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Needs Analysis for Developing AI-Based E-Modules to Improve Students Digital Literacy in History at SMA Muhammadiyah 1 Palembang

MUHAMMAD FADLURROHMAN SHUBHI[1], SYARIFUDDIN[2].
Universitas Sriwijaya, Palembang, Indonesia.
Email: rohmanshubhi@gmail.com, syarifuddin@fkip.unsri.ac.id

ABSTRACT:
The development of digital technology demands a transformation in the world of education, including the development of learning media that is innovative and adaptive to the needs of students. This study aims to analyze the needs of students in the development of E-Modules based on Artificial Intelligence (AI) in history subjects at SMA Muhammadiyah 1 Palembang. The method used was a mixed qualitative and quantitative approach with a survey design. Data was collected through distributing questionnaires to students and analyzed descriptively. The results showed that 85.4% of learners were interested in the application of AI in learning, 80.6% were interested in using the E-Module, and 62.9% had previous experience in using it. In addition, 51.6% of learners have a visual learning style, while the lecture method still dominates history learning by 30.6%. These findings suggest that the development of AI-based E-Modules is needed to overcome the limitations of conventional learning methods and support the improvement of digital literacy, learning engagement, and 21st century competencies.
Keywords: *E-Modules, Artificial Intelligence, Digital Literacy, History, Needs Analysis*

ABSTRAK:
Perkembangan teknologi digital menuntut adanya transformasi dalam dunia pendidikan, termasuk pengembangan media pembelajaran yang inovatif dan adaptif terhadap kebutuhan peserta didik. Penelitian ini bertujuan untuk menganalisis kebutuhan peserta didik dalam pengembangan E-Modul berbasis Artificial Intelligence (AI) pada mata pelajaran sejarah di SMA Muhammadiyah 1 Palembang. Metode yang digunakan adalah pendekatan campuran kualitatif dan kuantitatif dengan desain survei. Data dikumpulkan melalui penyebaran angket kepada peserta didik dan dianalisis secara deskriptif. Hasil penelitian menunjukkan bahwa 85,4% peserta didik tertarik pada penerapan AI dalam pembelajaran, 80,6% berminat menggunakan E-Modul, dan 62,9% memiliki pengalaman sebelumnya dalam menggunakannya. Selain itu, 51,6% peserta didik memiliki gaya belajar visual, sementara metode ceramah masih mendominasi pembelajaran sejarah sebesar 30,6%. Temuan ini menunjukkan bahwa pengembangan E-Modul berbasis AI diperlukan untuk mengatasi keterbatasan metode pembelajaran konvensional dan mendukung peningkatan literasi digital, keterlibatan belajar, serta kompetensi abad ke-21.
Kata Kunci: E-Modul, Artificial Intelligence, Literasi Digital, Sejarah, Analisis Kebutuhan

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A. INTRODUCTION

The development of digital technology has brought significant changes in various aspects of life, including the field of education (Haleem et al., 2022). The digital era demands an update to traditional learning methods towards more personalized, adaptive, and technology-based learning models (Hartati et al., 2024). This transformation not only changes the way teaching and learning occur but also expands access and enhances the overall quality of education. Digital technology acts as an accelerator in creating a dynamic learning environment that is responsive to the individual needs of learners (Tabasi et al., 2024). By leveraging technology, educational institutions have the opportunity to implement more flexible, interactive, and competency-oriented learning models for the 21st century. Moreover, the application of digital technology also encourages innovation in curriculum design, learning strategies, and comprehensive education management (Jangjarat et al., 2023).

In this context, technology is not just an auxiliary tool, but rather accelerates the transformation of artificial intelligence (AI), which has penetrated various dimensions of the education system from learning management to instructional material design (Khatun et al., 2024). AI in education functions as a supporting tool for learning adaptation based on student profiles, learning styles, and varying levels of cognitive achievement (Yanto et al., 2025). AI-based systems can analyze learning data in real-time and provide recommendations tailored to the needs of each student (Silva et al., 2024). This presents a significant opportunity to reduce learning gaps and enhance the overall effectiveness of the educational process. The use of AI in the education sector has proven its ability to create personalized learning experiences and has a positive impact on the learning outcomes achieved by students (Al Nabhani et al., 2025).

The application of AI results in a more responsive and individualized learning system, providing real-time feedback and automatically adjusting teaching materials (Kabudi et al., 2021). AI offers great opportunities in designing more engaging history learning modules with data-driven approaches, interactive visualizations, and contextual simulations (He et al., 2024). In history learning, which is narrative and conceptual in nature, visual and simulated approaches are crucial to help learners understand historical contexts more deeply (Browning & Hohenstein, 2024). AI technology can assist in constructing historical narratives based on the mapping of relationships among events, figures, and locations interactively, making learning more engaging and easier to understand (Wang et al., 2024). In fact, AI is capable of automatically integrating various historical sources, allowing learners to explore information from different perspectives within interconnected contexts (Bertram et al., 2021).

One concrete form of technology integration in education is the e-module, which is a digital learning material that allows students to access content anytime and anywhere, supporting flexibility and independence in learning. When e-modules are integrated with AI, the result is a learning medium that can present content adaptively, providing interventions based on learning analytics (Tan et al., 2025). In history education, this integration is

particularly significant given the complex and narrative nature of the material, making visualization and personalization very helpful for understanding, as well as enhancing students' digital literacy in the context of history (Umamah et al., 2023). AI-based e-modules can utilize various advanced features such as interactive maps, adaptive quizzes, and audio-visual history narratives that can increase student engagement and motivation. Furthermore, carefully developed e-modules can also be tailored to the national curriculum and local needs, thus supporting relevant and contextual learning.

Digital literacy has become a fundamental competency for learners in facing the challenges of technology-based education, including in critically and contextually understanding historical material (Sulianta, 2024). Digital literacy in the context of history education encompasses the ability to search for, evaluate, and interpret various digital historical sources with an objective and analytical approach (Eguz, 2021). These skills are essential to prevent the spread of false information and manipulation of historical data in the digital age. In line with Jenkins' media literacy theory (2006), learners need to be trained not only to consume information but also to create and disseminate content responsibly and reflectively. With these abilities, learners will be better prepared to face global challenges and think critically about various historical issues that arise in society. Digital literacy is also an important foundation in shaping intelligent, critical, and responsible digital citizens in using information technology (Hakim, 2022).

This study shows that the development of AI-based e-modules is expected to significantly enhance students' digital literacy through interactive learning. The e-modules are designed to adapt to learning patterns and adjust to the difficulty of the material that can be completed by the students (Ristić et al., 2023). With a flexible and data-driven design, these e-modules can provide learning challenges that match each individual's skill level, as well as offer constructive feedback in the learning process. This is expected to improve students' digital literacy and strengthen their understanding of historical concepts in depth. The interactive features in the e-modules also allow students to explore the material independently and collaboratively, enhancing critical thinking skills and problem-solving abilities.

In another study, the application of artificial intelligence (AI) in the learning process has been shown to enhance the effectiveness of self-directed learning and strengthen student engagement in school activities (Nuryadin, 2023). AI also enables continuous monitoring of learning progress, allowing educators to provide timely and appropriate interventions based on needs (Pusporini & Nurdiyanto, 2024). With the presence of adaptive and personalized systems, students feel more valued and supported in their learning process, which ultimately has a positive impact on learning outcomes. This indicates that the utilization of AI-based technology in education is not merely a trend, but a strategic necessity in the development of quality and inclusive education (Akhmetova et al., 2025).

There is a gap in the use of technology based on practices in schools, particularly in Indonesia. An interview with an educator at Muhammadiyah High School 1 Palembang named Mr. Ikmal revealed that there are still educators who use lecture methods and do

not understand technology to support the learning process. This phenomenon indicates the need for intensive training for educators to effectively integrate technology into learning. Many educational institutions have not fully integrated AI and digital technology into the learning process due to limitations in infrastructure, educator training, and the availability of learning media that meets the needs of students. This challenge must be addressed with supportive policies, adequate resource provision, and the development of teachers' capacities through ongoing training (Rizki, 2024). Support from various parties, including the government, academics, and the technology industry, is essential in creating an education that fully supports digital transformation.

This research aims to address theoretical and practical issues by developing an AI-based e-module to improve digital literacy in history learning at SMA Muhammadiyah 1 Palembang, based on a student needs analysis. With a needs analysis approach, it is hoped that this e-module will not only be relevant in terms of knowledge but also effectively improve digital literacy in learning. This approach also considers the level of educator readiness to carry out the role of facilitator in dynamic digital learning. Educators are expected to be able to navigate technology and manage data-driven learning to create meaningful and enjoyable learning experiences for students (Opicho et al., 2025). Furthermore, a needs-based approach allows for the development of contextual materials, tailored to the characteristics and backgrounds of students (Wanci et al., 2024).

Thus, the main objective of this research is to develop an AI-based e-module that not only serves as a learning medium but also as a means of improving digital literacy, learning independence, and students' cognitive and emotional engagement in history learning. The research's focus lies in its approach to educational technology and historical science, with Artificial Intelligence (AI)-based materials and design. This research is expected to not only provide solutions to the limitations of history learning but also strengthen digital literacy and 21st-century readiness for students in Indonesia. In the long term, this model is expected to be applied to educational institutions to accelerate inclusive and sustainable digital transformation. This way, education in Indonesia will be better prepared to face global challenges and be able to produce a young generation that is adaptive, creative, and highly competitive in the digital era.

B. METHOD

The needs analysis phase of this study employed a combined qualitative and quantitative approach. The qualitative approach was implemented through structured interviews with history teachers to obtain in-depth information regarding the challenges faced in the learning process, the extent to which technology has been utilized, and teachers' expectations regarding the development of Artificial Intelligence (AI)-based e-module teaching materials (Bugti et al., 2024). These interviews also aimed to explore teachers' perspectives on the relevance of the material, infrastructure readiness, and pedagogical needs that could be supported through the development of AI-based e-modules (Saddik, 2024).

Meanwhile, the quantitative approach was conducted through the distribution of a

needs analysis questionnaire to students. This questionnaire was designed to collect data regarding students' preferences for digital teaching material features, their level of digital literacy, and their expectations regarding the integration of technology in history learning (Hidayanti, 2021). The data obtained from the questionnaire were analyzed descriptively to identify general trends and relevant need patterns. The combination of data from interviews and questionnaires provides a strong and comprehensive foundation for designing AI-based e-modules that align with the actual conditions, characteristics, and needs of students at SMA Muhammadiyah 1 Palembang. This triangulation approach is expected to produce effective, adaptive, and contextual development products.

C. RESULTS AND DISCUSSION

Needs analysis in the context of learning media development research is an essential process aimed at identifying critical components related to student readiness, interest, and characteristics in integrating Artificial Intelligence-based learning technology (Mendoza et al., 2025). This process includes assessing students' level of enthusiasm for the use of technology in learning, the effectiveness of conventional methods still used in the teaching and learning process, and the extent to which material can be understood through these approaches (Nurhidayat et al., 2024).

In addition, aspects of students' experiences using e-modules, their preferences for digital media, the dominance of certain learning styles, such as visual, and teachers' tendencies to use lecture methods are also comprehensively analyzed (Fadil et al., 2023). The results of this analysis provide a strong scientific basis for designing AI-based e-modules that are adaptive, contextual, and aligned with the dynamics of 21st-century learning.

Data analysis from a questionnaire distributed to students at SMA Muhammadiyah 1 Palembang indicates a significant need for the development of Artificial Intelligence (AI)-based e-modules as a more innovative and engaging history learning medium. Overall, these findings underscore the importance of transforming learning methods from conventional approaches to digital learning that adapts to student characteristics and the demands of the digital era (Godin & Terekhova, 2021).

Table 1. Summary of Student Needs Analysis Questionnaire Results

No	Domain Anaysis	Percentage (%)	Descreption
1	Student interest in the application of AI in education	85,4%	High – Demonstrates student readiness for smart technology
2	Understanding historical material using conventional methods	77,4%	Enough – There are still 22.6% who are not satisfied
3	Students consider history material boring	17,7%	Low – But still significant as an indication of method weakness
4	Students who do not understand the material at all	4,8%	Low – Needs intervention through more interactive media

5	Interest in using E-Modules	80,6%	High – Supports E-Module development
6	Experience using E-Modules	62,9%	Quite high – Indicator of readiness for technology use
7	Dominant learning style (visual)	51,6%	Visual learning style dominant – Visualization is required in E-Modules
8	The dominance of lecture methods in history learning	30,6%	High – Requires innovation in learning methods

Based on data obtained from questionnaires and interviews, it was found that the majority of students demonstrated high enthusiasm for technology-based learning, particularly that supported by artificial intelligence. This finding reinforces the urgency of developing AI-based e-modules as a learning medium capable of not only increasing participation but also significantly improving student learning outcomes. The details of the eight aspects analyzed are presented below:

1. **Student Interest in the Application of AI in Education**

The high percentage of students interested in the application of artificial intelligence in education, at 85.4%, reflects their readiness and enthusiasm for technological innovation. This interest is a strong early indicator that students are willing to engage in new AI-based learning models. This aligns with the spirit of digital transformation in education, which demands adaptation to intelligent technology (Klopov et al., 2023).

2. **Understanding Historical Material with Conventional Methods**

While 77.4% of students felt they understood history material adequately using conventional methods, 22.6% were still dissatisfied. This indicates that traditional approaches are not fully effective in reaching all students. The low effectiveness of the lecture method in conveying narrative and chronological material is a significant concern in developing more modern and contextual history learning strategies (Beigzadeh et al., 2024).

3. **Students consider history material boring.**

As many as 17.7% of students find history lessons boring. While this figure is not a majority, it remains a significant indicator of the current lack of appeal in history learning. These findings call for a more creative and interactive approach that brings historical material to life through technology-based visualizations and simulations.

4. **Students who do not understand the material at all**

The finding that 4.8% of students did not understand the material at all indicates a group at risk of falling behind. This percentage, while small, requires a differentiated learning strategy. The application of AI-based interactive technology can be a solution for detecting individual learning needs and providing appropriate feedback in real time, so that students who are lagging behind can be

assisted appropriately (Adil & Sakhamuri, 2024).

5. Interest in Using E-Modules

80.6% of students expressed interest in using e-modules in their learning. This data supports the development of flexible, accessible learning media that can present material in a variety of formats. These results demonstrate that e-modules can address the need for independent learning and time flexibility.

6. Experience Using E-Modules

With 62.9% of students already having experience using e-modules, it can be concluded that the majority of students have had exposure to digital media. This provides a strong foundation for continuing the development of AI-based e-modules. This initial experience will also facilitate the transition from print to digital media in history learning.

7. Dominant Learning Style (Visual)

As many as 51.6% of students report having a visual learning style. This preference demands learning media rich in visual elements such as images, videos, and animations. AI-based e-modules can adapt content to each student's individual learning style.

8. Dominance of Lecture Method in History Learning

Lecture methods still dominate history learning, with 30.6% of students confirming this. This dominance underscores the need for innovation in learning methods toward more participatory approaches, such as project-based learning or discovery learning (Isa & Azid, 2021). These learning models encourage students to actively construct knowledge through exploration, which aligns with the use of AI-based learning technology (Arqam & Asrifan, 2024).

An interview with Mr. Kemas Ikmal, a history teacher at SMA Muhammadiyah 1 Palembang, revealed that learning is still dominated by lecture methods, resulting in low student engagement and an inability to optimally develop 21st-century skills. He sees the integration of AI and the use of e-modules as potential solutions to improve learning outcomes and digital literacy, although there are still challenges in understanding technology among teachers. This statement aligns with questionnaire data on the development of AI-based e-modules, which are essential for history learning.

Findings from interviews and a needs analysis questionnaire indicate that students at SMA Muhammadiyah 1 Palembang generally have a high level of readiness and interest in technology-based learning, particularly that integrated with Artificial Intelligence. The development of AI-based e-modules is highly relevant to address the limitations of the still-dominant lecture method, as well as a means of improving digital literacy and understanding of history material (Wati & Syafriani, 2023). Therefore, the development of this e-module is expected to not only support learning effectiveness but also be a strategic step in developing students who are adaptive to the challenges of education in the digital era and society 5.0.

D. CONCLUTION

Based on the results of the analysis of student needs at SMA Muhammadiyah 1 Palembang, it was found that 85.4% of students were interested in the application

of Artificial Intelligence (AI) in learning and 80.6% were interested in using E-Modules as a learning medium, with 62.9% of them having experience using them. As many as 51.6% of students have a visual learning style, which shows the importance of integrating visual media in learning. Although 77.4% stated that they understood the history material, there were still 17.7% who found the material delivery boring and 4.8% did not understand the material at all, while the lecture method still dominated at 30.6%. These findings emphasize the need for the development of AI-based E-Modules as a more interactive, adaptive, and personalized learning solution to improve digital literacy, learning engagement, and 21st-century competencies in the digital era and society 5.0.

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