, evaluate, and generate information for everyday purposes, with this ability being shaped by surrounding media, particularly the internet (Wahyuni et al, 2025).

According to Hasibuan et al. (2023), a product is considered practical if it can be effectively utilized in the learning process, with the ultimate outcome of facilitating the implementation of classroom instruction. In this study, the measurement of practicality was conducted using the User Experience Questionnaire (UEQ), with the results categorized as "Excellent." This indicates that the developed product can be considered effective for use in the learning process.

4. Conclusion

This study concludes that the DDD-E model effectively supports the systematic development of interactive electronic learning modules, guiding the process from initial goal setting to final product design. The developed e-module for the subject of Basic Electricity was validated by experts in content, media, and language, all of which fell into the "valid" category. User perception data collected through the User Experience Questionnaire (UEQ) also demonstrated high ratings across attractiveness, clarity, efficiency, accuracy, stimulation, and novelty, indicating that the product is not only feasible but also positively received by students.

In practical terms, this e-module can serve as an effective supplementary or primary learning resource for teachers, supporting active student engagement, digital literacy, and independent learning. For students, the module provides an accessible, interactive medium that enhances understanding of abstract concepts in electricity through visualization, hyperlinks, and interactive tasks.

Future research is recommended to further investigate the long-term effectiveness of the e-module in improving higher-order thinking skills (HOTS), problem-solving abilities, and practical competencies in vocational education. In addition, expanding the module with advanced interactive features such as simulations and dynamic animations, as well as testing its implementation in broader school contexts, could provide deeper insights into its scalability and impact on learning outcomes.

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