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Needs Analysis for the Development of an Electronic Module Based on Discovery Learning Assisted by Generative AI (ChatGPT) Animated Videos

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Abstrak- This study aims to analyze the need for developing an electronic module based on Discovery Learning assisted by Generative AI (ChatGPT) animated videos as an innovative digital learning resource. The research employed a quantitative descriptive survey design involving teachers and students as respondents to identify current learning conditions and expected characteristics of the proposed product. Data were collected using a five-point Likert-scale needs questionnaire covering learning conditions, electronic modules, Discovery Learning, animated videos, Generative AI, and multimedia integration, and were analyzed using descriptive percentage analysis. The results indicate a substantial gap between current learning conditions and respondents' expectations for technology-integrated learning resources. In addition, animated videos, multimedia integration, Generative AI utilization, and Discovery Learning emerged as major components required in the proposed electronic module. The findings suggest that integrating these components can provide a relevant framework for designing interactive, visual, and student-centered learning resources. In conclusion, the needs analysis provides an empirical foundation for developing the proposed electronic module. This study contributes to technology-enhanced learning design and recommends further product development, expert validation, classroom implementation, and effectiveness testing.

Keywords: *animated videos; Discovery Learning; electronic module; Generative AI; needs analysis*

1 Introduction

Digital transformation in education requires a shift from static instructional materials toward electronic learning environments that provide flexible access, multimodal representations, and more student-centered learning activities. In physics education, this need has become increasingly important because many concepts cannot be adequately understood through verbal explanations and mathematical equations alone; instead, they require visualization, observation of phenomena, and activities that guide students in constructing relationships among concepts. Wulandari and Jumadi (2023) demonstrated that the use of e-modules in physics learning provides opportunities to support various student competencies through more flexible learning materials. Nilyani et al. (2023) found that advances in educational technology have increased the need for physics e-modules that correspond to the characteristics of the subject matter and students' learning needs. Aldilla et al. (2023) emphasized that needs analysis is an essential stage prior to e-module development because it provides information regarding existing learning resources, media, and actual learning conditions. Chairatunnisa et al. (2024) indicated that limitations in the learning resources available to students provide a rationale for developing e-modules capable of facilitating the understanding of physics concepts. Harahap et al. (2024) demonstrated that electronic modules can integrate learning content, language, and media elements into a structured learning resource. Aldilla and Usmeldi (2024) further showed that physics e-modules can be systematically designed to accommodate the demands of

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twenty-first-century skills. Irsalina et al. (2026) found that the need for interactive e-modules is not limited to the digitalization of content but also encompasses pedagogical and technical aspects, higher-order thinking skills, and self-regulated learning. These findings emphasize that electronic module development should begin with a needs analysis capable of identifying the gap between current learning conditions and the characteristics of digital learning resources required by students.

The quality of an electronic module is determined not only by the sophistication of the technology employed but, more importantly, by the pedagogical framework that regulates how students interact with learning materials and construct knowledge. Discovery Learning is particularly relevant in this context because it directs students toward discovering concepts through stimulation, problem identification, data collection, data processing, verification, and generalization. Ghadzia et al. (2023) demonstrated that integrating Discovery Learning into physics e-modules can produce instructional materials that are valid, practical, and applicable to optics learning at the secondary school level. Maghfiroh et al. (2023) showed that physics e-modules based on Discovery Learning can be designed to facilitate learning activities while simultaneously developing students' scientific literacy. Udyaningsih et al. (2024) reported that the need for STEM-Discovery Learning-based e-modules emerges when existing learning resources do not optimally facilitate students' thinking and collaboration skills. Dewi et al. (2024) emphasized that integrating a learning model into an e-module enables electronic instructional materials to function as tools for guiding learning activities rather than merely as repositories of information. Hendrawensi et al. (2024) demonstrated that electronic modules structured according to a particular learning model can organize content and learning experiences more systematically. Astuti et al. (2024) found that a needs analysis for electronic modules should consider the alignment between the pedagogical model and the competencies to be facilitated. Hayati et al. (2025) further indicated that the development of inquiry-based e-modules should begin by identifying student characteristics, existing learning-resource conditions, and the initial competencies to be developed. Therefore, integrating Discovery Learning into electronic modules serves a fundamental pedagogical function by transforming the module from a digital reading resource into a learning environment that systematically guides students through the discovery process.

In addition to pedagogical structure, the characteristics of information representation constitute an important consideration in electronic module development because abstract concepts require visual support capable of dynamically representing changes, relationships, and processes. Animated videos have advantages in representing objects or phenomena that are difficult to observe directly and allow information to be presented through a combination of visuals, motion, text, and narration. Caella and Yulianto (2024) showed that animated videos can increase students' interest in science learning because information is delivered through representations that are more engaging than conventional media. Dewi and Tyas (2024) found that VideoScribe-based animated videos can be used to visualize changes in states of matter and support students' cognitive learning outcomes. Rabiasa et al. (2024) demonstrated that animated video learning media can be developed by considering student characteristics so that visualization becomes an integral part of the learning experience rather than merely a supplementary element. Chairatunnisa et al. (2024) found that students require electronic learning resources capable of presenting learning materials through more varied representations than printed instructional materials. Irsalina et al. (2026) also identified students' need for interactive physics modules that integrate multimedia components to support independent learning activities. Wulandari and Jumadi (2023) indicated that one of the strengths of e-modules in physics education lies in their capacity to accommodate various forms of digital representation. Udyaningsih et al. (2024) emphasized that the need for electronic media in physics learning is associated with the demand for learning resources capable of supporting discovery activities and students' skills. Therefore, animated videos within Discovery Learning-based electronic modules should be positioned as

conceptual stimuli that guide students to observe phenomena, identify problems, obtain information, evaluate interpretations, and discover concepts.

The development of Generative Artificial Intelligence (GenAI) has expanded opportunities for multimedia content development because generative AI can assist in producing texts, visual ideas, scenarios, dialogues, storyboards, questions, and instructional designs that can subsequently be developed into animated educational videos. ChatGPT has become one of the most extensively studied forms of GenAI in education since its emergence in late 2022; however, its application requires a clearly defined pedagogical design to ensure that AI functions as a support for learning rather than as a substitute for students' cognitive activities. Yeadon and Hardy (2024) demonstrated that AI has considerable potential in physics education, including its capacity to provide learning support and facilitate more adaptive learning experiences. Monteiro et al. (2024) found that the use of ChatGPT in K–12 science education creates opportunities for instructional material development, teaching and learning, and assessment while simultaneously requiring careful consideration of accuracy and appropriate use. Yusuf et al. (2024) identified GenAI as a technology with the potential to support pedagogical improvement, productivity, and learning-resource development, although research at the K–12 level remains relatively limited. Ogunleye et al. (2024) showed that the use of GenAI in teaching and learning continues to expand, but its effectiveness depends on the alignment among technology, pedagogical strategies, and learning objectives. Zhang et al. (2024) found that empirical research on GenAI in education has begun to demonstrate diverse implementation patterns, although further contextual evidence is required regarding how this technology can be effectively integrated into instructional design. Khan and Saunderson (2024) emphasized that GenAI implementation should consider both its potential for personalization and the risks associated with critical thinking processes and technological dependency. Marzano (2026) demonstrated that research on GenAI in K–12 education is expanding, while implementation design, teacher roles, and alignment between technology and learning activities remain important concerns. Accordingly, ChatGPT in the present study is not positioned as a replacement for teachers or as a direct animation-generation application; rather, it is conceptualized as a GenAI technology that supports the conceptualization and development of animated video content that is subsequently integrated pedagogically into an electronic module.

Although research on electronic modules, Discovery Learning, animated videos, and GenAI has expanded considerably, the integration of these four components continues to reveal a research gap, particularly at the needs-identification stage prior to product development. Rahmawati et al. (2021) demonstrated that an e-module needs analysis is necessary to identify discrepancies between available instructional materials and the learning characteristics required by students. Nilyani et al. (2023) indicated that decisions concerning the development of physics e-modules should be based on empirical evidence regarding learning conditions, media utilization, and user needs. Aldilla et al. (2023) emphasized that needs analysis enables developers to determine product characteristics based on actual educational problems rather than technological assumptions. Marisda et al. (2024) showed that the needs-analysis stage in electronic module development can identify curriculum conditions, student characteristics, learning content, and required learning resources. Zhang and Tur (2024) found that the implementation of ChatGPT in K–12 education offers various opportunities but also presents limitations and threats that require carefully planned implementation strategies. Alfarwan (2025) demonstrated that GenAI studies in K–12 education remain concentrated within particular contexts and types of interventions, indicating the need for research that connects AI technology with more specific learning-resource designs. Lin and Tan (2025) further emphasized that successful GenAI integration in K–12 education is determined by the alignment among learning objectives, activities, technological roles, and expected learning outcomes. Based on this research gap, there is insufficient empirical justification for directly developing a Discovery Learning-based electronic module assisted by Generative AI animated videos without first identifying users' actual needs.

Therefore, this study aims to analyze the need for developing a Discovery Learning-based electronic module assisted by Generative AI (ChatGPT) animated videos by identifying existing learning conditions, student characteristics and needs, teacher needs, the use of instructional materials and digital media, requirements for implementing the Discovery Learning syntax, the characteristics of the required animated videos, and relevant forms of GenAI integration as an empirical foundation for subsequent product development.

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2. Research Methodology

This study employed a quantitative descriptive survey design to analyze the need for developing an electronic module based on Discovery Learning assisted by Generative AI (ChatGPT) animated videos. Needs analysis was conducted as a preliminary stage of product development because it enables researchers to identify discrepancies between existing learning conditions and the characteristics of learning resources required by users (Putri & Asrizal, 2023). A questionnaire-based needs assessment is also appropriate for systematically capturing teachers' and students' perceptions before module development (Govindasamy et al., 2024). The research process consisted of identifying learning problems, conducting literature analysis, developing and validating the questionnaire, collecting teacher and student responses, analyzing the data, and establishing product-development requirements, as illustrated in Figure 1.

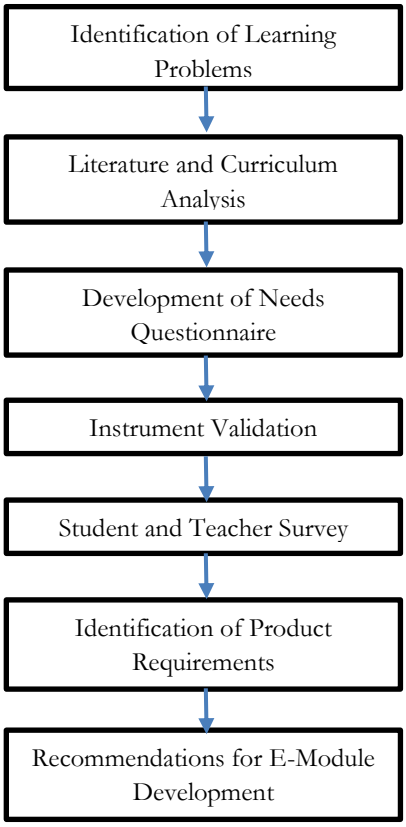

Figure 1. The Research Process

The questionnaire was designed using a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Likert-type questionnaires provide a systematic mechanism for quantifying respondents'

perceptions of educational needs (Govindasamy et al., 2024). The indicators were developed to represent both current learning conditions and expected characteristics of the proposed product, as presented in Table 1.

Table 1. Indicators of Student and Teacher Needs Questionnaire

Needs Aspect	Main Indicators
Current learning conditions	Learning difficulties, learning resources, learning activities
Electronic module needs	Accessibility, interactivity, independent learning
Discovery Learning	Stimulation, investigation, verification, generalization
Animated video	Visualization, attractiveness, conceptual representation
Generative AI (ChatGPT)	AI familiarity, learning support, AI-generated content
Product characteristics	Content, interface, navigation, multimedia integration

Questionnaire scores were converted into percentages and analyzed descriptively. This approach is commonly employed in digital teaching-material needs analysis to determine the priority level of product development (Putri & Asrizal, 2023). The interpretation criteria are presented in Table 2.

Table 2. Product Development Needs Category Levels

Percentage (%)	Category
81–100	Very highly needed
61–80	Highly needed
41–60	Moderately needed
21–40	Less needed
0–20	Not needed

The percentage was calculated using

$$P = \frac{f}{N} 100\% \quad \text{..... (1)}$$

where *f* represents the obtained score and *N* represents the maximum possible score. Higher percentages indicate a stronger empirical need for developing the proposed electronic module.

3. Results and Discussion

3.1 Results

The needs analysis was conducted to identify the gap between current learning conditions and the expected characteristics of an electronic module based on Discovery Learning assisted by Generative AI (ChatGPT) animated videos. Six aspects were analyzed, including learning conditions and activities, the use of electronic modules, implementation of Discovery Learning, use of animated videos, utilization of Generative AI (ChatGPT), and multimedia characteristics and integration. The results indicate that the current condition scores ranged from 62.4% to 76.8%, whereas the level of need for the proposed product ranged from 91.7% to 97.2%. This difference indicates a substantial gap between currently available learning resources and the type of digital learning environment expected by respondents.

The detailed results are presented in Table 3. The highest level of need was found for animated video utilization at 97.2%, followed by multimedia integration at 96.1%, Generative AI (ChatGPT) utilization at 95.3%, electronic module use at 94.6%, Discovery Learning implementation at 93.8%, and learning conditions and activities at 91.7%.

Table 3. Results of Product Development Needs Analysis

No	Analyzed Aspect	Current Condition (%)	Level of Need (%)	Gap
1	Learning conditions and activities	68.5	91.7	23.2
2	Use of electronic modules	72.3	94.6	22.3
3	Implementation of *Discovery Learning*	65.7	93.8	28.1
4	Use of animated videos	76.8	97.2	20.4
5	Utilization of Generative AI (ChatGPT)	62.4	95.3	32.9
6	Multimedia characteristics and integration	70.6	96.1	25.5
	Average	**69.4**	**94.8**	**25.4**

The average current-condition score was 69.4%, while the average level of need reached 94.8%, producing an average gap of 25.4 percentage points. The largest gap occurred in the utilization of Generative AI (ChatGPT), with a difference of 32.9 percentage points. This result suggests that interest in and perceived need for AI-supported learning are relatively high, whereas its current classroom implementation remains limited. At the same time, the high level of need for animated videos and multimedia integration indicates that the proposed product should prioritize visual representation, interactivity, accessibility, and integration of multiple forms of digital content. These findings provide an empirical basis for proceeding to the design and development stages of the electronic module.

3.2 Discussion

The gap between the current condition score of 69.4% and the level of need of 94.8% indicates that existing learning resources have not fully accommodated the demands of digital learning. This is important because an electronic module should not merely serve as a digital replacement for printed materials, but should integrate text, visualization, learning activities, and assessment within a coherent learning environment. Asrizal et al. (2024) showed that technology-enhanced physics e-modules can support students' conceptual understanding and 4C skills. Tang (2024) emphasized that science learning requires multimodal representation because scientific meaning is constructed through the interaction of language, visuals, and representational systems. Ng (2024) further demonstrated that pedagogically integrated AI in science learning can support students' science knowledge, behavioral engagement, and motivation.

The high need for Discovery Learning, which reached 93.8%, with a gap of 28.1 percentage points, demonstrates the need for an electronic module that does more than present information. The module should organize learning through stimulation, problem identification, information collection, information processing, verification, and generalization. Within this framework, animated videos can function as stimuli for presenting phenomena that are difficult to observe directly, while module activities can guide students in constructing concepts from evidence. Tang (2024) highlighted the importance of interaction, critical questioning, argumentation, and multimodal representation in science knowledge construction. Cheung et al. (2025) argued that Generative AI can contribute to science education when it supports scientific practices and conceptual understanding rather than replacing students' epistemic activity. Daniel et al. (2025) also reported that Generative AI has the potential to support higher-order cognitive skills, including critical thinking, analytical reasoning, and problem solving, when used within an appropriate pedagogical design.

The highest level of need was found in animated video utilization at 97.2%, while multimedia integration reached 96.1%. These findings indicate that respondents require learning resources capable of representing concepts more dynamically than conventional text-based materials. Animated videos are especially relevant in physics because abstract phenomena can be visualized through motion, direction, interactions among variables, and temporal changes. Asrizal et al. (2024) found that digital physics modules can support conceptual understanding when learning content is presented through structured and technology-supported environments. Tang (2024) explained that multimodal representation plays a major

role in how students interpret, communicate, and construct scientific meaning. Cheung et al. (2025) further emphasized that the integration of Generative AI in science education should preserve students' active engagement in understanding, evaluating, and constructing scientific knowledge.

The utilization of Generative AI (ChatGPT) showed the largest gap, increasing from a current-condition score of 62.4% to a perceived need of 95.3%. This pattern indicates strong demand for AI-based innovation, but also suggests that its implementation should be carefully directed. Within the proposed product, ChatGPT should not function as a substitute for students' thinking processes, but rather as a supporting tool for generating instructional ideas, scenarios, storyboards, prompting questions, and content that can be transformed into animated learning videos. Garofalo and Farenga (2025) showed that science teachers perceive AI as an educational opportunity while also recognizing epistemic and pedagogical concerns that must be managed carefully. Wu et al. (2025) found that Generative AI offers opportunities for personalized learning and assessment, but its acceptance is strongly influenced by users' perceptions and patterns of use. Chen and Cheung (2025) further reported that Generative AI may contribute positively to academic achievement, affective-motivational outcomes, and higher-order thinking when it is implemented within meaningful learning designs.

From a pedagogical perspective, the integration of electronic modules, Discovery Learning, animated videos, and Generative AI has broader potential than merely fulfilling a need for digital learning media. Electronic modules can provide a structured environment for independent learning; Discovery Learning can guide students through knowledge construction; animated videos can support visualization of abstract concepts; and Generative AI can assist with personalization, content generation, and learning interaction. Asrizal et al. (2024) provided evidence that physics e-modules can support conceptual understanding. Ng (2024) indicated that AI-supported science learning can strengthen motivation and learner engagement. Chen and Cheung (2025) also reported potential benefits of Generative AI for academic performance, affective-motivational outcomes, and higher-order thinking. Therefore, the proposed product has the potential to support conceptual understanding, learning motivation, engagement, independent learning, and critical thinking skills. However, because the present study remains at the needs-analysis stage, these outcomes cannot yet be claimed as empirical effects of the product. Their effectiveness should be examined in subsequent development, validation, implementation, and experimental testing phases.

4. Conclusion

This study demonstrates a substantial need for the development of an electronic module based on Discovery Learning assisted by Generative AI (ChatGPT) animated videos. The needs analysis revealed a clear gap between current learning conditions and teachers' and students' expectations regarding interactive, visual, and technology-supported learning resources. Animated videos, multimedia integration, Generative AI, and Discovery Learning emerged as essential components to be incorporated into the proposed module. The findings provide an empirical foundation for designing an electronic module that facilitates active knowledge construction, visualization of abstract physics concepts, independent learning, and meaningful interaction with digital learning resources. The proposed integration also has the potential to support students' conceptual understanding, learning motivation, engagement, critical thinking, and self-regulated learning. However, these potential outcomes require further verification through product development, expert validation, classroom implementation, and experimental effectiveness testing. Future research should therefore focus on developing and evaluating the proposed module in authentic physics learning environments.

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