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# Development of an E-Book on Measurement, Quantities, And Units to Improve Digital Literacy of Grade X Students

Titin Takke Rannu<sup>1</sup>, Heru Kuswanto<sup>2</sup>

<sup>1,2</sup> Pascasarjana Pendidikan Fisika Universitas Negeri Yogyakarta

e-mail: [titintakke.2022@student.uny.ac.id](mailto:titintakke.2022@student.uny.ac.id)

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## Abstract

This study aims to develop a Contextual Teaching and Learning (CTL)-based e-book integrated with digital literacy on the topic of measurement, quantities, and units to improve students' digital literacy. The research employed the Research and Development (R&D) method using the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. The subjects of this study were Grade X students of SMAN 1 Sekatak, who were divided into an experimental class and a control class. The research instruments included a digital literacy questionnaire and validation sheets, which had been tested for validity and reliability. The validity test results showed that all instrument items were valid, with very high reliability (Cronbach's Alpha = 0.874). The implementation results indicated a significant improvement in digital literacy in the experimental class compared to the control class. The average score of the experimental class increased more significantly after the use of the CTL-based e-book. In addition, the evaluation results showed that the e-book was practical, with a reliability value of 0.709, and received positive responses from students. These findings indicate that the CTL-based e-book integrated with digital literacy is valid, practical, and effective in improving students' digital literacy and in supporting more contextual and meaningful physics learning.

**Keyword:** E-book, Contextual Teaching and Learning (CTL), digital literacy, measurement of quantities and units, ADDIE model, physics learning

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## 1. Introduction

Education is the main foundation of national development because it plays an important role in shaping human resources that are intelligent, adaptive, and possess strong character (Musyarofah et al., 2026). Education not only transfers knowledge, but also develops critical and creative thinking skills, as well as life skills that are relevant to the development of the times (Laili

& Pradikto, 2025). However, in the 21st century, the demands placed on education have significantly evolved, particularly with the rapid advancement of digital technology. Empirical data indicate that students' digital literacy levels are still relatively low. For instance, results from the Programme for International Student Assessment (PISA) show that Indonesian students' performance in reading, mathematics, and science skills closely related to digital literacy remains below the international average (Nurtanto et al., 2025). This condition reflects a gap between the demands of digital-era learning and students' actual competencies.

Digital literacy is not merely the ability to use technology, but also includes the capacity to access, analyze, evaluate, and create information in digital contexts (Falloon, 2020). In reality, many learning processes still rely on conventional teaching materials that are less interactive and do not optimally support the development of students' digital competencies (Guillén et al., 2022). This issue is particularly evident in physics learning, especially in the topic of measurement, quantities, and units, which requires conceptual understanding as well as practical application. Students often experience difficulties in understanding abstract concepts due to the lack of engaging and technology integrated learning resources (Abubakar, 2024).

In the context of the 21st century, education is required to integrate the development of Information and Communication Technology (ICT) into the learning process in order to produce students who possess both academic competence and adequate digital literacy (Muhammad, 2025). The digital transformation in education has led to a shift in the learning paradigm. Learning is no longer teacher-centered but is oriented toward student-centered learning, where students actively construct knowledge through interaction with various learning resources (Sitorus et al., 2025). Therefore, innovation in the development of learning media and instructional materials has become an urgent necessity so that the learning process becomes more contextual, interactive, and meaningful. One of the current challenges in education is the low level of students' digital literacy. Digital literacy is not merely the ability to operate technological devices, but also includes the ability to access, evaluate, manage, and utilize information critically and responsibly (Putu & Arima, 2024; Cynthia & Sihotang, 2023). However, various studies have shown that students' digital literacy is still relatively low, including in physics learning Tamarengki et al., (2026). The study found that students' digital literacy score was 43.93 (low category). It also revealed students' low ability to utilize digital learning resources in measurement materials. This condition indicates a gap between the availability of technology and students' ability to use it optimally for learning (Saputra & Sa, 2026).

On the other hand, measurement, quantities, and units are fundamental concepts in physics that serve as the foundation for advanced topics such as kinematics, dynamics, and energy (Notonegoro, 2026). An inadequate understanding of these concepts can lead to persistent misconceptions. Studies have shown that students still experience difficulties in distinguishing between fundamental and derived quantities, performing unit conversions, and understanding

measurement uncertainty (Rohman et al., 2026). Misconceptions such as considering the kilogram as a unit of weight are also still frequently found (Kelana, 2026). This problem is further exacerbated by the limited use of interactive media that can visualize concepts in a concrete manner.

The use of digital learning materials, particularly e-books, has become one of the strategic solutions to address these challenges. An e-book is an electronic learning material that integrates text, images, audio, video, and interactive features that can be accessed through various digital devices (Asy et al., 2026). E-books not only increase the flexibility of learning access, but also can enhance students' motivation, reading interest, and learning independence (Marthinus et al., 2026). In addition, the integration of digital literacy in e-books enables students not only to understand the material but also to develop skills in managing information critically (Riyadi, F. A., Laila, A., & Putri, 2026).

Although many studies on the use of e-books in physics learning have been conducted, most of them still focus primarily on improving learning outcomes or conceptual understanding. There are still limited studies that specifically develop an e-book on measurement, quantities, and units that is systematically integrated with digital literacy indicators and designed based on the Contextual Teaching and Learning (CTL) approach. In fact, the CTL approach emphasizes the connection between learning materials and real-life contexts, thereby helping students understand concepts in a more meaningful way (Flawless et al., 2026;Sanzania & Wati, 2025;Azizah et al., 2026).

Based on the review above, three research gaps can be identified that highlight the urgency of conducting this study. First, the low level of students' digital literacy in physics learning has not been optimally addressed through the development of instructional materials that systematically integrate digital literacy indicators. Second, the topic of measurement, quantities, and units, as fundamental concepts in physics, is still often taught conventionally and is rarely connected to students' real-life contexts. Third, the development of physics e-books that explicitly integrate the Contextual Teaching and Learning (CTL) approach with the strengthening of digital literacy within a comprehensive design remains limited. This study aims to develop an e-book on measurement, quantities, and units that is specifically designed to improve the digital literacy of Grade X students. The novelty of this research lies in the integration of digital literacy indicators such as information evaluation, digital content interaction, and critical thinking into physics learning materials, combined with an interactive e-book format that supports independent and technology-based learning. Thus, this study not only contributes to the development of digital teaching materials but also offers an innovative approach to embedding digital literacy within physics education.

Therefore, this study is important to conduct in order to present an innovation in digital instructional materials that not only improves students' understanding of fundamental physics concepts but also strengthens their digital literacy in an integrated and sustainable manner.

## 2. Methods

This study employs a Research and Development (R&D) approach aimed at producing a product in the form of an e-book based on Contextual Teaching and Learning (CTL) integrated with digital literacy on the topic of measurement, quantities, and units. Research and Development is used to design, develop, and evaluate a learning product so that it meets the criteria of validity, practicality, and effectiveness. The development model used in this study is the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. This model was selected because it is systematic and suitable for the development of technology-based digital learning materials (Sugiyono, 2019).

This research was conducted in the odd semester of the 2024/2025 academic year at SMAN 1 Sekatak. The selection of the research location was based on curriculum compatibility, the need for the development of digital learning materials, and the accessibility of the research site. The population of this study consisted of all tenth-grade students in the odd semester. The results of the needs analysis, conducted through questionnaires and focused group discussions, revealed that most students were not accustomed to independently searching for scientific information from credible digital sources. The questionnaire used in this study consisted of several items adapted from previous research on digital literacy by Heriyanto (2018), covering key indicators such as internet searching skills, hypertextual navigation, and content evaluation. These indicators include students' ability to use search engines effectively, understand the structure and characteristics of web-based information (e.g., hyperlinks, URLs, and web browsers), and critically evaluate the accuracy, relevance, and credibility of digital content.

The findings showed that when assigned tasks requiring online reference searching, students tended to rely on the first source that appeared without further verification of its validity and reliability. Their ability to evaluate the accuracy, relevance, and objectivity of digital sources had not yet been adequately developed. Furthermore, students had not optimally utilized digital media to deepen their understanding of physics concepts, for example through the use of experimental videos, measurement simulations, or popular scientific articles that could enrich their perspectives on the topics of measurement, quantities, and units.

The research procedure followed the stages of the ADDIE model. In the analysis stage, literature studies and field studies were conducted to identify learning needs and the level of students' digital literacy. The design stage included designing the structure of the e-book, integrating digital literacy indicators into CTL-based learning activities, and developing research instruments. The development stage involved preparing the e-book draft, conducting validation by material experts and media experts, and revising the product based on the validators' suggestions. The implementation stage was carried out through a limited trial using a quasi-experimental design with a pretest–posttest control group design to determine the effectiveness of the e-book in

improving students' digital literacy. Finally, the evaluation stage was conducted both formatively and summatively to assess the validity, practicality, and effectiveness of the product.

The independent variable in this study was the use of a CTL-based e-book integrated with digital literacy, while the dependent variable was students' digital literacy. The control variables included learning materials, the teacher, learning time, and the learning environment. Research data were collected using a digital literacy questionnaire, product validation sheets, and documentation. The digital literacy instrument was developed based on indicators of information searching skills, hypertext navigation, and evaluation of digital content.

Content validity was tested through expert judgment using Aiken's V, while empirical validity was tested using the Pearson Product Moment correlation. Instrument reliability was analyzed using Cronbach's Alpha with a coefficient criterion of  $\geq 0.70$ . The data were analyzed using both quantitative and qualitative approaches. The effectiveness analysis included normality tests, homogeneity tests, and an independent sample t-test to determine differences in the improvement of digital literacy between the experimental and control classes. In addition, effect size was calculated to determine the magnitude of the influence of the e-book on improving students' digital literacy

### **3. Result and Discussion**

#### **Analysis Stage**

At the analysis stage, an in-depth identification was conducted regarding the initial condition of digital literacy among tenth-grade students at SMAN 1 Sekatak in the context of physics learning. Based on classroom observations, interviews with teachers, and analysis of the learning materials used, it was found that the level of students' digital literacy was still in the moderate category and had not been systematically integrated into the learning process. In general, students already had access to digital devices, particularly smartphones, and actively used them in their daily lives. However, their usage was mostly directed toward communication through social media, digital entertainment, and general information searching that was not necessarily academic in nature. Activities requiring analytical, reflective, and evaluative thinking skills in utilizing digital information were still very limited within the context of physics learning.

The analysis of the teaching materials used showed that the learning process still relied on printed textbooks published by the Ministry of Education and Culture and general companion books. Although these books met curriculum standards, their presentation tended to be conventional and linear. The material was delivered in the form of text and static images without interactive features that encourage further exploration. In addition, these books did not provide integrated access to additional digital resources such as learning videos, interactive simulations, or links to relevant online scientific references. As a result, students did not gain learning experiences

that train them to navigate digital information, compare multiple sources, or independently evaluate the accuracy of content. The learning process was more focused on conceptual understanding through teacher explanations and routine exercises, leaving limited opportunities for the development of digital literacy.

The results of the needs analysis, conducted through questionnaires and focused discussions, also revealed that most students were not accustomed to independently searching for scientific information from credible digital sources. When assigned tasks that required online reference searching, they tended to take information from the first source that appeared without further verification of its validity and reliability. Their ability to evaluate the accuracy, relevance, and objectivity of digital sources had not yet been adequately developed. Furthermore, students had not optimally utilized digital media to deepen their understanding of physics concepts, for example through the use of experimental videos, measurement simulations, or popular scientific articles that could enrich their perspectives on the topics of measurement, quantities, and units. These findings indicate that the low level of students' digital literacy is not caused by limited access to technology, but rather by the absence of learning designs that explicitly and systematically train digital literacy skills within an academic context. Technology is already available and widely used, but it has not yet been directed as a tool to develop critical, analytical, and reflective thinking skills in managing scientific information. Therefore, an innovation in instructional materials and learning strategies is needed to systematically integrate digital literacy into physics learning, so that the use of technology becomes not only consumptive, but also productive and educational.

### **Design Stage**

At the design stage, the development of the e-book was focused not only as a medium for delivering physics material but was also intentionally designed as a pedagogical instrument to train and strengthen students' digital literacy. The design process considered the results of the previous needs analysis, ensuring that each component of the e-book had a clear purpose in developing digital literacy skills in a structured manner. The targeted aspects of digital literacy included the ability to access digital information effectively, understand and navigate hypertext or digital links, evaluate the quality and accuracy of digital content, and utilize technology as a medium for scientific communication within the learning context.

To achieve these objectives, several features were strategically designed to directly contribute to the improvement of digital literacy. The e-book was equipped with hyperlinks connected to learning videos and other supporting resources, enabling students to become accustomed to navigating multiple sources of information rather than reading text in a purely linear manner. In addition, a user guide for independent use of the e-book was provided to help students understand how to access features, open links, and utilize digital content effectively. The integration of digital-based reflective activities also became an important element in the design,

where students were guided to write their understanding, evaluate the information obtained, and reflect on their learning process through digital devices. The exercises included in the e-book were designed not merely to test conceptual memorization but to emphasize analysis, data interpretation, and the application of concepts in contextual situations that require the exploration of additional information.

Furthermore, the e-book design adopted the Contextual Teaching and Learning (CTL) approach, ensuring that each topic was connected to real-life phenomena relevant to students' experiences. This approach encouraged students to relate information obtained from various digital sources to practical contexts around them, such as measurement in everyday activities or the use of units in modern technology. In this way, the use of technology was no longer merely consumptive or limited to following instructions but became an active and meaningful process in constructing conceptual understanding. At this design stage, a strong foundation for improving digital literacy began to emerge, as students were positioned not only as recipients of information but also as individuals who actively explore, navigate, evaluate, and manage digital information within a systematic and contextual learning framework.

### **Development Stage**

At the development stage, the activities focused on the process of refining the product through the validation of the digital literacy instrument and the validation of the designed e-book. This stage aimed to ensure that the measurement instrument was appropriate for use and that the developed product met the standards of content feasibility, language, presentation, and graphical design before being implemented in the classroom. The validation process was conducted by material experts, media experts, and physics education practitioners, ensuring that the revisions made were comprehensive in terms of both the substance and the technical aspects of digital presentation. Based on the results of the validity test of the digital literacy test instrument, all question items were declared valid with r-count values ranging from 0.367 to 0.680. These values were above the r-table value of 0.361, indicating that each item was capable of measuring the digital literacy construct according to the established indicators. The reliability test results showed a Cronbach's Alpha value of 0.874, which falls into the very high category. This result indicates that the instrument has strong internal consistency and can therefore be used to measure students' digital literacy in a stable and reliable manner.

Figure 1. cover e-book



In summary, the results of the validity and reliability tests can be presented in the following table:

Testing Aspect	Result
Range of r-count values	0,367 – 0,680
r Table	0,361
Validity Description	All item valid
Cronbach's Alpha	0,874
Reliability Category	Very High

These findings indicate that the instrument used is truly capable of measuring digital literacy consistently and accurately. With a valid and reliable instrument, the results of digital literacy measurement at the implementation stage can be considered trustworthy and supported by a strong methodological foundation.

In addition to instrument validation, the developed e-book product was also validated by experts and practitioners. The validation process generated several constructive suggestions for improving the product. Some aspects that were revised included ensuring the consistency of physics symbols and units in accordance with scientific standards, simplifying and refining the language to make it more communicative and easier for students to understand, and adding more contextual example problems to clarify the application of concepts. A summary of the validation results and the follow-up revisions can be seen in the following table:

Table 1. Suggestions for Improvement from the Material Expert

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Each indicator should use only one operational verb (KKO)						
No	Pernyataan	SS	SI	KS	TS	STS
1.	Saya berusaha menyenangkan Mata pelajaran fisika					
2.	Saya belajar mata pelajaran Fisika dengan cara mengulangi kembali di rumah materi yang telah diajarkan oleh guru di sekolah.					
3.	Saya belajar mata pelajaran Fisika walaupun tidak disuruh oleh orang tua.					
4.	Waktu senggang di rumah saya gunakan untuk belajar mata pelajaran Fisika.					
5.	Saya bersungguh-sungguh dalam mengatasi kesulitan belajar pelajaran Fisika.					
6.	Keberhasilan saya dalam mata pelajaran fisika di peroleh dengan kerja keras.					

No	Pernyataan	SS	ST	KS	TS	STS
1.	Saya berusaha menyenangkan materi <u>Pengukuran, Besaran, dan Satuan.</u>					
2.	Saya belajar materi <u>Pengukuran, Besaran, dan Satuan</u> dengan cara mengulangi kembali di rumah materi yang telah diajarkan oleh guru di sekolah.					
3.	Saya belajar materi <u>Pengukuran, Besaran, dan Satuan</u> walaupun tidak disuruh oleh orang tua.					
4.	Saya menggunakan waktu senggang untuk belajar materi <u>Pengukuran, Besaran, dan Satuan</u> di rumah.					
5.	Saya bersungguh-sungguh dalam mengatasi kesulitan belajar materi <u>Pengukuran, Besaran, dan Satuan.</u>					
6.	Saya berhasil memahami materi <u>Pengukuran, Besaran, dan Satuan</u> dalam mata pelajaran fisika yang					

Table 2. Suggestions for Improvement by Practitioners

No	Practitioner 1	Practitioner 2
1.	The e-book is already very good; however, the layout needs improvement.	The font size is too small; it should be enlarged to improve readability.
2.	The material is easy to understand; however, more practice questions should be added.	The e-book design needs improvement, particularly in the use of colors and layout, to make it more engaging and less monotonous for students.

Based on the suggestions provided by practitioners, the developed e-book is generally considered good in terms of content clarity and usability. However, several improvements are needed, particularly in layout design, font size, visual appearance, and the addition of more practice questions. By addressing these aspects, the quality of the e-book is expected to improve further, making it more effective, engaging, and user-friendly for students.

### Implementation Stage

At the implementation stage, the developed e-book was tested in the learning process to examine its effectiveness in improving students' digital literacy. This stage became a crucial part of the study because it demonstrated the extent to which the design and development of the product had a real impact on digital literacy skills within the context of physics learning. The implementation was carried out through two schemes, namely a limited trial and an empirical test involving an experimental class and a control class with 30 sample.

## A. Limited Trial

The limited trial was conducted in one class to observe the initial responses and the effectiveness of the product before it was implemented more broadly. The results of the analysis showed a significant improvement in students' digital literacy. The average pretest score of 79.06 increased to 87.5 in the posttest, resulting in an increase of 8.43 points. This improvement indicates that the use of the CTL-based e-book had a positive impact on students' digital literacy skills. A summary of the limited trial results can be seen in the following table:

Table 2. Limited Trial Results

<b>Component</b>	<b>Score</b>
Average Pretest Score	79,06
Average Posttest Score	87,5
Increase Difference	8,43
Paired Sample t-test Results	$p < 0,001$
Description	Significant

The results of the statistical test using a paired sample t-test showed a significance value of  $p < 0.001$ , indicating that the improvement in digital literacy was statistically significant. This means that the difference between the scores before and after the use of the e-book did not occur by chance, but rather was the result of the treatment provided.

This improvement occurred because during the learning process students did not merely read the material, but were also involved in repeated and structured digital activities. Students accessed learning videos through hyperlinks available in the e-book, which helped them become accustomed to navigating digital information. They also managed information independently, searched for additional explanations when needed, and discussed as well as presented the results of their exploration in front of the class. In addition, there were reflection activities that encouraged students to evaluate their learning process. These activities directly trained students' abilities to access, understand, evaluate, and utilize digital information, which are the core components of digital literacy.

## B. Empirical Test (Experimental and Control Classes)

After the limited trial, an empirical test was conducted involving one experimental class that used the e-book and two control classes that continued to use conventional learning materials. The results showed that the experimental class experienced a much higher improvement in digital literacy compared to the control classes.

A summary of the average digital literacy scores can be seen in the following graph:

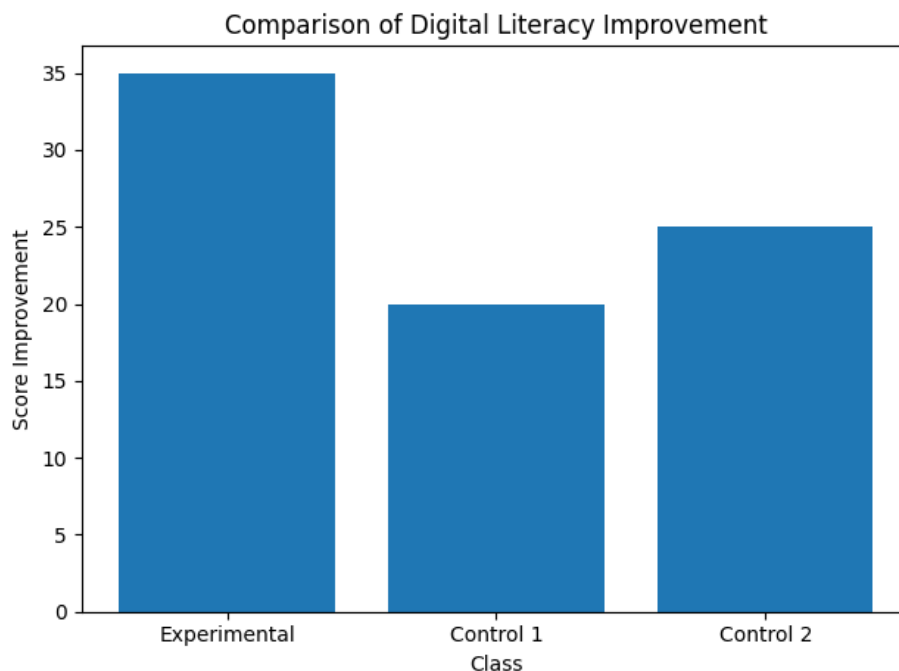


Figure 2. Graph of the Comparison of Digital Literacy Improvement

The graph in Figure 2 shows a noticeable difference in the improvement of digital literacy between the experimental class and the control classes. The experimental class experienced an increase of 35.0 points, from an average pretest score of 54.9 to 89.9 in the posttest. Meanwhile, control class 1 increased by 19.2 points (from 58.3 to 77.5), and control class 2 increased by 24.1 points (from 53.3 to 77.4). The inclusion of two control classes aimed to provide a more comprehensive comparison by examining the effectiveness of the developed e-book against both an alternative e-book and conventional physics textbooks. This design allows for a clearer evaluation of whether the observed improvements are specifically attributed to the developed e-book rather than to the general use of digital or traditional learning materials.

This difference suggests that the e-book-based learning intervention had a stronger impact on strengthening students' digital literacy. In the experimental class, students not only received information passively but were also actively involved in accessing hyperlinks, watching instructional videos, exploring digital resources, and engaging in discussions and presentations based on information searches. These activities directly trained students to access, understand, evaluate, and utilize digital information critically and independently.

In contrast, in the control classes, the learning process was still dominated by the use of printed materials or conventional methods that did not explicitly require digital exploration. Although there was still an increase in scores, the improvement was relatively lower because students did not receive intensive and repeated digital literacy stimulation as occurred in the experimental class.

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Furthermore, the effect size analysis indicates that the treatment had a substantial impact on students' learning outcomes. Based on the results of the Between-Subjects Effects test, the  $R^2$  value for learning independence reached 0.633, meaning that 63.3% of the variance in students' learning independence can be explained by the treatment differences across classes. Referring to Cohen's criteria, this value is categorized as a large effect size, indicating that the developed e-book has a strong influence on improving students' learning independence. In contrast, the effect size for digital literacy was lower ( $R^2 = 0.072$ ), suggesting a relatively small effect, although still statistically significant ( $p = 0.039$ ). These findings imply that while the developed e-book is highly effective in enhancing learning independence, its impact on digital literacy, although positive, is more modest.

### **Evaluation Stage**

The evaluation stage in this study was conducted through two approaches: formative evaluation and summative evaluation. Formative evaluation aimed to examine the practicality and implementation of the product during the implementation process, while summative evaluation was conducted to assess the overall feasibility of using the e-book after the trial had been completed.

The evaluation results showed that the developed e-book had a good level of practicality, with a Cronbach's Alpha reliability value of 0.709. This value is above the minimum threshold of 0.70, which is generally considered to meet the criteria for reliability. Therefore, the practicality assessment instrument can be trusted to measure the consistency of students' responses.

In addition to being reliable, all items in the practicality questionnaire were declared valid based on the results of the validity test. This means that each statement in the instrument accurately measured the intended aspects, such as ease of use, clarity of navigation, readability of the material, accessibility of features, and learning comfort when using the e-book. The validity and reliability

results strengthen the finding that the product is not only academically effective but also technically and operationally feasible for use in the learning process.

## Discussion

The results of the study at the analysis stage showed that the digital literacy of tenth-grade students at SMA Negeri 1 Sekatak was still in the moderate category and had not yet been systematically integrated into physics learning. Although most students already had access to smartphones and actively used technology in their daily lives, the use of technology tended to be more consumptive rather than academic in nature. This condition is in line with the view that Solehuddin et al., (2026) which emphasizes that digital literacy is not merely the ability to use devices, but also the ability to understand, evaluate, and utilize information critically. This finding is also supported by the perspective of Afifah & Setiawan, (2026) who stated that ownership of technology does not automatically reflect a high level of digital literacy, because digital literacy requires cognitive, evaluative, and reflective skills. In the context of this study, students still tended to take information from the first source that appeared without conducting further verification, indicating that their evaluative ability toward digital information had not yet developed optimally. The analysis of teaching materials showed that learning still relied on printed textbooks that were linear and conventional in nature. The presentation of material with minimal interactive features meant that students were not accustomed to navigating various digital information sources. This condition is less aligned with the demands of 21st-century learning as emphasized by Partnership for 21st Century Skills, which highlights the importance of mastering information and technology literacy as part of students' core competencies (Sumiarsih et al., 2026). Therefore, an innovation in teaching materials is needed that not only conveys physics concepts but also systematically trains digital literacy skills in an academic context.

At the design stage, the e-book was designed as a pedagogical instrument that consciously integrates digital literacy training into each of its components. This design is in line with the model of technology integration in learning proposed by various educational scholars, which emphasizes that technology should function not only as a medium for delivering information but also as a tool for developing higher-order cognitive and digital competencies (Varlami, I., et.al, 2026) , where technology does not merely function as a substitute for printed media but is capable of modifying and transforming the learning experience. The integration of hyperlinks, instructional videos, and digital reflection activities enables students to interact actively with information sources (Purnama et al., 2026). This approach is also supported by the perspective that Mulyono (2026) This approach is also supported by the view that digital literacy encompasses the ability to navigate hypertext and construct meaning through various digital sources. By adopting the Contextual Teaching and Learning (CTL) approach, the e-book connects physics concepts with real-life phenomena, making learning more meaningful while encouraging independent exploration of information.

The development stage demonstrated that the digital literacy instrument possessed strong methodological quality, with a Cronbach's Alpha value of 0.874, categorized as very high. This indicates good internal consistency, ensuring that the measurement results are reliable. Validation by material and media experts confirmed that the e-book met standards of content, language, and presentation. The revision process based on expert feedback showed that development was conducted systematically and reflectively, in line with research and development principles that emphasize gradual product improvement to produce media that is both valid and feasible for instructional use (Cahyono et al., 2026).

At the implementation stage, the results of both the limited trial and the empirical test showed a significant improvement in digital literacy, particularly in the experimental class that used the e-book. The much higher improvement compared to the control class indicates that e-book-based learning is effective in training digital literacy skills. Activities such as accessing hyperlinks, watching instructional videos, engaging in discussions, presenting exploration results, and conducting digital reflections provided a deeper learning experience. This finding aligns with various previous studies stating that multimedia-based interactive learning significantly enhances critical thinking skills and information literacy compared to conventional learning (Arafani, 2026). The evaluation stage showed that the e-book had a good level of practicality with a reliability value of 0.709, and all practicality items were valid. This practicality is important because the effectiveness of learning media is strongly influenced by ease of use. Distribution through WhatsApp and the PDF format enabled flexible access that aligned with students' habits, thereby supporting independent learning (Shabayani et al., 2026). Overall, the results of this study strengthen previous findings that systematically and pedagogically designed technology integration can significantly improve students' digital literacy, particularly when technology is used not merely as a supporting tool but as an integral part of contextual and reflective learning strategies.

#### **4. Conclusion**

This study concludes that the CTL-based e-book integrated with digital literacy for the topic of measurement, quantities, and units is valid, practical, and effective for use in physics learning. The development process through the ADDIE model ensured a systematic and quality-driven product that aligns with students' learning needs in the digital era.

The integration of digital literacy within the e-book provides a meaningful contribution by promoting not only conceptual understanding but also students' ability to engage critically with digital information. Therefore, this study highlights the importance of embedding digital literacy into subject-specific teaching materials as an innovative approach to support more relevant and effective learning in the 21st century

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