

## Statistics learning innovation through contextual numeration of literacy e-module

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### ABSTRACT

The numeracy literacy skills of Indonesian students, particularly in solving story problems and presenting statistical data, remain relatively low. However, teaching materials that effectively support numeracy literacy in mathematics are still limited. This study aims to describe the development of a numeracy literacy e-module as an alternative teaching material for statistics. Using a Research and Development approach within the ADDIE model, the study was conducted through the implementation stage due to time constraints. Participants included 30 seventh-grade students from Junior High School 2 Kuningan. Data were obtained from expert validation and student response questionnaires and analyzed descriptively using percentages. Validation results from material and media experts were 90.62%, 95.31%, and 94.12%, categorized as very valid. Student responses indicated a practicality level of 91.33%. The contextual story-based e-module effectively connects statistical concepts to real-life situations. The findings conclude that the developed e-module is highly valid and practical for classroom use. However, implementation faces challenges, including limited teacher training and inadequate digital infrastructure. Therefore, teacher training and better digital support are recommended, along with further studies to evaluate the long-term effectiveness of the e-module.



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## INTRODUCTION

Numeracy literacy is a crucial competency that learners need to develop in order to tackle the challenges of the 21st century. This skill encompasses the capacity to think logically, critically, and solve problems, which is vital for everyday activities (Deda et al., 2023). However, the educational landscape in Indonesia indicates that students' numeracy literacy skills remain quite low. This observation is corroborated by the outcomes of national assessments and international studies that emphasize the inadequate performance of students in numeracy (Kaize et al., 2024). For instance, the PISA 2022 results reported that Indonesian students achieved an average mathematics score of 379, significantly below the OECD average of 472, placing Indonesia in the bottom quartile globally (OECD, 2023). Similarly, data from the Minimum Competency Assessment (AKM) 2021 revealed that only about 25% of students reached the "proficient" level in numeracy, while the majority remained in the "basic" or "below basic" categories (Kemdikbudristek, 2021). A primary factor

contributing to this issue is the teaching approach to mathematics, which lacks contextualization and relevance to students' everyday experiences. Thus, the importance of learning mathematics lies in structuring students' abilities, one of which is mathematical communication skills, which must be emphasized as an essential focus in mathematics learning (Shabrina et al., 2023).

Statistics is a component of the mathematics curriculum that holds significant promise for enhancing numeracy skills. Statistics is one of the important fields of study in learning activities. Statistics plays a role in managing pocket money, profits and losses in trading, recording student grades, and others (Hidayati & Djamaan, 2025). This area emphasizes the importance of data reading, information interpretation, and making decisions based on data (Kurniawan et al., 2022). Unfortunately, the approach to learning statistics in schools tends to be heavily theoretical and abstract. Educators often present questions that are mechanical and lack a meaningful connection to students' real-life contexts (Suratman & Pranata, 2024), leading to students struggling to grasp concepts and apply them in everyday situations.

To address this issue, employing a contextualized story problem method has proven to be an effective strategy. Contextual maths problems are mathematical problems that are related to context, either directly related to real objects or related to abstract objects such as mathematical facts, concepts, or principles (Agnesti & Amelia, 2020). This method not only presents problems that resonate with students' experiences but also enhances their understanding of concepts through relevant situations (Hasibuan et al., 2023). By utilizing this approach, students are motivated to think critically, evaluate information, and devise solutions rooted in real-life contexts (Azubuike et al., 2024). This makes the educational experience more engaging and challenging.

Learning mathematics is a basic science, so it is needed in the learning process. Mathematics and critical thinking skills are interconnected; this critical thinking will train students to get used to working on small steps first before they can then be adept at higher-level critical thinking (Rahmaini & Chandra, 2024). Nowadays, critical thinking skills are very important in daily life because they develop other thinking skills, such as the ability to make decisions and solve problems (Saputra, 2020). Critical thinking is essential in mathematics education, particularly when addressing intricate problems. Learners must not only arrive at solutions, but they must also be capable of analyzing data, assessing information, and presenting sound arguments (Fristadi & Bharata, 2015). Contextualized story problems offer an opportunity to exercise these skills by presenting genuine challenges that require thoughtful and profound reasoning (Azubuike et al., 2024).

Despite this, the reliance on printed teaching resources, like traditional modules, remains prevalent and comes with several drawbacks. Such printed modules are often static, lack interactivity, and cannot offer instant feedback. Their inability to cater to the unique needs of individual students also restricts the enhancement of self-directed learning (Maruyama & Igei, 2024). This is why e-modules serve as a strategic alternative for delivering learning that is more adaptable, engaging, and contextually relevant.

Yet, there is still a lack of research that specifically focuses on creating e-modules for numeracy literacy with a contextual story problem approach in statistics education. In contrast to the study by Hasibuan et al., (2023), which only looks into the use of contextual story problems in a broad sense, this research homes in on developing e-modules intended to enhance students' numeracy literacy in statistics learning. This e-module not only presents mathematical material, but also contains contextual problems that can guide students in solving problems related to numeracy, so that they are able to analyse, formulate problems, solve problems, and present in various forms and situations (Safitri et al., 2023). This focus is a vital foundation for researching to create innovative teaching materials that meet the needs of contemporary students (Leon et al., 2025). When compared with previous studies, several similarities and differences highlight the contribution of the present research. In terms of similarities, both this study and the works of Zawacki-Ritchter et al., (2019) and Dogan et al., (2023) employed a systematic framework for developing digital learning media. However, differences can be observed in the focus and outcomes produced. Earlier research often emphasizes the development of alternative media, such as AI-powered learning systems, personalized learning platforms, adaptive educational technologies, and collaborative digital environments that stress interaction among teachers, students, and technology (Bozkurt et al., 2021; Leon et al., 2025).

In contrast, the present study concentrates on the development of a numeracy literacy e-module centered on contextual problem-solving in statistics, directly aligned with the requirements of the Minimum Competency Assessment (MCA) and the implementation of the Merdeka Curriculum. Thus, the unique contribution of this research lies in the explicit integration of numeracy literacy within the design of a digital e-module, an aspect that has not been extensively explored in previous studies, thereby reinforcing its relevance to both educational media innovation and national education policy. This method offers several benefits, including the capacity to connect students with authentic situations through relevant and demanding challenges. Prior studies indicate that problems rooted in context can enhance students' comprehension of mathematical concepts and numerical literacy (Rochsun & Agustin, 2020). Additionally, e-modules as digital tools provide flexibility, facilitating self-directed learning, digital literacy, and the application of Minimum Competency Assessment (MCA).

Given this context, the goal of this research is to create e-modules focused on numeracy literacy that utilize a contextual story problem approach in teaching statistics. This study is anticipated to significantly enhance students' numeracy literacy, foster critical thinking abilities, and render the learning of statistics more relevant, engaging, and enjoyable. By presenting statistical concepts through real-life scenarios, the e-module encourages students to connect mathematics with their daily experiences. This not only strengthens conceptual understanding but also builds confidence in problem-solving (Maruyama & Igei, 2024). Furthermore, the digital format of the module provides opportunities for interactive learning, making it a practical and adaptive resource for both students and teachers in modern classrooms (Jamaan & Yerizon, 2023). The use of relatable scenarios in the modules helps students see the practical value of statistical concepts in everyday life. This approach also encourages active learning, where students are not only solving problems but also interpreting data and drawing meaningful conclusions. As a result, the learning process becomes more student-centered and supports the development of 21st-century skills.

## METHOD

The study employs a research and development (R&D) dengan menerapkan langkah-langkah pengembangan model ADDIE (Analyze, Design, Develop, Implementation, Evaluation). The approach is primarily aimed at creating interactive e-modules that utilize contextual story problems related to statistics, which can enhance students' numeracy skills (Kusna et al., 2023). The R&D method was selected as it offers a structured and accountable strategy for developing or improving products to increase their effectiveness in the educational process (Afriani et al., 2025). Moreover, this method highlights the significance of creating media that aligns with various learning styles to bolster student achievement (Adiastuty et al., 2024). The development framework applied is the ADDIE model, which includes five phases: Analysis, Design, Development, Implementation, and Evaluation. Each phase is conducted in a sequential and systematic manner to guarantee that the resulting product meets the students' needs and possesses high-quality content, aesthetics, and effectiveness (Afriani et al., 2025; Alifiya & Sabandar, 2023). The procedure/stages of product development are illustrated below.

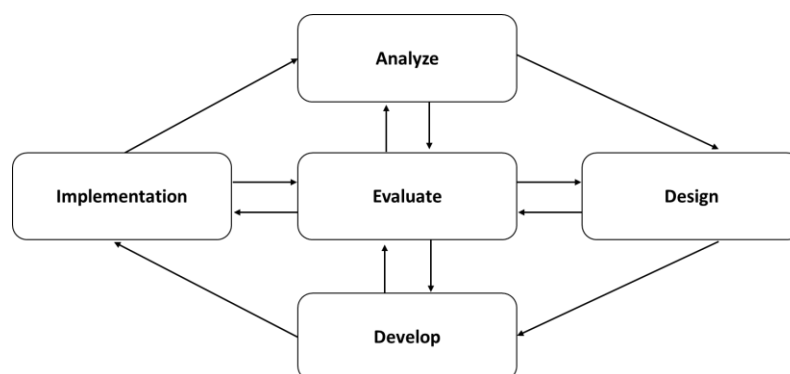


Figure 1. ADDIE Model Flowchart

This study took place at Junior High School 2 Kuningan from January to June 2023 during the 2022/2023 academic year. The data collection commenced with interviews with teachers on February 7, 2023, aimed at understanding the needs for teaching materials and the current state of statistics education in the classroom. In addition, a field trial was carried out with students on May 30, 2023, to assess the effectiveness of the developed product and gather their feedback. The participants in this research consisted of 30 students from class VII at Junior High School 2 Kuningan, who were chosen through a purposive sampling method based on their availability and willingness to take part in the product trials. The design adopts a quasi-experimental pre/posttest with a comparison group, or at a minimum, a single-group pretest–posttest design.

The study utilized several instruments, including: (1) an expert validation sheet aimed at evaluating the content, presentation, and media elements of the developed e-module, which was assessed by two expert lecturers specializing in learning media; (2) a student response questionnaire utilizing a 4-point Likert scale to gauge the e-module's readability, appeal, and usability; and (3) a set of interview guidelines for teachers to investigate learning needs and challenges faced by students in comprehending statistics material. The collected data were analyzed through both quantitative and qualitative methods. Quantitative data, derived from validation findings and student response questionnaires, were processed using descriptive percentage analysis to ascertain the validity and practicality levels of the product. On the other hand, qualitative data, including insights from teacher interviews, were examined through thematic analysis to outline learning needs and the context surrounding students' difficulties in grasping statistics material (Fauziyyah et al., 2024). Validity testing focuses on determining whether the developed media accurately reflects the intended content, instructional design, and technical aspects, as evaluated by experts in the field. A valid learning medium must meet standards of accuracy, relevance, and appropriateness, ensuring that it can effectively support learning objectives. Practicality testing, on the other hand, emphasizes the usability and applicability of the media from the perspective of its users, including students and teachers. This process examines whether the media is easy to use, engaging, and able to facilitate learning activities in real classroom conditions. A learning medium that meets both validity and practicality criteria can be considered suitable for broader implementation, as it not only aligns with educational standards but also addresses the needs and experiences of its users.

**Table 1.** Criteria for Validity Assessment Percentage

| No. | Assessment Percentage    | Criteria   |
|-----|--------------------------|------------|
| 1   | $X < 37.5\%$             | Not Valid  |
| 2   | $37.5\% \leq X < 62.5\%$ | Less Valid |
| 3   | $62.5\% \leq X < 87.5\%$ | Valid      |
| 4   | $87.5\% \leq X < 100\%$  | Very Valid |

Based on Table 1, the learning media is considered feasible for implementation to students if it achieves an average validator score of 62.5%–87.5% with the “valid” category and an average validator score of 87.5%–100% with the “very valid” category. If the developed learning media obtains an average score of less than 62.5%, it is deemed not feasible for implementation. The level of practicality of the developed learning media can be seen in Table 2.

**Table 2.** Practicality Criteria of Learning Media

| No. | Interval              | Criteria         |
|-----|-----------------------|------------------|
| 1   | $76\% < P \leq 100\%$ | Very Practical   |
| 2   | $51\% < P \leq 75\%$  | Practical        |
| 3   | $26\% < P \leq 50\%$  | Not Practical    |
| 4   | $0\% < P \leq 25\%$   | Very Impractical |

Based on Table 2, if the results fall within the interval of 51%–75%, the differentiated learning media is categorized as practical. Meanwhile, if the average practicality score falls within the interval of 76%–100%, it is categorized as very practical. This indicates that differentiated learning media meeting the practicality criteria can support students in the learning process. Conversely, if the results fall below 51%, the learning media cannot effectively support students in the learning process. To eliminate any confusion, some important terms in this study are clarified. E-modules are defined as

interactive digital resources created to aid in learning statistics through real-life contextual story problems (Sumarni et al., 2023). Numeracy literacy refers to students' capability to comprehend, apply, and interpret mathematical information in practical situations (Rosjanuardi & Juandi, 2023). Contextual story problems are those derived from scenarios or experiences that resonate with students' everyday lives (Yuliani & Chotimah, 2023), while statistics is regarded as a branch of mathematics that involves the collection, processing, analysis, and interpretation of data aimed at solving problems (Zahran et al., 2024).

## RESULTS AND DISCUSSION

### Results

The creation of e-modules for numeracy literacy focusing on data presentation for seventh-grade junior high school students was executed using the ADDIE model, which consists of the phases of Analysis, Design, Development, Implementation, and Evaluation. This development aims to produce valid, practical teaching materials based on contextual problem stories that can be utilized in mathematics instruction, thereby enhancing students' numeracy literacy abilities.

During the Analysis phase, discussions were held with mathematics instructors at Junior High School 2 Kuningan to pinpoint learning requirements. The teachers indicated that students struggled to comprehend contextual problems related to statistics material. They also conveyed the necessity for more engaging and contextually relevant teaching resources. These findings are supported by literature reviews (Ismanto, 2022) that indicate the effectiveness of e-modules based on numeracy literacy in improving learning outcomes and aiding students in grasping concepts more effectively. (Hidayanthi et al., 2024).

The design phase involves creating e-modules following phase D of the Merdeka Curriculum. These modules are formatted in A4 portrait size, utilizing Arial font at size 13 with 1.5 line spacing. In addition, researchers prepared supporting tools, such as validation sheets for material and media experts, along with questionnaires for learner feedback. The e-module is systematically structured, comprising a cover page, preface, table of contents, e-module map, usage instructions, learning outcomes and objectives, subject content and sample questions, exercises and assessments, summary, answer key, glossary, and bibliography.

During the Development phase, researchers gathered relevant contextual stories and questions. The module was created using Canva to ensure it has an appealing design. Once the prototype was completed, it underwent validation by two material experts and one media expert. Revisions were implemented based on feedback from the validators concerning language, illustration modifications, color contrast, and the layout, including page margins. The cover of the e-module is depicted in Figure 2. Figure 3 presents the access barcode that can be scanned to access the e-module online.



Figure 2. Cover and Mind Mapping of E-Module



Figure 3. Barcode E-Module

The Implementation phase was conducted as a limited trial with 30 students from class VII Junior High School 2 Kuningan during the even semester of the 2022/2023 academic year. The focus of the implementation activities was on familiarizing students with the e-module structure and collaboratively solving statistical story problems. Observational results indicated that students effectively utilized the module and were actively engaged in the learning process.

Validation by two subject matter experts confirmed that the e-module was deemed highly valid. According to the quantitative data conversion results, the first validator rated 6 indicators in the 'valid' category and 10 indicators in the 'very valid' category, while the second validator assessed 4 indicators as "valid" and 12 indicators as 'very valid'. Table 3 summarizes the findings from the validation by the material experts, showing that the average validity percentage is 94.12%, falling into the 'Very Valid' category. Suggestions from the validators included recommending the use of more eye-friendly colors that are not overly bright.

Table 3. Material Expert Validation Results

| No.                  | Indicators         | Material Expert 1 |               |                   | Material Expert 2 |               |                   |
|----------------------|--------------------|-------------------|---------------|-------------------|-------------------|---------------|-------------------|
|                      |                    | Score             | Percentage    | Note              | Score             | Percentage    | Note              |
| 1                    | Self Instructional | 27                | 96.42%        | Very Valid        | 25                | 89.28%        | Very Valid        |
| 2                    | Self Contained     | 4                 | 100%          | Very Valid        | 3                 | 75%           | Valid             |
| 3                    | Stand Alone        | 4                 | 100%          | Very Valid        | 4                 | 100%          | Very Valid        |
| 4                    | Adaptive           | 3                 | 75%           | Valid             | 4                 | 100%          | Very Valid        |
| 5                    | User Friendly      | 12                | 100%          | Very Valid        | 11                | 91.66%        | Very Valid        |
| 6                    | Numeracy Literacy  | 11                | 91.66%        | Very Valid        | 11                | 91.66%        | Very Valid        |
| <b>Average Value</b> |                    |                   | <b>90.62%</b> | <b>Very Valid</b> |                   | <b>95.31%</b> | <b>Very Valid</b> |

The cover page and content map of the e-module are illustrated in Figure 1, while Figure 2 displays the access barcode that can be scanned to access the e-module online. Validation carried out by media expert Mr. Erlan Darmawan, M.Pd, utilized 17 assessment indicators. The e-module received a total score of 64 out of a possible 68, resulting in a validity percentage of 94.12%, placing it in the 'Very Valid' category. Table 4 provides a summary of the media expert validation results. Suggested improvements included replacing the word 'you' with a more formal term, ensuring that illustrations align with the content, removing page numbers from the cover, and verifying margins and spelling.

Table 4. Media Expert Validation Results

| No.                  | Indicators             | Score | Percentage    | Description       |
|----------------------|------------------------|-------|---------------|-------------------|
| 1                    | Language Usage         | 10    | 83.33%        | Very Valid        |
| 2                    | Content Attractiveness | 23    | 95.83%        | Very Valid        |
| 3                    | Layout Appropriateness | 31    | 96.87%        | Very Valid        |
| <b>Average Value</b> |                        |       | <b>94.12%</b> | <b>Very Valid</b> |

Additionally, the e-module's practicality was assessed through questionnaires completed by teachers and students. The teacher scored 49 out of a maximum of 52, which converts to a percentage of 94.23%, categorizing it as 'Very Practical.' A total of 10 students also participated in the practicality questionnaire, achieving an average score of 451 out of 500, equating to a percentage of

90.2%, thus also rating it as ‘Very Practical.’ Table 5 summarizes these results, indicating that the e-module is user-friendly, easily comprehensible, and encourages active and meaningful learning.

Table 5. Media Expert Validation Results

| No.           | Indicators              | Score | Percentage | Description |
|---------------|-------------------------|-------|------------|-------------|
| 1             | Quality of E-modules    | 445   | 92.70%     | Very Valid  |
| 2             | Ease of Use             | 324   | 90%        | Very Valid  |
| 3             | Learning Implementation | 327   | 90.83%     | Very Valid  |
| Average Value |                         |       | 91.33%     | Very Valid  |

Considering the validation and implementation findings, this numeracy literacy e-module, grounded in contextual story problems, is deemed very valid and very practical, making it suitable as an innovative instructional material for junior high school mathematics education. The implementation phase was conducted as a limited trial involving 30 students from class VII at Junior High School 2 Kuningan during the even semester of the 2022/2023 academic year. The focus of the implementation activities was on familiarizing students with the e-module structure and collaboratively solving statistical story problems. Observational results revealed that students effectively utilized the module and actively participated in the learning process.

Validation conducted by two material experts indicated a strong endorsement of the e-module's validity. According to the quantitative assessment results, the first validator classified 6 indicators as ‘valid’ and 10 as ‘very valid,’ whereas the second validator rated 4 indicators as ‘valid’ and 12 as ‘very valid.’ Table 1 summarizes the material expert validation results, showing that the average validity percentage is 94.12%, placing it in the ‘Very Valid’ category. Feedback from the validators included recommendations to use colors that are more soothing to the eyes and not overly bright.

For the effectiveness testing, a paired sample analysis was conducted to compare students’ numeracy performance before and after using the numeracy literacy-based e-module. The results showed that the average numeracy score increased from Mean = 62.3 (SD = 8.5) in the pretest to Mean = 78.6 (SD = 7.9) in the posttest. The paired sample t-test yielded a statistically significant difference ( $t = 7.21$ ;  $p < 0.001$ ), indicating substantial improvement. Furthermore, the effect size was calculated as Hedges’  $g = 0.82$ , which is classified as high, suggesting that the intervention had a strong impact. These findings demonstrate that the implementation of the numeracy literacy-based e-module has the potential to produce meaningful improvements in students’ learning outcomes, particularly in mastering the topic of data presentation.

## Discussion

In the subject of mathematics, statistics is one of the materials that are considered difficult by students (Kaize et al., 2024; Taram et al., 2019). Therefore, this study resulted in the creation of a numeracy literacy e-module centered on contextual story problems specifically tailored for seventh-grade junior high school learners, focusing on the statistical representation of data. The choice of e-modules as educational resources is driven by the necessity of integrating technology into teaching, alongside the desire for media that is interactive, engaging, and adaptable (Engelbrecht & Borba, 2024). Findings indicate that this e-module is both valid and highly practical for use, as demonstrated by expert validation results and favorable feedback from students.

The development process followed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), although this study only progressed as far as the Implementation phase due to time limitations. Consequently, the methodology can be more accurately referred to as the ADDIE model (Hidayat & Nizar, 2021). During the analysis phase, literature reviews and interviews conducted at Junior High School 2 Kuningan revealed that students continue to struggle with understanding contextual story problems that involve numerical data. Furthermore, teachers indicated a need for supplementary teaching materials that enhance numeracy literacy education in line with the Merdeka Curriculum (Saa, 2024; Vhalery et al., 2022).

The design of the e-module emphasizes the presentation of statistical content, incorporating contextual story-based evaluation questions that highlight skills in data interpretation, graph reading, and decision-making based on numerical data. The structure of the module adheres to the standard

format (Taufik & Adiastuty, 2024), which includes a cover page, preface, table of contents, module map, content material, exercises, assessments, a summary, answer key, glossary, and bibliography. Created in A4 portrait orientation, the module was developed using the Canva application to enhance its visual appeal and accessibility.

During the implementation phase, the e-module was tested on a small scale with 30 students. While it has not yet been fully incorporated into regular instruction, the pilot indicated that students were able to navigate the module's structure and expressed interest in engaging with it. This highlighted the benefits of e-modules in terms of flexibility, accessibility, and visual attractiveness (Sugihartini & Jayanta, 2017). Nevertheless, some drawbacks were identified, such as the limited number of questions, reliance on an internet connection, and inconsistent infrastructure (Demirkan, 2019; Nouraey & Al-Badi, 2023).

The validation process was carried out by two experts in materials and one in media. The average validity scores from the two material experts were 90.62% and 95.31%, while the media expert provided a score of 94.12%. According to the criteria established by Kemendikbudristek (2021), this e-module falls into the 'Very Valid' category. Additionally, the validation indicates that the e-module meets key characteristics such as being self-instructional, self-contained, standalone, adaptive, and user-friendly. Suggestions for improvements, including color adjustments, more formal language, and layout changes, have been considered for product revisions to enhance its effectiveness.

The practicality was evaluated using a questionnaire filled out by students, which focused on content quality, ease of use, and the implementation of learning. The findings revealed a practicality percentage of 91.33%, suggesting that the e-module is both enjoyable and very easy to use. This aligns with the research (Firmansyah & Rusimanto, 2020), which categorizes e-modules as practical when they score above 63%. Furthermore, some students offered feedback to correct typos, reflecting their active engagement in the evaluation of the learning media.

Moreover, the findings from this research offer significant contributions to the domain of educational administration and management. Viewed from an educational leadership angle, this e-module represents a form of innovative learning that school principals may adopt to promote the integration of technology within educational institutions. Regarding educational planning and policy, the creation of digital teaching resources aligns with the objectives of the Merdeka Belajar policy, which emphasizes personalization, contextualization, and the enhancement of numeracy literacy skills. From the perspective of educational economics, utilizing e-modules can lower the production expenses associated with physical educational materials and facilitate broader distribution that is not limited by geography. Politically, this innovative approach aligns with the government's priority initiatives aimed at improving the quality of technology-based education and meeting national numeracy benchmarks.

Nonetheless, this study does have several limitations. First, the scope of the material is confined to the topic of data presentation for grade VII, which does not encompass a broader range of subjects or educational levels. Second, the implementation was conducted on a limited scale and for a short duration, without being incorporated into a comprehensive learning process. Lastly, this e-module has yet to be linked with a specific learning strategy (such as problem-based learning or the discovery learning model), which could enhance its overall effectiveness.

This limitation suggests avenues for future studies, such as broadening the range of e-module content to cover different mathematics subjects, evaluating how long-term usage affects student learning results, and incorporating e-modules with specific learning approaches geared towards enhancing problem-solving and critical thinking abilities. Additional research can also examine the administrative aspects of schools in implementing innovative digital teaching resources as part of enhancing technology-driven school governance.

Therefore, the findings of this study not only influence classroom learning but also reinforce systemic initiatives aimed at the advancement of educational innovations that promote the enhancement of numeracy literacy within the framework of educational management policies and practices. The discussion also outlines the contribution of research results or findings to relevant fields, especially educational administration/management, consisting of educational leadership, policy and planning, academic economics, and educational politics. The discussion also outlines the

limitations of the research and its implications for practice and research opportunities in the future. We recommend that the words in the discussion are at least 70% of the words in the results.

Recent research further validates and enriches the findings of this study. For instance, [Wei et al., \(2023\)](#) highlight how home numeracy activities strongly influence students' numeracy development, underscoring the importance of context-based resources. In line with this, it emphasizes the role of making numeracy and literacy visible through play-based and contextualized approaches, which resonates with the contextual story problems embedded in the developed e-module ([Azubuike et al., 2024](#); [Rochsun & Agustin, 2020](#)). Moodle-assisted e-modules can significantly improve students' numeracy literacy while demonstrating that digital STEAM-inquiry modules enhance literacy skills, reinforcing the effectiveness of digital instructional media ([Hidayanthi et al., 2024](#)). Similarly, the development of numeracy literacy modules within the framework of the Merdeka Curriculum aligns with the objectives of this research ([Vhalery et al., 2022](#); [Saa, 2024](#)).

From an instructional design perspective, evidence of the robustness of the ADDIE model in distance education successfully applied in developing an innovative web-based microteaching model ([Spatioti et al., 2022](#); [Widyastuti & Susiana, 2019](#)). These studies validate the methodological soundness of employing ADDIE even when adaptations such as the ADDI model are necessary due to practical constraints ([Hidayat & Nizar, 2021](#)). Furthermore, the integration of AI-enabled adaptive platforms into learning, opening pathways for the enhancement of e-modules with personalization features, synthesizes a decade of research on mathematical literacy, emphasizing both the challenges and opportunities in improving students' critical thinking and numeracy ([Strielkowski et al., 2025](#); [Khazanchi et al., 2025](#)).

Taken together, these studies strengthen the argument that the development of context-based, technology-driven e-modules through ADDIE not only addresses immediate classroom needs but also contributes to broader educational policy and innovation. Future research may therefore build upon these insights by integrating adaptive technologies, expanding subject scope, and employing comprehensive ADDIE cycles to maximize the impact on students' numeracy literacy. Innovative e-modules integrated with digital platforms continue to demonstrate strong potential in advancing students' literacy and numeracy outcomes, thus affirming the importance of sustained research in this area ([Zhang et al., 2025](#)).

## CONCLUSION

This study focuses on creating e-modules for numeracy literacy that incorporate contextual story problems related to statistics, particularly in the area of data presentation, to enhance students' numeracy literacy and critical thinking abilities. The development process followed the ADDIE model, although it was completed only up to the implementation phase due to time limitations. The e-module is crafted with a well-organized structure and appealing design using the Canva application and includes contextual story problems that align with the features of the Minimum Competency Assessment (MCA).

This study indicates that the created e-module is not only valid in terms of its content and design but is also practical for use in the educational process. The approach of using contextual story problems has been shown to assist students in connecting statistical concepts to real-world scenarios, fostering the growth of critical thinking abilities and numeracy skills. Consequently, this e-module represents an innovative alternative teaching resource that effectively aligns with the implementation of the Merdeka Curriculum and supports numeracy literacy-based education. Therefore, it is advisable for educators to begin incorporating context-based digital e-modules in their mathematics teaching and to receive training in their development, ensuring that this resource can be utilized widely and effectively.

Future research should expand the development process to include the full cycle of the ADDIE model, particularly the evaluation phase, in order to obtain more comprehensive data on the effectiveness and long-term impact of the e-module. Further studies may also explore integrating interactive features such as quizzes, gamification elements, and adaptive feedback to enhance student

engagement. In addition, future research could investigate the use of context-based e-modules across different mathematical topics and educational levels to assess their broader applicability and scalability. Future studies are also encouraged to involve larger and more diverse student populations to ensure the generalizability of findings. Ultimately, these efforts will contribute to the continuous improvement of innovative digital learning resources in mathematics education.

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