

The requirements of junior high school/MTs mathematics teachers in Riau for integrated literacy and numeracy teaching modules aimed at enhancing students' critical mathematical thinking skills

Elfis Suanto, Kartini, Anisa Sonia*

Universitas Riau, Riau, Indonesia

*Correspondence: anisa.sonia6966@grad.unri.ac.id

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Abstract

The role of teachers as implementers is crucial in the execution of the Independent Curriculum. Teaching modules can serve as guidelines for teachers to ensure effective and efficient learning. Strengthening literacy and numeracy is one of the demands of the Independent Curriculum, aiming to develop students with critical mathematical thinking skills to compete globally. However, field observations indicate that teachers still require guidance in compiling teaching modules that align with the Independent Curriculum and meet their students' needs. This descriptive study analyzes teachers' needs for integrated literacy and numeracy teaching modules to enhance students' critical thinking skills. Data were collected through a non-test questionnaire distributed via Google Forms to junior high school/MTs mathematics teachers in Riau, with 11 participants. The study's results indicated that 72.7% of teachers expressed a significant need for integrated literacy and numeracy teaching modules to improve students' critical mathematical thinking abilities. Additionally, the analysis revealed that some teachers had developed their own teaching modules, but these lacked the integration of literacy and numeracy, and did not facilitate students' critical mathematical thinking skills. This highlights the necessity for the development of integrated literacy and numeracy teaching modules to enhance students' critical mathematical thinking skills.

Keywords: Critical mathematical thinking skills, Literacy numeracy, Teaching module, Teacher needs

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Introduction

The implementation of the Independent Curriculum is a strategic initiative by the government to enhance the quality of education across various educational units. a. Teacher professionalism needs to be fostered, and educators must update their knowledge and skills to design learning experiences that align with current trends and the needs of students (Ibda et al., 2023). Student-centered learning is prioritized to ensure more meaningful educational experiences (Maharani & Fuadiyah, 2024). The role of teachers is crucial in the successful implementation of the Independent Curriculum. As implementers, teachers are vital in

aligning the curriculum with the needs and characteristics of their students (Hilmin et al., 2022). The Independent Curriculum emphasizes essential materials, allowing students to thoroughly study fundamental competencies such as literacy and numeracy with adequate time (Priantini et al., 2022). A key feature of the Independent Curriculum is the strengthening of literacy and numeracy within the learning process (Mulyasa, 2023).

Numeracy literacy is defined as the ability to analyze information presented in tables, graphs, and other formats to make predictions and decisions (Aprilia et al., 2024). According to the Ministry of Education and Culture (2017) indicators of numeracy literacy ability include: (1) using various numbers and basic mathematical symbols to solve practical problems in everyday life, (2) analyzing information presented in charts, tables, graphs, and so forth, and (3) interpreting the results of analyses to make predictions and decisions. The levels of numeracy literacy ability are categorized into four: requiring special intervention (far below minimum competency), basic (below minimum competency), proficient (achieving minimum competency), and advanced (above minimum competency). The components of numeracy literacy encompass content areas such as numbers, measurement and geometry, data and uncertainty, and algebra. Additionally, it involves cognitive processes including understanding, application, and reasoning. A characteristic of students with numeracy skills is their ability to use mathematics to solve real-life problems (Adelia et al., 2024).

Integrating numeracy literacy in mathematics learning can be achieved by providing a meaningful context. Teachers are encouraged to emphasize how mathematics can be applied outside the classroom, for instance, by presenting problems whose solutions depend on specific contexts and asking students to verify the accuracy of their solutions and the selection of mathematical abilities used in problem-solving (Susanto et al., 2021). Strengthening numeracy literacy activities is essential for students to identify relationships between various topics or everyday problems, thereby acquiring skills such as mathematical critical thinking (Susanti & Krisdiana, 2021). The ability to think mathematically is a crucial component of solving everyday problems (Alfiyah & Putri, 2023). It represents an individual's intellectual capability to analyze problems and determine appropriate solutions (Kusdinar et al., 2017). Critical mathematical thinking skills can also be defined as the ability to think logically and prudently, focusing on making reliable decisions based on the information obtained (Runisah et al., 2017).

Integrating numeracy literacy into learning is considered effective in enhancing students' critical thinking skills. This is supported by research conducted by Musyafak and Agoestanto (Musyafak & Agoestanto, 2022) which demonstrates that literacy-based numeracy teaching materials can improve students' critical mathematical thinking skills. Furthermore, research by Alfiyah and Putri (2023) indicates that the relationship between numeracy literacy and students' critical thinking skills is influenced by learning approaches that emphasize numeracy literacy. This demonstrates that integrating numeracy literacy into learning can be a strategic effort to improve students' critical thinking skills.

The success of teachers in implementing the curriculum is demonstrated through the creation of an enjoyable learning process and the active involvement of students in each activity (Hidayat et al., 2022). A structured learning plan is essential as a reference for teachers in conducting these learning activities, one of which is through teaching modules

(Chasanah et al., 2023). Effective planning is crucial for the successful implementation of learning (Nurtanto et al., 2021). The availability of teaching modules is an absolute necessity in education (Dilfa et al., 2023). Teaching modules are learning tools used by educators to achieve learning outcomes and are designed according to the phases or stages of student development (Alfitri & Dahlan, 2022). A teacher's pedagogical ability is critical in compiling engaging and enjoyable teaching modules for the success of the learning process (Wulandari et al., 2023). However, field observations reveal that teachers are not yet proficient in creating teaching modules as envisioned by the independent curriculum (Suanto et al., 2023). Teachers still face many challenges in creating an active learning process. Most teachers deliver mathematics instruction using the lecture method (Suanto et al., 2023), even though the teacher's role should be that of a facilitator rather than merely a provider of material (Telesphore et al., 2024).

Literacy-based numeracy teaching modules are highly necessary in the Independent Curriculum. Observations reveal that the teaching modules currently used by teachers do not yet incorporate numeracy literacy and do not facilitate students in solving problems that require mathematical critical thinking skills. An example of an attachment to the teaching module in the form of a student worksheet used by a junior high school/MTs mathematics teacher in Riau can be seen in Figure 1.

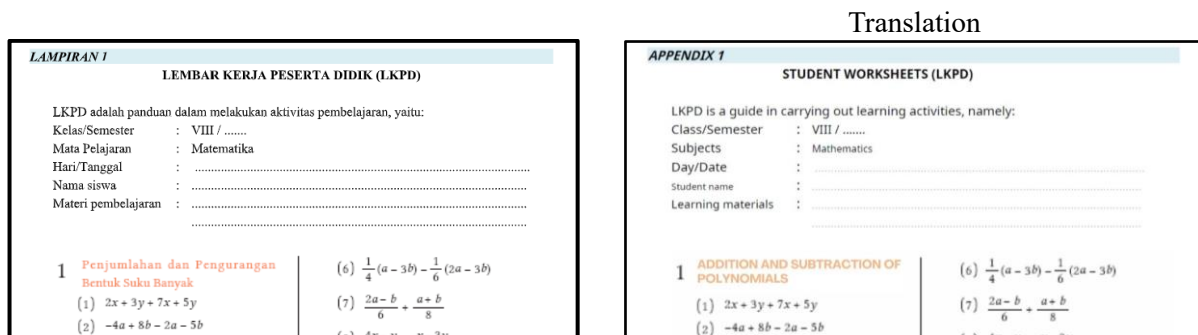


Figure 1. Sample Attachments to Teaching Modules Utilized by Educators

The absence or lack of teaching modules specifically designed to integrate numeracy literacy to improve students' critical thinking skills underscores the importance of developing such modules. The development of these teaching modules begins with a needs analysis process, serving as a reference for creating the expected module specifications. Therefore, this study includes an analysis of teachers' needs, particularly concerning integrated numeracy literacy teaching modules. Previous research conducted by Pratama et al. (Pratama et al., 2022) analyzed teachers' needs for the development of teaching modules to improve students' critical mathematical thinking skills. The results of the analysis indicate that developing such modules is necessary to support students' learning processes and enhance their critical thinking skills during the learning process. However, this previous study focused on teaching modules in general. The novelty of this study lies in its specific focus on teachers' needs for teaching modules integrated with numeracy literacy. Thus, this study aims to determine and analyze teachers' needs for teaching modules, particularly those integrated with numeracy literacy, to improve students' critical thinking skills.

Methods

This study is descriptive research utilizing mixed methods, combining quantitative and qualitative approaches to provide a more comprehensive and in-depth analysis. The research data were obtained from the distribution of non-test questionnaires to the research subjects, which included junior high school/MTs mathematics teachers in Riau who have implemented the Independent Curriculum, with 11 participants from different schools.

Data collection was conducted by sending a Google Form link containing the questionnaire via WhatsApp to a group of mathematics teachers in Riau Province. The non-test questionnaire includes several questions related to the teaching modules used by teachers, the integration of numeracy literacy in the teaching modules, and the critical thinking skills of students. These questions comprised both multiple-choice (closed questions) and descriptive (open questions) formats. Additionally, at the end of the questionnaire, the researcher requested respondents' willingness to send examples of teaching modules used in learning, which were uploaded via the Google Form. The indicators of questions in the teacher needs questionnaire can be seen in Table 1.

Table 1. Indicators for the Teacher Needs Questionnaire

No	Questionnaire Indicator	Question Items
1.	The curriculum used where the respondent teaches	1
2.	Problems faced in implementing the Independent Curriculum	2
3.	Teaching modules used by respondents	3 and 4
4.	Students' critical mathematical thinking skills	5
5.	Strengthening or integrating literacy numeracy in learning	6, 7, and 8
6	Teachers' need for integrated literacy teaching modules Numeracy to improve students' critical mathematical thinking skills	9 and 10

The results obtained from the distribution of this non-test questionnaire were used to determine teachers' needs for integrated numeracy literacy teaching modules aimed at improving students' critical mathematical thinking skills. The responses to the multiple-choice questions will be calculated as questionnaire scores and analyzed descriptively based on the teachers' answers to the closed questions. The method for calculating the questionnaire score can be seen in Formula (1).

$$\text{Questionnaire score} = \frac{\text{total number of respondents' answers}}{\text{number of respondents}} \times 100 \% \quad (1)$$

Result

The results of the teacher needs analysis in this study serve as the foundation for developing teaching modules. These teaching modules provide guidelines for teachers to implement learning that integrates numeracy literacy in accordance with the Independent Curriculum, aimed at improving students' critical mathematical thinking skills. The teacher needs questionnaire scores obtained are presented in Table 2.

Table 2. Teacher Needs Questionnaire Score

No.	Question Items	Answer	Number of answers	Percentage (%)
1	Has your school implemented the	Yes	11	100%

		No	0	0 %
2.	Independent Curriculum? What problems did you encounter while implementing the Independent Curriculum?	Description		
3	The Independent Curriculum teaching module that you use in your classroom learning is obtained from?	Teaching modules provided by the government	7	63.6%
		Teaching modules available on <i>the website</i>	4	36.4%
		Develop your own teaching modules	5	45.5%
4	Learning models that you often use in learning	<i>Problem Based Learning</i>	4	36.4%
		<i>Discovery Learning</i>	5	45.5%
		<i>Project Based Learning</i>	2	18.2%
		Conventional	6	54.5%
		Other	1	9.1%
5	What do you think about students' critical mathematical thinking skills today?	Description		
6	In your opinion, how important is strengthening or integrating literacy? numeracy in classroom learning?	Very important	10	90.9%
		Important	1	9.1%
		Less important	0	0 %
		Not important	0	0 %
7	literacy skills categorized? Number of students at your school based on education report cards?	Proficient	1	9.1%
		Talk	5	45.5%
		Base	5	45.5%
		Special intervention is needed	0	0 %
8	Based on content on literacy numeracy , which do you think is more difficult for students to understand?	Number	0	0 %
		Data and uncertainty	3	27.3%
		Measurement and geometry	6	54.5%
		Algebra	2	18.2%
9	In your opinion, can students who are accustomed to solving numeracy- type problems improve their critical mathematical thinking skills?	Yes	11	100%
		Possible	0	0 %
		No	0	0 %
10	Do you need an example of a teaching module that integrates literacy? numeracy in learning?	Very much needed	8	72.7%
		Need	3	27.3%
		Less need	0	0 %
		No need	0	0 %

Question item 1 in Table 2, related to the implementation of the Independent Curriculum in the schools where the teachers work, shows that all teachers answered "Yes" with a percentage of 100%. This indicates that teachers are expected to carry out learning in accordance with the demands of the Independent Curriculum, including developing learning plans in the form of teaching modules as educational tools.

However, in question item 2, regarding teachers' opinions on the difficulties in implementing the Independent Curriculum in each school, several issues were identified, including: Inappropriate student handbooks; Random learning materials; Challenges in creating and implementing teaching tools according to the Independent Curriculum; Insufficient supportive learning resources; and Students' difficulties in learning independently, leading to continued reliance on the lecture method. These responses indicate that the primary challenges teachers face in implementing the Independent Curriculum are related to learning tools.

Question item 3 in Table 2, related to the teaching module used by teachers, was a complex multiple-choice question, allowing teachers to select more than one response. The percentage of each answer to question 3 is presented in Figure 2.

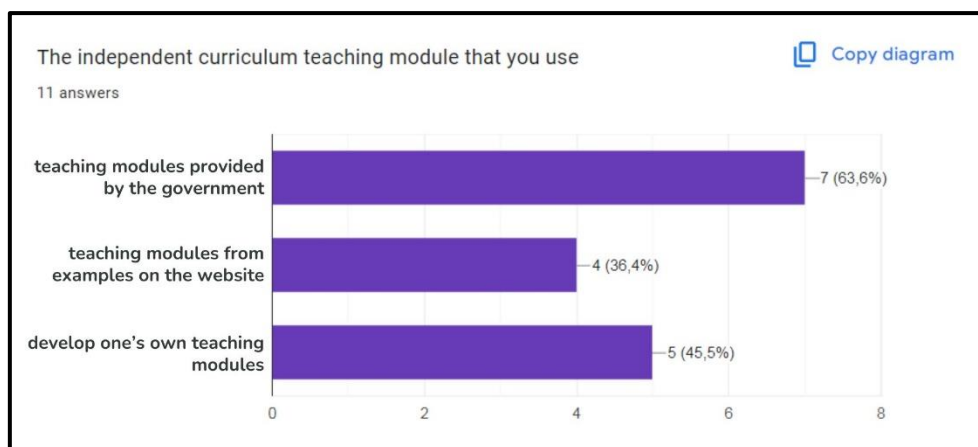


Figure 2. Percentage of Answers to Question 3

Based on Figure 2, it can be observed that 63.6% of teachers use teaching modules provided by the government through the Ministry of Education and Culture's website. Teachers who develop their own teaching modules constitute 45.5%, and those who use teaching modules from examples on the website make up 36.4%. This indicates that most teaching modules used by teachers are derived from government-provided examples, which may not necessarily align with the needs of different classes. Additionally, while some teachers have started to develop their own teaching modules, the arranged learning activities still do not adequately facilitate students' critical mathematical thinking skills. An example of a teaching module used by teachers is shown in Figure 3.

Translation:

<p>Kegiatan Pendahuluan (10 Menit)</p> <ul style="list-style-type: none"> Doa; absensi; menyampaikan tujuan pembelajaran; dan menyampaikan penilaian hasil pembelajaran Memotivasi siswa untuk tercapainya kompetensi dan karakter yang sesuai dengan <i>Profil Pelajar Pancasila</i>; yaitu 1) beriman, bertakwa kepada Tuhan Yang Maha Esa, dan berakhlak mulia, 2) mandiri, 3) bernalar kritis, 4) kreatif, 5) bergotong royong, dan 6) berkebinekaan global, yang merupakan salah satu kriteria standar kelulusan dalam satuan pendidikan. <p>Kegiatan Inti (90 Menit)</p> <ul style="list-style-type: none"> (suku tunggal) \times (suku tunggal) secara intuitif. Luas persegi panjang dihitung dengan (vertikal) \times (horizontal), yaitu $3a \times 4b$, akan tetapi ternyata itu sama dengan (3×4) kali luas satuan ab. Pastikan juga $3a$ adalah $3 \times a$. Pahami bahwa $3a \times 4b$ menjadi $12ab$ dilakukan dengan sifat komutatif pada metode perkalian. Kemudian, bentuk monom dapat dihitung dengan (perkalian koefisien) \times (perkalian variabel). Ini adalah metode perkalian yang mencakup penghitungan pangkat. Peserta didik mungkin bingung antara $2a^2$ dan $(2a)^2$ Jadi, pada tahap awal, $2a^2 = 2 \times a \times a$, $(2a)^2 = 2a \times 2a$ arahkan peserta didik untuk menulis ulang dan kemudian menghitung. 	<p>Introductory Activities (10 Minutes)</p> <ul style="list-style-type: none"> Prayer; attendance; conveying learning objectives; and conveying learning outcome assessments Motivate students to achieve competencies and characters that are in accordance with <i>Pancasila Student Profile</i>; namely 1) having faith, being devoted to God Almighty, and having noble morals, 2) being independent, 3) being able to think critically, 4) being creative, 5) being able to work together, and 6) being globally diverse, which is one of the standard criteria for graduation in educational units. <p>Core Activities (90 Minutes)</p> <ul style="list-style-type: none"> (single term) \times (single term) intuitively. The area of a rectangle is calculated by (vertical) \times (horizontal), which is $3a \times 4b$, but it turns out that it is equal to (3×4) times the unit area ab. Also make sure $3a$ is $3 \times a$. Understand that $3a \times 4b$ to be $12ab$ done with the commutative property of the multiplication method. Then, the monom form can be calculated by (coefficient multiplication) \times (variable multiplication). This is a multiplication method that includes calculating exponents. Students maybe confused between the $2a^2$ and $(2a)^2$. So, in the initial stage, $2a^2 = 2 \times a \times a$, and $(2a)^2 = 2a \times 2a$ direct students to rewrite and then calculate.
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Figure 3. Examples of Teaching Modules Used by Teachers

Figure 3 illustrates that the learning activities arranged by the teacher in the developed teaching module are not yet student-centered, showing no apparent involvement of students and tending to focus on the teacher explaining the learning material. Additionally, other teaching modules include exercises that remain routine and do not facilitate the development of students' critical mathematical thinking skills. Based on the teaching modules collected through the Google Form from respondents, researchers found that most examples of

teaching modules do not strengthen numeracy literacy or facilitate mathematical critical thinking skills.

In fact, responses to the open-ended questions regarding teachers' opinions on students' mathematical critical thinking skills in each school indicate that these skills are still low and need improvement. Some of the responses obtained from the questionnaire related to students' mathematical critical thinking skills include: Still low, Needs improvement, Not yet optimal according to age, Needs to be accustomed, and Needs further development to solve more complex mathematical problems.

This indicates that efforts need to be made to improve students' mathematical critical thinking skills. Question item 6 in Table 2 relates to the importance of strengthening or integrating numeracy literacy in the classroom learning process. According to the responses, 90.9% of teachers stated it was very important, and 9.1% said it was important. This indicates that the integration of numeracy literacy in learning is deemed highly significant. However, based on the responses to open-ended questions in the questionnaire, teachers have not integrated numeracy literacy in learning for several reasons: Students have difficulty focusing and understanding activities that integrate numeracy literacy; Lack of availability of learning resources related to numeracy literacy; and Minimal numeracy literacy skills possessed by students.

Regarding the numeracy literacy ability category of students, as addressed in question 7 in Table 2 and based on the school education reports where the respondents teach, 45.5% of students' numeracy literacy is still below the minimum competency, falling within the basic category. The categorization of students' numeracy literacy abilities is presented in Figure 4.

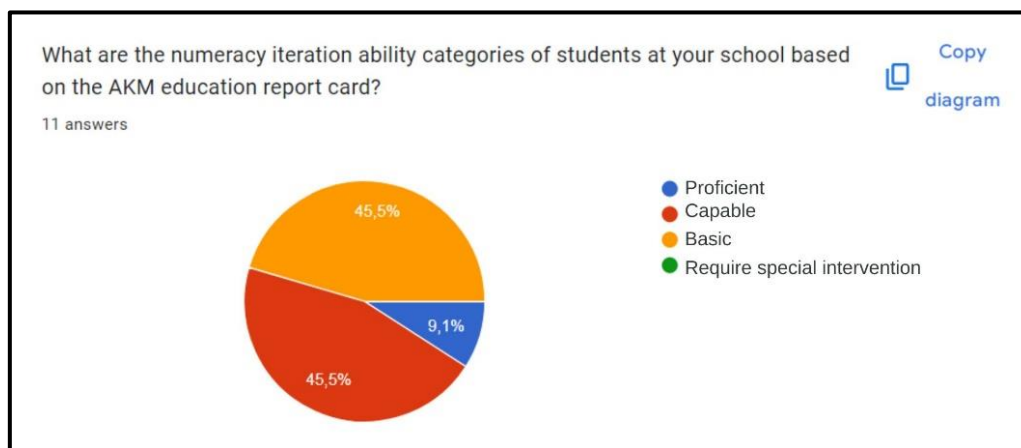


Figure 4. Literacy Skills Category Student Numeracy

Based on Figure 4, it can be seen that only 9.1% of students in the proficient category are above the minimum competency level, demonstrating the ability to reason and solve complex, non-routine problems based on their mathematical knowledge. Meanwhile, 45.5% of students in the proficient category have achieved the minimum competency level, indicating their ability to apply mathematical knowledge in various situations. The basic category, which also comprises 45.5% of students, has not yet achieved the minimum competency level. These students possess basic numeracy skills, such as solving mathematical problems involving direct calculations, basic geometric and statistical concepts, and routine problems.

Additionally, it is noteworthy that there are no students in the category requiring special intervention. However, efforts are still needed to establish habits or strengthen numeracy literacy in learning so that students can achieve minimum competencies, specifically in the proficient and advanced categories.

Question 9 in Table 2, with a response rate of 100%, shows that all teachers agree that familiarizing students with solving numeracy-type problems can enhance their critical mathematical thinking skills. Furthermore, question 10 in Table 2 relates to teachers' needs for integrated numeracy literacy teaching modules. The data for this question is presented in Figure 5.

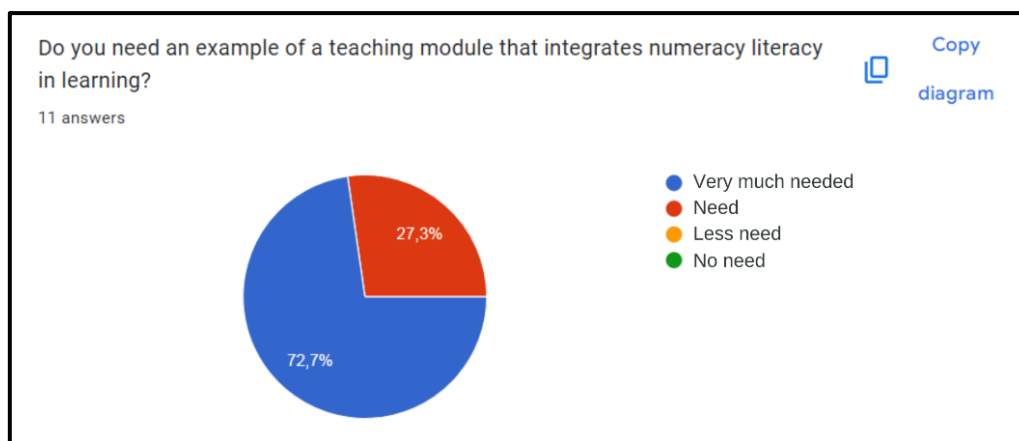


Figure 5. Percentage of Answers to Question 10

Figure 5 indicates that 72.7% of teachers express a strong need for teaching modules that integrate numeracy literacy, while the remaining 27.3% of teachers also acknowledge the necessity of such modules. This demonstrates that integrated numeracy literacy teaching modules are indeed crucial for teachers to meet the demands of the Independent Curriculum and to enhance students' critical mathematical thinking skills. Further research is needed to develop teaching modules that incorporate numeracy literacy using supportive learning models to improve students' critical mathematical thinking skills.

Discussion

One of the demands of the Independent Curriculum for teachers is to create learning plans that provide meaningful learning experiences aligned with the daily lives of students. This planning can involve the provision of teaching modules (Anggraena et al., 2022). However, based on the results of the questionnaire, it was found that teachers faced difficulties in implementing the Independent Curriculum, particularly in creating and executing learning plans in the form of teaching modules. This aligns with previous research, which indicated that most teachers are not yet skilled in developing teaching modules as specified by the Independent Curriculum (Suanto et al., 2023). Research by Taufiq et al. (Taufiq et al., 2023) found that 45% of teachers did not fully understand teaching modules and their components. Therefore, the role of schools is critical in providing guidance to enable teachers to implement the Independent Curriculum effectively. Similarly, research by Wafiroh and Fajrin (2024) highlights several challenges faced by teachers in developing teaching modules, including: 1) Determining the components of teaching modules that align

with the Independent Curriculum, 2) Establishing learning objectives based on learning achievements, 3) Selecting appropriate models or methods, 4) Developing assessments or evaluations.

The results of the questionnaire indicate that teachers are aware of the importance of integrating numeracy literacy in classroom learning. However, it is rare and has seldom been integrated to train students' critical mathematical thinking skills. (Setiyani et al., 2024) found that students in the low and middle groups have not yet mastered numeracy well, and recommend that teachers strengthen students' numeracy literacy skills and encourage them to practice solving various problems in classroom learning to improve their skills and accuracy in analyzing questions.

Based on the descriptive answers from respondents in question 2, factors that make it difficult for teachers to develop teaching modules that align with the Independent Curriculum include the limited time available for creating learning plans that meet students' needs and the lack of examples of teaching modules specifically designed to integrate numeracy literacy. In line with research by (Wafiroh & Fajrin, 2024) it was found that the challenges teachers face in independently developing teaching modules are due to the lack of optimal training received regarding teaching modules, the diversity of student characteristics, and the limited time available to teachers.

Low mathematical critical thinking skills are among the issues identified in the mathematics learning process. The results of the questionnaire indicated that 100% of teachers agreed that to improve students' mathematical critical thinking skills, it is necessary to habituate them to solving numeracy-type problems. This aligns with the findings of (Musyafak & Agoestanto, 2022) who reported that the effectiveness of the developed teaching materials resulted in more than 74.5% of posttest students performing better than on the pretest. This demonstrates that literacy-based numeracy teaching materials can enhance students' critical mathematical thinking skills. Additionally, research conducted by (Alfiyah & Putri, 2023) found that numeracy literacy influences students' critical thinking skills. Teachers can incorporate thinking skills. As students' understanding of numeracy literacy increases, so too will their ability to solve problems critically (Safitri et al., 2023).

Based on Figure 5, it can be observed that 72.7% of teachers express a strong need for teaching modules that integrate numeracy literacy. This indicates that integrated numeracy literacy teaching modules are essential for teachers to improve students' critical mathematical thinking skills. This is consistent with research conducted by (Pratama et al., 2022) which found that 100% of teachers required a teaching module to support students' learning processes and enhance their critical thinking skills. Other studies also highlight the necessity of developing mathematics teaching materials to improve teachers' abilities in designing teaching materials and students' numeracy literacy (Musyrifah et al., 2022). Furthermore, (Imtiyaaz, 2023; Md-Ali et al., 2016) stated that teachers, as facilitators, are expected to maximize classroom learning to make it more meaningful. Incorporating learning that strengthens numeracy literacy is considered necessary and appropriate.

The limitations of this study include the fact that the research sample of respondents is not fully representative of the population of all junior high school/Islamic junior high school mathematics teachers in Riau Province who require integrated numeracy literacy teaching modules. Additionally, this study has not provided detailed specifications of the integrated

numeracy literacy teaching module aimed at improving students' critical mathematical thinking skills. Therefore, the findings of this study can serve as a consideration for future researchers in developing the intended teaching modules.

Conclusion

Based on the results of the distribution of non-test questionnaires, it was found that 72.7% of teachers expressed a strong need for examples of integrated numeracy literacy teaching modules, while the remaining 27.3% also acknowledged this need. This requirement is driven by several factors: Teachers' limitations in independently developing systematically arranged teaching modules according to needs; The importance of strengthening numeracy literacy in the Independent Curriculum; The need to improve students' critical mathematical thinking skills; and The lack of examples of integrated numeracy literacy teaching modules designed to enhance students' critical mathematical thinking skills.

Considering the importance of critical mathematical thinking skills for students and the emphasis on strengthening numeracy literacy in the Independent Curriculum, there is a significant need for examples of integrated numeracy literacy teaching modules. These modules can be used by teachers and students during the learning process to improve students' critical mathematical thinking skills.

Declarations

- Author Contribution : ES: Writing – Conceptualization, Review & Supervision.
K: Writing - Review & Editing.
AS: Conceptualization, Writing - Original Draft, Editing and Visualization.
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